

# COMMONWEALTH OF VIRGINIA 2012 URANIUM WORKING GROUP REPORT



**NOVEMBER 30, 2012**

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**LIST OF ACRONYMS**

ABA	Acid-Base Accounting
ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	As Low As Reasonably Achievable
ATSDR	Agency for Toxic Substances and Disease Registry
BRFSS	Behavior Risk Factor Surveillance System
CAD	Computer Aided Design
CATEX	Categorical Exclusion
CD	Certificate of Deposit
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
COPD	Chronic Obstructive Pulmonary Disease
COVEOP	Commonwealth of Virginia Emergency Operations Plan
COVERERP	Commonwealth of Virginia Radiological Emergency Response Plan
CPI	Consumer Price Index
CSMs	Conceptual Site Models
DEIS	Draft Environmental Impact Statement
DEQ	Department of Environmental Quality
DLS	Division of Legislative Services
DMME	Department of Mines, Minerals and Energy
DOE	Department of Energy
DOL	Department of Labor
DPM	Diesel Particulate Matter
DRH	Division of Radiological Health
EAs	Environmental Assessments
EIA	Environmental Impact Analysis
EIS	Environmental Impact Study
EISs	Environmental Impact Statements
EPA	Environmental Protection Agency
ER	Environmental Report
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
FTE	Full Time Employees
GIS	Geographic Information System
GWMA	Groundwater Management Act
HCP	Hearing Conservation Program
IAEA	International Atomic Energy Agency
ILOC	Irrevocable Letter of Credit
IMPEP	Integrated Materials Performance Evaluation Program
IRAA	Indoor Radon Abatement Act
ISL	In Situ Leach
MCL	Maximum Contaminant Level
MLA	Mineral Liberation Analyzer
MSHA	Mine Safety and Health Administration

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mrem	millirem
NAS	National Academy of Sciences
NATS	National Adult Tobacco Survey
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NGO	Nongovernmental Organizations
NIOSH	National Institute for Occupational Safety and Health
NMSS	Nuclear Material Safety and Safeguards
NRC	Nuclear Regulatory Commission
NUREG	NRC Regulatory Guides
OAG	Office of the Attorney General
ODW	Office of Drinking Water
OEHS	Office of Environmental Health Services
OEpi	Office of Epidemiology
OFHS	Office of Family Health Services
OSL	Optically Stimulated Luminescent
OMHHE	Office of Minority Health and Health Equity
OSHA	Occupational Safety and Health Administration
PFC	Points for Consideration
PM/PM10	Particulate Matter/coarse particle(s) (diameter <10 microgram)
PM/PM2.5	Particulate Matter/coarse particle(s) (diameter <2.5 microgram)
PMF	Probable Maximum Flood
PMP	Probably Maximum Precipitation
PRAMS	Pregnancy Risk Assessment Monitoring System
RAIs	Requests for Additional Information
RFP	Request for Proposal
RMP	Risk Management Plan
ROD	Record of Decision
SCBA	Self-Contained Breathing Apparatus
SDWA	Safe Drinking Water Act
SER	Safety Evaluation Report
SRP	Standard Review Plan
TEDE	Total Effective Dose Equivalent
TER	Technical Evaluation Report
TLDs	Thermoluminescent Dosimeters
TLVs	Threshold Limit Values
TSP	Total Suspended Particulates
TWA	Time Weighted Average
UMTRCA	Uranium Mill Tailings Radiation Control Act
UTF	Uranium Task Force
UWG	Uranium Working Group
VAC	Virginia Administrative Code
VaCARES	Virginia Congenital Anomalies Reporting and Education System
VCR	Virginia Cancer Registry
VDEM	Virginia Department of Emergency Management
VDH	Virginia Department of Health

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VHI	Virginia Health Information
VPDES	Virginia Pollutant Discharge Elimination System
VUI	Virginia Uranium, Inc.
VWP	Virginia Water Protection
WES	Wright Environmental Services
WL	Working Level
WLM	Working Level Month



## **EXECUTIVE SUMMARY**

### **INTRODUCTION**

In 1982, the General Assembly of Virginia passed Senate Bill 179 (SB 179) establishing requirements for the permitting of uranium exploration activities under Title 45.1, Chapter 21 (45.1-272 – 45.1-285.1). Section 45.1-283 of the Code, commonly referred to as the “moratorium,” further precluded the acceptance of uranium mining permit applications until a program for permitting uranium mining is established by statute. In 1983, Senate Bill 155 created the Uranium Administrative Group (UAG), which was authorized to contract with consultants to conduct studies evaluating the costs and benefits of uranium mining at specific locations in Pittsylvania County, and report its findings to the Virginia Coal and Energy Commission in December 1983. In January 1984, the Coal and Energy Commission accepted the UAG recommendation to continue and expand the scope of studies under the oversight of the newly created Uranium Task Force (UTF), which was to report its findings on October 1, 1984. The UTF, in its Final Report to the Coal and Energy Commission, concluded that “uranium development activity can be undertaken with an acceptable level of risk and with economic benefits to the state if the recommendations proposed are adopted and are treated as an essential ingredient that must accompany any lifting of the moratorium on uranium mining (UTF, 1984).”

In 2007, private sector interest in uranium mining and milling was renewed. The Department of Mines, Minerals and Energy (DMME) issued an exploration permit on November 20, 2007, to Virginia Uranium, Inc. (VUI) for a site at Coles Hill in Pittsylvania County, Virginia. Legislation was also introduced in the 2008 session to establish a legislative commission to consider whether uranium mining should occur in the Commonwealth. As a result, several studies were conducted to review public health and environmental issues associated with uranium mining and milling.

### **GOVERNOR’S DIRECTIVE**

In a letter dated January 18, 2012 members of the General Assembly requested that additional study be performed. In response to this letter, Governor McDonnell directed the establishment of the Uranium Working Group (UWG) consisting of staff from DMME, the Virginia Department of Health (VDH) and the Department of Environmental Quality (DEQ). Both letters may be found in Appendix A. The Governor directed the UWG to provide a scientific policy analysis to help the General Assembly determine the regulatory framework that would be required if the moratorium on uranium mining in the Commonwealth were lifted. The UWG was not charged with making a recommendation regarding lifting the moratorium; rather, to provide the General Assembly information to aid their decision-making.

The Governor’s Directive listed 18 issues for the UWG’s review and provided the agencies the authority to hire technical expertise to assist the UWG in fulfilling these duties. In order to provide additional scientific and technical expertise to this study the agencies issued two requests for proposals (RFPs). The Directive was used as the foundation for the scope of work in both RFPs.

## **UWG ACTIVITIES**

### **Wright Environmental Services Reports**

One RFP was a joint proposal by DEQ and DMME. The other, focusing more on public health issues, was issued by VDH. Both contracts were awarded to Wright Environmental Services (WES) of Fort Collins, Colorado. The reports from the two contracts can be found at <http://www.uwg.vi.virginia.gov/links.shtml>. These reports, reviewed and discussed in great detail by the UWG, provided the background information and the knowledge to develop this report and the Executive Summary. The WES Final Report includes a table with approximately 140 specific points for consideration (PFCs) that Virginia should consider when developing regulations if the moratorium is lifted. Each item is referenced back to the more detailed WES reports. The PFCs include much more detail than the UWG's Report or this Executive Summary and provide a valuable tool to assist with the regulatory development process, should the moratorium be lifted. The table of PFCs is attached as Appendix B to the UWG's Report.

### **UWG Public Meetings**

The UWG held several public meetings to provide information, to answer questions from the public and to take public comment:

- March 7, 2012, at the General Assembly Building in Richmond.
- June 18, 2012, at the Chatham High School auditorium.
- August 2, 2012, at the Olde Dominion Agricultural Complex in Chatham.
- August 28, 2012, at the Virginia Beach Convention Center.
- October 17, 2012, at the Olde Dominion Agricultural Complex in Chatham.
- November 27, 2012, at the Science Museum in Richmond.

### **VDH**

VDH conducted four public meetings on private well and recreational water use meetings and three facilitated discussions to promote participation from a diverse group of stakeholders and to ensure regional concerns were captured:

- Public Issue Meetings:
  - August 7, 2012, at the Circuit Court Building in Chatham.
  - August 15, 2012, at Lord Fairfax Community College in Warrenton.
  - August 29, 2012, at the Meyera Oberndorff Library Auditorium in Virginia Beach.
- Facilitated Discussions:
  - August 8, 2012, at the County Administration Building in Chatham.
  - August 16, 2012, at the Warrenton Rescue Squad Building in Warrenton.
  - August 30, 2012, at the Virginia Beach Health Department in Virginia Beach.
- Wrap-up Session:
  - September 17, 2012 in Chatham.

### **Other Meetings and Activities**

Members of the UWG met weekly in person or via conference call from January 19 to November 30. These meetings were supported by agency staff who researched, reviewed and drafted reports. A complete discussion of these meetings can be found in this report and citations for published documents that were reviewed by the UWG are included in the bibliography in

Appendix C of this report.

## **PROCESS FOR THE PERMITTING OF A MINE AND/OR MILL SHOULD THE MORATORIUM BE LIFTED**

The UWG was made up of representatives from the three primary agencies, VDH, DMME and DEQ, that would have responsibility for the regulation of uranium mining and milling in Virginia should the moratorium be lifted. Using the technical information provided by its consultant, the UWG assessed the risks and benefits of uranium mining and/or milling and evaluated what would be required in a conceptual regulatory framework if mining development were to proceed. It is anticipated that if legislation were to be introduced to lift the moratorium, the UWG's Report and Executive Summary would help identify issues that would have to be addressed by statutes and/or regulations. If such legislation passed both the House of Delegates and the Senate, and was signed by the Governor, then and only then could the agencies begin the process of drafting and promulgating regulations under the Administrative Process Act (APA). All regulations promulgated will follow the public participation requirements of the APA. This includes: public comment at the Notice of Intended Regulatory Action stage; the establishment of Regulatory Advisory Panel(s) with stakeholders to help draft the regulation; and, public comment and hearing(s) on the draft regulation. In addition, VDH and DEQ have citizen boards that hold the authority to adopt regulations and provide an additional opportunity for public comment at their meetings.

The next steps would involve the applicant's preparation of an environmental report and application to the Nuclear Regulatory Commission (NRC) for the milling operation and, if accepted, the development of a full Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA). A standalone mine permit application would require an Environmental Impact Analysis (EIA). The EIA requirement could be met by the EIS if co-located with the mill. An explanation of the required elements and process associated with submitting an EIS is included in the UWG's Report. The EIS/NEPA process also provides for an opportunity for public comment.

Virginia will need to decide whether or not to regulate the uranium mill or to leave this responsibility with the NRC. Virginia can regulate the mill by developing and fully staffing a program that is compatible with the NRC's regulatory requirements, which would require a significant dedication of resources as described in the UWG's Report. If the NRC maintains authority over uranium milling, Virginia agencies would be included in the EIS and application review process. The NRC would communicate routinely on notifications, inspection reviews, license reviews, amendments and renewals, and adverse incidents. In addition, Virginia can set the standards for any air emissions or water discharges from the mine and/or mill.

The next step would be to review applications for permits and licenses from the owner/operator wishing to mine and/or mill uranium in Virginia. The process for issuing or denying permits also includes an opportunity for public comment. Prior to a license being issued by the NRC, the NRC is required to provide an opportunity for the public to submit written comments and participate in a public hearing. Virginia agencies would also be provided an opportunity to participate in this comment and hearing process so that state-specific concerns and conditions the Commonwealth believes should be included in a license are considered by the NRC.

## **GENERAL ROLE OF EACH STATE AGENCY**

**DMME:** The DMME's mission is to enhance the development and conservation of energy and mineral resources in a safe and environmentally sound manner. DMME is the lead agency in Virginia for the health and safety of mine workers and the protection of the environment from activities associated with mining. If the moratorium were to be lifted, DMME would be responsible for assuring the occupational safety of those persons working on the mine site through its mine safety program. DMME would also have the responsibility to regulate the mining process through all phases of its life, from exploration, permitting, development and operations to reclamation, closure, and bond release. These responsibilities would include permitting and engineering review of all mine, operations, drainage, and reclamation plans, compliance with approved permit requirements, monitoring of operational and environmental data required by regulation and permit requirements, and approval of all reclamation prior to permit and bond release.

**DEQ:** DEQ is the lead agency in Virginia for the protection of water quality and quantity, and air quality. DEQ has delegation for several federal programs including the Clean Air Act and the Clean Water Act. Therefore, if the moratorium is lifted, DEQ will have responsibilities at all stages of the life cycle of a uranium mining and/or milling operation, starting with a role in determining and documenting baseline environmental conditions, especially for the offsite environs. DEQ would have permitting, compliance and monitoring responsibilities during the operational phase. These responsibilities would include managing through permitting and compliance: stream and wetland impacts from construction, air emissions and water discharges, reviewing monitoring data provided by the operator, and collecting and reviewing ambient monitoring data from offsite.

**VDH:** The mission of VDH is to promote and protect the health of all Virginians. This mission is reflected in VDH's Vision statement, "Healthy People in Healthy Communities." VDH is authorized to execute appropriate roles and responsibilities to this end. VDH's scope of authority includes:

- Ensuring clean, safe drinking water and protecting the public from waterborne disease and water pollution;
- Preventing exposure to toxic substances and minimizing exposure to radiation;
- Strengthening the culture of preparedness and responding in a timely manner to any emergency affecting public health; and,
- Promoting systems, policies and practices that facilitate improved health for all Virginians.

**VDACS:** The Virginia Department of Agriculture and Consumer Services (VDACS) is responsible for enforcing laws and regulations relating to consumer protection and the promotion of agriculture. VDACS would provide oversight on agricultural and consumer protection, and collaborate with other state agencies on environmental monitoring, sampling and analysis.

**VDEM:** The Virginia Department of Emergency Management (VDEM) works with local, state and federal agencies and voluntary organizations to provide resources and expertise on emergency preparedness, response, recovery and mitigation. VDEM's role is discussed in the Emergency Response section of the UWG's Report.

**DOLI:** The Virginia Department of Labor and Industry (DOLI) promotes safe, healthy workplaces, best employment practices and job training opportunities with the goal of making Virginia a better place in which to work, live and conduct business. However, worker safety at a

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mine and/or mill is regulated by DMME and also by the Mine Safety and Health Administration (MSHA), which is discussed in the General Roles of Federal Agencies section of the UWG's Report.

### **GENERAL ROLES OF FEDERAL AGENCIES**

**NRC:** The NRC focuses its regulatory actions on protecting the health and safety of the public and the environment during the active life of a uranium recovery operation and after the facility has been decommissioned. The NRC staff accomplishes this mission by performing the following activities:

- Developing regulations and guidance for the regulated community.
- Reviewing license applications and amendments.
- Developing environmental assessments (EAs) and EISs to support the agency's reviews.
- Inspecting uranium recovery facilities.
- Reviewing decommissioning plans and activities.

**EPA:** The Environmental Protection Agency (EPA) is the lead agency regulating radon. The EPA is also authorized under the 1978 Uranium Mill Tailings Radiation Control Act (UMTRCA) to set generally applicable health and environmental standards to govern the stabilization, restoration, disposal, and control of effluents and emissions at both active and inactive mill tailings sites. The EPA has delegated and continues to have oversight of the Clean Water Act and the Clean Air Act, both of which are delegated to DEQ, and the Safe Drinking Water Act, which is delegated to VDH.

**MSHA:** MSHA, an agency of the United States Department of Labor (DOL), administers the provisions of the Federal Mine Safety and Health Act of 1977. MSHA enforces occupational health and safety laws for all miners at coal and mineral mines as well as all mineral processing operations. If a uranium mine and/or milling operation were permitted and licensed MSHA would be responsible for overseeing the safety and health of workers under 30 CFR. MSHA regulations provide exposure limits for radon, gamma radiation, silica, and diesel fumes.

**DOE:** The Department of Energy (DOE) takes responsibility for the uranium milling site once the NRC certifies closure of the site, including ongoing monitoring.

### **POLICY CONSIDERATIONS**

In establishing a conceptual statutory and regulatory framework that could be used to govern all aspects of uranium mining and/or milling in Virginia, the UWG has identified several topical areas, which would fall within multiple jurisdictional areas of existing state agencies. The UWG recommends that any potential regulatory program include coordination between the relevant agencies to minimize duplication of effort and coordinate enforcement of the requirements assigned to DMME, DEQ, VDH, and other state agencies. The UWG has addressed the areas of concern identified in previous studies, from comments received at public meetings and through emails to the UWG's web site. Some of these concerns can be addressed by revised environmental standards while others will have to be addressed by wholly new statutory authority followed by implementing regulations. The UWG has also reviewed federal standards and will discuss where Virginia should look to more protective standards. Below are the policy considerations the UWG suggests if the moratorium is lifted in Virginia.

## **Public Participation**

All regulatory actions will follow the public participation requirements of the APA. This includes: public comment at the Notice of Intended Regulatory Action stage; the establishment of a Regulatory Advisory Panel with stakeholders to help draft the regulation; and, public comment and hearing(s) on the proposed and final regulations. In addition, VDH and DEQ have citizen boards that hold the authority to adopt regulations and provide an additional opportunity for public comment. The public may sign up on the Virginia Regulatory Town Hall (<http://townhall.virginia.gov>) to be notified by email of regulatory actions, meetings, and public hearings. The public also may post comments regarding specific regulatory actions in public forums found on the Virginia Regulatory Town Hall.

Any statutory framework should include multiple opportunities for public input throughout the complete lifecycle of the mining and/or milling operation. Specific opportunities should be defined in the environmental assessment process, the permitting processes, ongoing environmental monitoring, significant permit modifications or renewals, enforcement actions, and termination of operations.

To ensure the transparency of environmental monitoring data, Virginia could require that any uranium mining and/or milling operation develop a data management system that allows the agencies and the public to have timely access to the environmental data collected by the facility. All environmental data collected by the agencies would be made available in a similar manner. A local community oversight committee to review and monitor environmental data could be established and supported by the State. In addition, any uranium mining and/or milling operation could be required to develop a Community Involvement Plan laying out an ongoing process for public involvement.

## **Uranium Mining Statute**

If the General Assembly decides to lift the existing moratorium, the need for a comprehensive program to regulate uranium mining within DMME can be met by developing a statutory and regulatory program for uranium mining. A key component of a uranium mining regulatory program is the requirement for a complete and thorough operations plan as part of the mine permitting process. This plan would describe the method of mining to be employed (surface, underground, in situ leach [ISL], etc.), the equipment used, the required facilities and structures, and the location of those facilities and structures. It would also describe all water supply and dewatering systems, any ventilation or airborne pollutant control systems, and any other information, which would assist in evaluating the safety and environmental protections provided by the proposed operation.

Another key component of an operations plan is the method(s) that will be instituted to mitigate probable hydrologic consequences of the proposed mining activities on both the quantity and quality of surface water and groundwater, including storm events and mine dewatering. Such consequences are required to be explained in the EIA. Also critical is the requirement for a reclamation plan that enumerates the timing and sequencing of mining activities and the steps that will be taken to provide reclamation over the life of the mine. Contemporaneous reclamation, whenever possible, is also key part of a comprehensive regulatory program.

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Finally, the uranium mining statute would include requirements for a comprehensive review of environmental impacts associated with mining. This process, described in the report as the EIA will mirror those of the NEPA that provides specifications for the EIS.

### **Air Quality Monitoring**

Comprehensive ambient air monitoring on uranium mining and/or milling sites with monitoring equipment installed and operated by the owner/operator is needed to ensure the protection of public health. An evaluation of the air-monitoring network to determine what additions need to be made to the existing network to provide an early warning of offsite impacts would be needed, along with monitoring for radon, radionuclides and radiation. DEQ and VDH would need additional resources to monitor air quality. No additional regulatory or statutory authority would be needed.

### **Air Permitting**

The addition of radionuclides and radon to the list of toxics regulated under the state air toxics program by the State Air Pollution Control Board would enable DEQ to permit and enforce all of the currently regulated emissions from mining and/or milling operations such as crushing, screening, haul roads and engine emissions, plus radon and radionuclides. Mandatory Prevention of Significant Deterioration pre- and post-construction monitoring would provide important baseline information by which to measure any changes. Regulatory authority would be needed for Virginia to regulate air emissions of radon and radionuclides.

### **Groundwater Monitoring**

The performance of a comprehensive hydrologic characterization and a groundwater monitoring network installed and operated by the owner/operator on uranium mining and/or milling sites is needed to address the protection of groundwater resources in the area of a uranium mining and/or milling operation. This includes monitoring of groundwater levels and groundwater quality near key features such as waste rock and tailings storage areas and at the property boundaries. The well installation methods, number of wells, list of constituents to be sampled, sampling methods and sampling frequency should at least meet the requirements imposed by the NRC and standard practices to characterize the groundwater resource. The operation of an offsite monitoring network near uranium mining and/or milling sites using a combination of private well sampling and the installation of dedicated monitoring wells would also be beneficial in achieving prompt warning and the institution of timely compensatory measures. Additional resources, statutory and regulatory authority would be needed.

### **Surface Water Monitoring**

Adding uranium and radionuclides to DEQ's Trace Element Monitoring Program in order to establish what the natural background concentration of total and dissolved uranium in the surface waters of the Commonwealth is necessary. Routine stream monitoring in the watershed where mining and/or milling is occurring would be used to establish background natural fluxes of target parameters as well as to ensure compliance with discharge limits and in-stream water quality standards prior to, during, and after all mining and/or milling operations. Additional resources would be required, but no additional regulatory or statutory authority would be needed.

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If a uranium mining and/or milling program is put in place, the applicant/licensee should be required to continue sampling, analyses and timely reporting on a periodic basis from the end of the baseline sampling program, as required by the EIS until the radioactive materials license for the mill is either granted or denied by the regulatory authority. This recommendation should be made to the NRC if Virginia does not amend the current Agreement. No additional statutory and regulatory authority is required.

### **Water Quality Standards**

Establishment by DEQ of a Scientific Advisory Committee to review and make recommendations on the groundwater and surface water criteria for radioactivity would ensure that the standards are protective. In addition, the Scientific Advisory Committee should look at the need for a special standard that would establish surface water quality standards for public water supplies downstream of any uranium mining and/or milling operation. The Scientific Advisory Committee should coordinate with a Regulatory Advisory Panel. The latter is the stakeholder advisory group required for the development of draft regulations. These criteria and standards would have to be adopted by the State Water Control Board. Regulatory authority would be needed, but no additional statutory authority would be needed.

### **Surface Water Discharge Permitting**

To protect water quality all excess water from mine dewatering, tailings management and any storm water that comes in contact with mineralized waste rock and a mill licensed area should be stored and released only if it meets both:

- Special water quality criteria established through the work of the Scientific Advisory Committee that provides public water supply protection of surface waters downstream from any uranium mining and/or milling operation, and
- Virginia new source technology effluent limits for process wastewater.

To ensure that the effluent standards are protective, DEQ should include the development of Virginia new source technology effluent limits in the work of a Scientific Advisory Committee. Consideration of the impacts of a probable maximum precipitation event should be part of the engineering requirements for all retention ponds and tailing ponds. Regulatory authority would be needed, but no additional statutory authority would be needed.

### **Groundwater Permitting**

The establishment a groundwater management area for a uranium mining and/or milling operation would provide protection for offsite groundwater from dewatering and other impacts. A local scale groundwater flow model should be built in conjunction with the United States Geological Survey for evaluating impacts. Regulatory authority would be needed, but no additional statutory authority would be needed.

The State Water Control Board's anti-degradation policy for groundwater would be the standard for the engineering design requirements in all uranium mining and/or milling permits and licenses. It is important to determine the natural background concentration of total and dissolved uranium in groundwater.



## **Compliance and Enforcement**

To assure compliance with laws and regulations for the mining and/or milling of uranium in the Commonwealth, a strong program will be essential. Key components in a statutory and regulatory framework include:

- Coordination of inspections and monitoring functions among all of the agencies;
- Right of entry upon the site to make unannounced inspections;
- Authority to order immediate cessation of activities to prevent or eliminate an imminent danger to the health or safety to employees or the general public; or to prevent significant harm to land, air or water resources;
- Authority to revoke or suspend the permit when a pattern of violation exists or the permittee fails to comply with orders of the state agencies;
- Provisions for appeal of violations through the Administrative Process Act;
- Public access to all inspection, monitoring, and violation records; and,
- Public notification and participation for all hearings resulting from enforcement actions taken against the operator.

The General Assembly should grant additional authority to issue orders requiring mandatory civil penalties to the owner, operator and/or responsible individuals for the violation of law, regulations, permit conditions, and specific activities that will be subject to criminal prosecution to address the public's concern for strong enforcement. Any monies collected through civil charges or penalties should be directed to a fund specific for the regulation of uranium mining and/or milling operations. Statutory and regulatory authority and additional resources would be needed.

## **Worker and Public Health Monitoring**

In order to ensure the protection of worker and public health, the licensee must perform monitoring of airborne contaminants, and the regulating authority performs confirmatory monitoring and inspections to ensure compliance. The licensee must also make timely notifications of any exceedance of regulatory limits to the licensing agency. The initial monitoring of the health of the community to establish a baseline, and subsequent monitoring at periodic intervals to identify changes over time if mining operations are implemented would be an important component of an overall regulatory framework. Data that could be analyzed as part of such monitoring could include information pertaining to cancer, congenital anomalies, toxic substances-related illnesses, behavioral risk factors, and causes of hospitalizations and deaths. VDH should explore the availability of additional data on population exposures or health outcomes and be prepared to conduct epidemiologic studies if data indicate a health hazard. Statutory and regulatory authority and additional resources would be needed to support these efforts.

DMME's regulatory program would benefit workers by instituting a requirement that the operator provide a radiological protection plan for all mine workers as part of the operations plan. This plan would address worker exposure to radon and gamma radiation, and provide details of worker exposure monitoring and records. Standards for worker exposure would be established in conjunction with VDH, and data on exposures should be shared with VDH. Incorporation of the "as low as reasonably achievable" (ALARA) concept is critical in order to provide additional reductions in worker exposure. Statutory and regulatory authority and additional resources would be needed.

## **Environmental Laboratory**

The mill operator should have an analytical environmental laboratory either on site or readily available that is capable of detecting and measuring environmental levels of radionuclides and chemicals associated with uranium mining and milling. The laboratory should be capable of completing analyses within 24 hours of the time a sample is taken. This comment should be directed to the NRC, if Virginia does not amend the current Agreement. No additional statutory and regulatory authority is required.

## **Private Water Supplies**

In order to provide protection for private water supplies, the applicant/licensee (with the consent of the property owner) should sample and analyze private water supplies on a monthly basis within the area defined to be at risk, through groundwater modeling developed during the baseline sampling period. Such sampling, analyses and timely reporting would need to continue on a periodic basis from the end of the baseline sampling program, as required by the EIS or EIA (if it is a standalone mine) until the permit and/or license for the mine and/or mill is either granted or denied by the regulatory authority and through the operations. Statutory and regulatory authority and additional resources would be needed.

## **Private Water Well Regulations**

To help ensure the protection of private water supplies water quality standards within the area defined to be at risk through groundwater modeling developed during the baseline sampling period are needed. A Scientific Advisory Committee should be used to review and make recommendations to VDH on public health-risk based standards for radionuclides and other contaminants of concern associated with uranium mining and/or milling. This should be coordinated with any action by DEQ to establish a Scientific Advisory Committee to review and make recommendations on the groundwater criteria. Statutory and regulatory authority and additional resources would be needed.

The ability to require the proper and permanent abandonment of any private water supply, within the area defined to be at risk through groundwater modeling developed during the baseline sampling period, that is found to be unsuitable for use, either through contamination or lack of production, may be needed in order to eliminate potential pathways for groundwater contamination. Statutory and regulatory authority and additional resources would be needed.

## **Waterworks Regulations**

VDH's waterworks regulations currently address the radiological quality of water supplied by public water systems. These standards are consistent with those of the EPA and are considered protective of public health. Public waterworks within an area defined to be at risk through groundwater modeling, developed during the baseline sampling period, should be monitored at a non-reduced quarterly frequency.

## **Environmental Monitoring of Commercial Food Sources by Applicant/Licensee**

The public needs to be reassured that food supplies are safe; therefore, representative sampling with the consent of the property owner, associated analyses and timely reporting of crops being commercially grown for human and/or livestock foodstuff (including pasture land grasses and tobacco) within a minimum of 2 miles should be conducted. Sampling, analyses and reporting shall be conducted according to procedures and methods approved by VDH/VDACS prior to commencement of sampling. Statutory and regulatory authority and additional resources would be needed to implement these recommendations.

## **Regulations Concerning Recreational Use of Water**

Water quality standards for swimmable surface water would be needed. Such standards must exist to protect public health with an adequate margin of safety. This process should be coordinated with DEQ's proposal to establish a Scientific Advisory Committee to review and make recommendations on the groundwater and surface water criteria for radioactivity. Authority to establish water-monitoring requirements for all water quality standards at summer camps and campgrounds could be the second phase of such protections. The Commissioner of Health would need the authority to prevent access to waters at summer camps, campgrounds and beaches when levels exceed the developed water quality standards for swimmable surface water.

## **Regulations Concerning Human Health Surveillance and Reporting**

The UWG's Report contains a review of adverse health outcomes that could potentially occur among workers and the community. Lung cancer, other respiratory diseases, and renal toxicity have been cited as adverse health effects in workers among sites that existed before regulations were put into effect. The UWG's Report identifies potential pathways for exposures to workers and the community, such as inhalation, ingestion, and dermal (skin) that could lead to exposure. Best management practices and engineering controls, such as dust control measures, pollution prevention devices on stacks, ore storage pads and tailings impoundment liners, and water diversion channels, are designed to minimize impacts from mine and mill operations.

While the risk of exposures and adverse health effects is minimal, the UWG's Report includes a recommendation that VDH monitor available data pertinent to the health of the community. VDH maintains a number of data systems that can be used to monitor the health status in different areas of the state. Such data systems allow the assessment of cancer, congenital anomalies, various other chronic diseases, toxic substances-related illnesses, hospitalizations and deaths. Currently, VDH has sufficient authority to evaluate public health impacts in the Commonwealth. However, VDH may need additional authority to collect data necessary to monitor human health impacts that may be associated with uranium mining and milling. For example, an individual's occupation may need to be recorded to establish trends in worker health effects, if any. The current list of diseases pursuant to 32.1-35 does not include diseases related to exposure to radionuclides, and certain toxins relating to uranium mining and recovery may need to be added to the toxic substance list in order for VDH to collect Private Health Information from those exposed to such agents if uranium mining and/or milling occurs in the Commonwealth. Studies of the health of the population living near any potential mining or milling operation should be conducted initially and reassessed at regular intervals to identify

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any changes in health status. VDH would conduct further assessments if the data indicates human health hazards exist. Statutory and regulatory authority and additional resources would be needed.

### **Mine Financial Assurances**

Strong financial assurance is a critical part of any statutory and regulatory framework created for the mining of uranium in order to protect the public from financial obligations for actions or inactions resulting from the operation. Such a program must take into consideration the complete life cycle of the mining from exploration through reclamation and decommissioning of the mine. Key components of a financial assurance statute require 1) a performance or reclamation bond based on third party performance of required reclamation work; 2) liability insurance sufficient to provide coverage for personal and economic injury as well as property and natural resource damage protection; 3) a uranium response fund which is readily accessible to the Commonwealth to respond to the release or threatened release of any pollutant or contaminant into the environment from the mining operation; and 4) long-term environmental monitoring fund or trust which would assure financial resources for monitoring surface water, groundwater and air quality during and after reclamation and decommissioning of the mine. Each of these components needs to be funded by the operator and established prior to the commencement of operations.

### **Mill Financial Assurances**

The NRC has a strong financial assurance program for uranium mills. These regulations are included in 10 CFR Part 40, Appendix A. This financial assurance program is discussed in full detail within the Permit/License Development Process section of the UWG's Report. Equivalent provisions would need to be instituted by the Commonwealth if Virginia were to amend its Agreement.

### **Resources**

**DMME:** DMME anticipates utilizing existing staff including geologists, hydrologists, ecologists, engineers and GIS specialists to review the initial mining permit. DMME staff is well versed in reviewing the various components necessary to obtain a mine permit. To ensure seamless communication during the review process, DMME would work closely with experts from VDH and DEQ and outside consultants as necessary. Once operations commence, DMME anticipates needing 5 FTEs in the areas of mine inspection, mine engineering, hydrogeology and other technical specialists. It is estimated that these positions combined would cost approximately \$1,000,000 per year in personnel, administrative and equipment costs. Although funding will be required initially to fully develop and support the permitting program, these costs would eventually be covered through permit and license fees paid by the operator.

**VDH:** VDH could see a demand for increased services and regulatory activities particularly in communities and areas where uranium mining and/or milling activities occurred. Five offices and one division within VDH have been identified as organizational units that would be impacted by increased workloads and citizen expectations if uranium mining were to be conducted in Virginia.

The Division of Radiological Health (DRH) is presently organized, staffed, and equipped to administer the radiation control activities for the Commonwealth for users of radioactive materials and other sources of ionizing radiation. There would be an increase in workload for

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DRH even if the NRC remained the regulatory agency for the licensing of any uranium mills within Virginia. A radon program, for instance, would need to be instituted to help educate the public about the risks associated with radon exposure as well as on techniques to mitigate dose.

If the Commonwealth were to amend its Agreement for uranium milling, a major increase in staffing and funding for DRH would have to occur before the NRC would approve an amended Agreement. An estimated 8 DRH FTEs and \$1,000,000 annually would be required. DRH has estimated that an additional 2.5 FTEs and \$145,000 annually would be necessary if the mining moratorium is lifted.

The Office of Drinking Water (ODW) would need an additional 0.5 FTE and about \$40,000 of additional annual funding. The Office of Epidemiology (OEpi) would need an additional 4 FTEs and \$360,000 annual funding for epidemiologists, health educators, and data managers. If there is a desire to oversample BRFSS data for a local area, OEpi would need approximately 500 surveys per area sampled at an additional cost of about \$25,000 - \$30,000 for each area. The Office of Environmental Health Services (OEHS) would need an additional 6 FTEs and \$1,858,848 annual funding for additional annual sampling and analyses of private water wells, assuming that VDH would bear the costs of sampling and analyses.

**DEQ:** DEQ anticipates utilizing existing staff such as hydrologists, engineers and biologists to review and issue various environmental permitting, compliance and monitoring. To ensure seamless communication during the review process, DEQ will work closely with experts from VDH and DMME and outside consultants as necessary. Once operations commence, DEQ anticipates needing 4 FTEs in the areas of environmental permitting, compliance and monitoring. Initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$800,000 per year in personnel, administrative and equipment costs.

### **Permit and License Fees**

Having permit and license fees (initial and annual) covering the full costs of regulating uranium mining and milling in Virginia would ensure that the public does not have to bear such costs. Funds from these fees should be held in a dedicated non-general fund account in each agency. Statutory authority would be needed. Other possible resources could include general funds and fees generated from a severance tax.

## I. INTRODUCTION

In 1982, the General Assembly of Virginia passed Senate Bill 179 (SB 179) establishing requirements for the permitting of uranium exploration activities under Title 45.1, Chapter 21 (45.1-272 – 45.1-285.1). Section 45.1-283, commonly referred to as the “moratorium,” further precluded the acceptance of uranium mining permit applications until a program for permitting uranium mining is established by statute. The moratorium, found in Section 45.1-283 of the Code of Virginia (Code), is as follows:

*§45.1-283. Uranium mining permit applications; when accepted; uranium mining deemed to have significant effect on surface.*

*Notwithstanding any other provision of law, permit applications for uranium mining shall not be accepted by any agency of the Commonwealth prior to July 1, 1984, and until a program for permitting uranium mining is established by statute. For the purpose of construing §45.1-180(a), uranium mining shall be deemed to have a significant effect on the surface. (1982, c.269; 1983, c.3)*

In 1983, Senate Bill 155 created the Uranium Administrative Group (UAG), which was authorized to contract with consultants to conduct studies evaluating the costs and benefits of uranium mining at specific locations in Pittsylvania County, and report its findings to the Virginia Coal and Energy Commission in December 1983. In January 1984, the Coal and Energy Commission accepted the UAG recommendation to continue and expand the scope of studies under the oversight of the newly created Uranium Task Force (UTF), which was to report its findings on October 1, 1984. The UTF, in its Final Report to the Coal and Energy Commission, concluded that “uranium development activity can be undertaken with an acceptable level of risk and with economic benefits to the state if the recommendations proposed are adopted and are treated as an essential ingredient that must accompany any lifting of the moratorium on uranium mining” (UTF, 1984). Among the key UTF recommendations was the following (#3):

*That a uranium mining statute be adopted with features that are appropriate for this particular mineral. The specific features that should be considered within that law are spelled out in supporting documents of the Task Force and are the subject of continuing work by the Division of Legislative Services (DLS).*

The work of the Division of Legislative Services (DLS) resulted in draft legislation (HB1129), entitled “Virginia Uranium Mining and Milling Regulatory Act of 1985”. This legislation was introduced but was withdrawn before being heard in committee due to changes in market demand for uranium.

A complete list of studies reviewed by the Uranium Working Group (UWG) is attached in the bibliography. Several of these studies are available electronically and can be found at <http://www.uwg.vi.virginia.gov/links.shtml>.

In 2007, interest in uranium mining and milling was renewed. The Department of Mines, Minerals and Energy (DMME) issued an exploration permit on November 20, 2007, to Virginia Uranium, Inc. (VUI) for a site at Coles Hill in Pittsylvania County, Virginia. Legislation was also introduced in the 2008 session to establish a legislative commission to

consider whether uranium mining should occur in the Commonwealth. As a result, several studies were conducted to review public health and environmental issues associated with uranium mining and milling.

## II. GOVERNOR'S DIRECTIVE

In a letter dated January 18, 2012 members of the General Assembly requested that additional study be performed. In response to this letter, Governor McDonnell directed the establishment of the UWG consisting of staff from DMME, the Virginia Department of Health (VDH) and the Department of Environmental Quality (DEQ). Both letters may be found in Appendix A. The Governor directed the UWG to provide a scientific policy analysis to help the General Assembly determine the regulatory framework that would be required if the moratorium on uranium mining in the Commonwealth were lifted. The UWG was not charged with making a recommendation regarding lifting the moratorium; rather, to provide the General Assembly information to aid their decision making.

The Governor's Directive listed 18 issues for the UWG's review and provided the agencies the authority to hire technical expertise to assist the UWG in fulfilling these duties. In order to provide additional scientific and technical expertise to this study the agencies issued two requests for proposals (RFPs). The Directive was used as the foundation for the scope of work in both RFPs.

### Uranium Study Procurement

One RFP was a joint proposal by DEQ and DMME. The other, focusing more on public health issues, was issued by VDH. The two RFPs were issued on March 2 and March 5, 2012, respectively. The DMME/DEQ contract was awarded on May 21 and the VDH contract was awarded on June 6. Both contracts were awarded to Wright Environmental Services (WES) of Fort Collins, Colorado. The WES proposals can be viewed at <http://www.uwg.vi.virginia.gov/links.shtml>

On March 2, 2012, the DEQ issued RFP # 12-06-PJ (Uranium Study). The purpose of the procurement was to acquire contractor services to provide information and expert analysis of uranium mining and milling issues in Virginia relevant to the statutory jurisdictions of DEQ and DMME. DEQ received five proposals:

- Wright Environmental Services
- Southwest Research Institute
- Marshall Miller & Associates
- Southeast Rural Community Assistance Project
- Trinitek Services

An award was made to WES on May 21, 2012 in the amount of \$513,133. The contract period is through November 30, 2012.

The work included an initial review of existing studies and the provision of ongoing technical advice and assistance to the UWG. The work also included a series of interim reports analyzing a range of issues identified in the RFP and a final report that: 1) compares the Points for Consideration (PFCs) in the initial report to the statutory jurisdictions of DEQ and DMME; 2) identifies areas where regulatory coverage needs to be created, modified or

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expanded to ensure protection of public health and the environment with respect to the lifespan of mining and milling projects in Virginia and long-term site monitoring requirements; and 3) recommends a structure for possible new statutes.

On March 5, 2012, VDH issued RFP # 1200001-999 (Uranium Study). The purpose of the procurement was to acquire contractor services to conduct a study of uranium mining and milling issues in Virginia relevant to the statutory jurisdiction of VDH. The RFP identified two major work Tasks (A and B). Work Task A involved the development of an initial report based on 1) a review of Virginia and other relevant studies related to uranium mining and milling in Virginia, 2) a comparison of existing uranium mining and milling regulatory programs including the Nuclear Regulatory Commission (NRC), Agreement State programs, and international programs (such as Canada and France), and provisions from within those regulatory programs that are relevant to the Board of Health's mission, and 3) a review of emerging standards from international organizations. VDH received three proposals:

- Wright Environmental Services
- Southwest Research Institute
- Trinitek Services

An award was made to WES on June 6, 2012 in the amount of \$520,350. The contract period is through December 14, 2012.

The initial report for VDH was completed on July 27, 2012 by WES. Work Task B involved ongoing technical advice and assistance to the UWG. The efforts of Work Task B has resulted in a series of interim reports analyzing a range of issues identified in the RFP (Task B.1 and B.2), and support of the VDH public meetings regarding the regulation of private wells as well as development of a final report.

### **III. UWG ACTIVITIES**

#### **Review of Existing Studies**

In addition to the 18 items in the Governor's Directive, the UWG reviewed numerous reports to identify potential issues and risks that may be associated with uranium mining and milling. This was an important first step in the work of the UWG, so that the UWG could develop recommendations and a conceptual statutory and regulatory framework to mitigate those risks to the extent possible. In addition, the contractor was asked to review these reports and to assist the UWG with the identification of risks. The most important issues identified in the reports are:

- A holistic evaluation of health and environmental concerns considering Virginia specific characteristics and encompassing the entire life cycle of an entire mining and milling operation is needed to ensure the health and safety of workers and the general public;
- The current mining statutes under Title 45.1 of the Code do not address the unique radioactive and geochemical properties of uranium-mineralized rocks found in ore grade concentrations, or the associated mineralized non-ore waste rock, soils, and subsurface hydrological environments. Some of the unique characteristics that should be considered in providing a statutory framework for uranium mining include:
  - Exposure to gamma radioactivity;



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- Radon exposure hazards (underground mine workers, mine ventilation outlets, emissions from waste rock and stockpiles);
  - Exposure to chemical toxicity of uranium and associated elements;
  - Radionuclide (e.g. radium) transport in mine waters;
  - Release of airborne radio-particulates in dust; and
  - Ensuring site stability during periods of temporary cessation of operations.
- If the moratorium is lifted, cooperation between multiple state and federal regulatory programs to assure an orderly and comprehensive regulatory pattern and avoid duplication would be needed;
  - If the moratorium is lifted, a comprehensive uranium mining regulatory program should incorporate specific technical standards and best practices in operations and reclamation that are unique to that industry; these standards should ensure that uranium mining would be conducted in a manner that is protective of the Commonwealth's natural resources and that reclamation is accomplished as contemporaneously as practicable with mining. Such a program should include:
    - An environmental impact analysis (EIA) prior to the commencement of mining activities (an internationally accepted best management practice);
    - Waste rock and ore stockpiles being managed effectively to prevent the release of radiological and non-radiological contaminants;
    - Appropriate performance standards for bond release; and
    - Engineering design standards that consider the possibility of extreme weather and climate events.
  - The NRC currently has a comprehensive uranium milling regulatory program which incorporates specific technical standards and best practices in operations that are unique to that industry including:
    - Site characterization;
    - Air-borne monitoring;
    - Radiation exposure monitoring;
    - Uranium recovery process;
    - Waste management;
    - Bio-assay program;
    - Contamination control program;
    - Tailings pond design;
    - Reclamation and decommissioning; and
    - Accident response and mitigation.
  - If the moratorium is lifted, a comprehensive and effective community-engaged environmental monitoring program would be necessary to ensure compliance and foster transparency;
  - Virginia's positive water balance conditions and implications for runoff from mine waste, tailings, and ore stockpiles must be considered in determining whether uranium mining should be allowed;
  - If the moratorium is lifted, protection of groundwater resources in accordance with Virginia's anti-degradation policy for groundwater would require:

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- Thorough site characterization supplemented by predictive modeling to evaluate the potential risks of environmental impacts; and
- Consideration of future impacts of mine dewatering on groundwater resources.
- If uranium mining took place in the Commonwealth, reclaimed uranium mined lands would require long-term environmental monitoring and property-transfer encumbrance requirements that are not available in existing mining laws;
- If the moratorium is lifted, a statutory and regulatory framework for uranium mining and milling should include public participation and transparency throughout the life cycle of mine planning, operations, reclamation, closure, and environmental monitoring;
- If the moratorium is lifted, financial assurances should be required from the operator that sufficiently address short-term and long-term environmental risks, while minimizing the risk that reclamation and mitigation costs would be borne by the citizens of the Commonwealth; and,
- If the moratorium is lifted, additional staff with specific technical expertise that is unique to this industry and a mechanism for recovering the costs to the Commonwealth should be included in any new statutory framework.

## Wright Environmental Services Reports

The reports from the two contracts can be found at <http://www.uwg.vi.virginia.gov/links.shtml>. These reports, reviewed and discussed in great detail by the UWG, provided the background information and the knowledge to develop the recommendations in this report. The WES Final Report includes a table with approximately 140 specific recommendations or “PFCs” that Virginia should consider when developing regulations. Each item is referenced back to the more detailed WES reports. The PFCs include much more detail than this report and provide a valuable tool to assist with the regulatory development process, should the moratorium be lifted. This table is attached to this report for the reader’s convenience.<sup>1</sup>

A list of the reports developed by WES for DEQ and DMME follows:

- Uranium Study: Initial Report
- Uranium Study: Surface Water and Groundwater Monitoring Plans and Standards Adequacy Assessment
- Uranium Study: Assessment of Financial Assurance Mechanisms
- Uranium Study: Air Quality Monitoring Report
- Uranium Study: Safe Disposal of Mine and Mill Wastes
- Uranium Study: Engineering Design and Best Management Practices
- Uranium Study: Full Components of Environmental Impact Analyses

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<sup>1</sup> Table of PFCs can be found in Appendix B.

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A list of the reports developed by WES for VDH follows:

- Uranium Study: Initial Report, Commonwealth of Virginia, Department of Health
- Uranium Study: Interim Report #1, Commonwealth of Virginia, Department of Health
- Uranium Study: Interim Report #2, Commonwealth of Virginia, Department of Health
- Facilitators Final Report: Public Meetings Regarding Impacts to Private Wells, Public Water Supplies and Recreational Waters by Uranium Mining and Milling, Commonwealth of Virginia, Department of Health
- Uranium Study: Final Report, Commonwealth of Virginia - Department of Health, Department of Environmental Quality, Department of Mines, Minerals and Energy

### **UWG Public Meetings**

The UWG held several public meetings to provide information, to answer questions from the public and to record public comment.

- March 7, 2012, at the General Assembly Building in Richmond. This meeting did not provide an opportunity for public comment but was used to inform the Uranium Subcommittee of the Coal and Energy Commission of the UWG's work plan.
- June 18, 2012, in the Chatham High School auditorium. DMME provided a description of the unique characteristics of uranium and rationale for a new mining statute and regulatory program, and an overview of what the conceptual program should include. Specific topics included: EIA, mine permitting, engineering designs and best management practices, management of mine waste, environmental monitoring of mine sites, compliance and enforcement, and mine site reclamation. Over 400 people attended the meeting. The question-and-answer period and the public comment period went well beyond the scheduled completion time of 8 p.m., as it did for all of the public meetings.
- August 2, 2012, at the Olde Dominion Agricultural Complex in Chatham. This meeting consisted of a joint presentation by VDH and NRC staff on NRC's role in regulating uranium milling. Approximately 150 to 200 people attended the meeting.
- August 28, 2012, in Virginia Beach at the Convention Center. At this meeting DEQ described its programs and covered these study topics: air monitoring, air permitting, surface water monitoring, water quality standards, water permitting, compliance and enforcement. Approximately 150 to 200 people attended the meeting.
- October 17, 2012, at the Olde Dominion Agricultural Complex in Chatham. At this meeting VDH described its programs and covered these study topics: protection of public health, protection of private wells, Agreement State status (NRC delegation of milling regulatory authority), and NRC mill regulations. Approximately 150 to 200 people attended the meeting.
- November 27, 2012, at the Science Museum in Richmond. This meeting covered: worker safety, impacts on economic development, protection of existing business and property values, financial assurance, and coordinated emergency response.

## **VDH Private Well and Recreational Water Use Meetings**

VDH recognized that the moratorium would be of interest to stakeholders across the Commonwealth. Accordingly, VDH conducted four public meetings (Chatham, Warrenton, Virginia Beach and a final wrap-up session in Chatham) and three facilitated discussions to promote participation from a diverse group of stakeholders and to ensure regional concerns were captured. Attendees were asked to consider the following questions in the first three general public meetings:

- What are the public's concerns related to the impact of uranium mining and milling on water quality and quantity of private wells?
- What are the public's concerns related to the impact of uranium mining and milling on recreational use of surface water?
- What role should VDH play in assuring that public health is protected in regard to private wells and recreational water use in the event uranium mining and milling were allowed in the Commonwealth?
- What safeguards should be in place to protect private wells and recreational water if the moratorium on uranium mining is lifted?

After each general public meeting, similar comments were grouped into broad categories to facilitate further discussion at the following day's discussion, a day-long facilitated meeting intended to have sufficient discussion of the broad topics to identify the basic stakeholder concerns. Understanding the core concerns of the public would help VDH determine what issues would have to be addressed should the moratorium be lifted. The attendees were not asked to reach consensus as to the validity of a stated concern.

Representatives from VDH, DEQ, and DMME attended the discussion sessions to help identify concerns that might be addressed by their agency.

VDH conducted a final public meeting in Chatham on September 17th to summarize the comments and questions collected by VDH regarding private wells and recreational water issues related to uranium mining and milling in Virginia. During that meeting, the UWG process was summarized. Other topics discussed included VDH's structure and experience, VDH's authority and enforcement, the mill permitting process, best management practices, monitoring and the possibility of catastrophic events, economic impacts, and opportunities for public participation.

Discussion group members represented a wide variety of stakeholder interests: landowners, farmers, business owners, local governments, universities, health care professionals, environmental companies, and non-profit entities. Most commenters favored retaining the moratorium. Attendees shared their concerns using historical examples of past uranium mining and milling activity and other examples from Virginia and surrounding states such as the coal industry and fracking technology.

One overriding concern was present in each session and was basic to most of the categories; the possible cost and financial burden of the uranium industry operations and of managing the legacy wastes. Attendees contended that there would be huge costs and expressed uncertainty over who would have responsibility for the burden of payment if the moratorium were lifted in the following areas:

- to create a baseline on pre-mining environmental and health conditions,

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- to develop the regulatory framework to regulate the industry (including pursuing Agreement State status with the NRC, should the Commonwealth choose to do so),
- to staff the appropriate agencies in the Commonwealth to effectively regulate the industry,
- to conduct environmental monitoring (in perpetuity),
- to manage the uncertainties of operations and potential catastrophic events,
- to bear the burden of cleanup in the event the operator defaults on its obligations, and
- to maintain the legacy facility in perpetuity.

Some participants asserted their belief that the financial burden would fall largely to the taxpayers in the Commonwealth and eventually become a federal government burden. Another central theme was the concern about transparency of information disseminated from all phases of the operations. Participants expressed a lack of confidence that operators, regulators, and decision makers would be forthcoming about the impacts to stakeholders, both from routine operations and from operational failures or catastrophic events. This concern extended to whether the Commonwealth would have the ability to anticipate the problems, to ensure a facility and system design that addresses the problems, and to create contingencies to maintain protectiveness in the event of a disaster.

A report summarizing the VDH Private Well and Recreational Water Use meetings is available on the UWG website.

### Other Meetings and Activities

Members of the UWG met weekly in person or via conference call from January 19 to November 30. These meetings were supported by agency staff who researched, reviewed and drafted reports. Citations for published documents that were reviewed by the UWG are included in the bibliography in Appendix C.

- On March 22, 2012, members of the UWG met with staff from the NRC to discuss NRC regulations and programs and the role of the NRC in licensing any mill proposed in Virginia.
- Members of the UWG attended all of the public meetings conducted by the National Academy of Sciences (NAS) about their report in order to hear and understand the concerns raised by the public.
- VDH developed four maps detailing the structures, public wells and the groundwater and surface water public intakes in the Coles Hill vicinity, as well as the watershed downstream of the area; site and a population density comparison between Virginia and Canada; and a topographical characterization.
- DEQ staff visited with VUI on April 26<sup>th</sup>. VUI briefed DEQ primarily on surface water and groundwater monitoring but also touched on other environmental monitoring that they are undertaking. After the briefing, DEQ was given a tour of the site including all of the surface water monitoring sites on and off the property. DEQ also received the results of groundwater samples taken on the site and from private wells offsite and surface water samples from both on and offsite. DEQ did not receive information on the location of any of the offsite wells to protect the privacy of the well owners. Not having location information or any information on the construction of the wells did limit the value of the

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information. DEQ shared summaries of the VUI hydrologic data evaluations with the rest of the UWG.

- DMME conducted an information gathering visit to the VUI office in Chatham and the Coles Hill site on May 16-17; examined and sampled Marline and VUI core; visited rock outcrops, meteorological stations, surface water sample locations on Whitethorn, Mill, and Georges Creek, examined confluence at Bannister River; visited possible mill and tailings site locations; discussed geology, mine and mill plans. Rock core samples from the Coles Hill site were submitted for geochemical analysis to Activation Laboratories Ltd, located in Ancaster, Ontario. Actlabs is an internationally recognized commercial laboratory providing a range of specialized mineral analytical services. The analytical procedures included 1) whole rock geochemical analysis, 2) acid-base accounting (ABA), and 3) mineralogical characterization by mineral liberation analyzer (MLA) methods. The results of these analyses indicate nothing in the geochemical or mineralogical character of the expected ore, sub-ore, or waste rock at Coles Hill that would be considered “unique,” or could not be addressed in a statewide conceptual framework for regulating uranium mining.
- Members of the UWG attended an evening citizen’s forum on uranium mining and milling in Chatham on July 9. The forum provided information for the Pittsylvania County Board of Supervisors.
- Members of the UWG met with and consulted the Virginia Department of Emergency Management (VDEM) to discuss and develop emergency response planning and procedures that would be needed if the moratorium were lifted.
- Members of the UWG attended the Public Forum on Uranium Mining in Virginia, held at the Cabell Brand Center, Virginia Western Community College located in Roanoke on July 27.
- Members of the UWG held a webinar on September 18 with Professor Robert Bodnar with Virginia Tech, several of his colleagues, and graduate students to discuss the ongoing research being conducted to develop an environmental baseline on Coles Hill.
- On October 2, UWG members attended an evening uranium informational forum in Danville, sponsored by the Danville-Pittsylvania County Chamber of Commerce and the UVA Sorensen Institute for Political Leadership.
- Members of the UWG met with Mr. Kevin Scissons on October 3, former Director of the Canadian Nuclear Safety Commission to learn more and ask questions about the Canadian regulatory system for uranium mining and milling.

## **GENERAL ROLE OF EACH STATE AGENCY**

### **DMME**

The mission of the DMME is to enhance the development and conservation of energy and mineral resources in a safe and environmentally sound manner in order to support a more productive economy in Virginia.

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DMME employs approximately 208 people in six divisions and an administrative support group located in four offices across the state (Richmond, Charlottesville, Lebanon and Big Stone Gap). The department is staffed with individuals with extensive knowledge and expertise in mining and reclamation. These include mining engineers, mine safety specialists, Geographic Information System (GIS) and computer aided design (CAD) specialists, environmental and reclamation specialists, geologists, and hydrologists. DMME staff review permit applications and provide technical assistance to ensure mining is conducted in an environmentally responsible fashion. Mine inspectors and mine safety specialists also ensure industry's compliance with existing laws and regulations.



**Figure 1**

DMME provides for worker safety on coal and mineral mine sites throughout the Commonwealth. DMME also assists with worker safety on gas and oil extraction sites. DMME investigates complaints from citizens living near mining or gas and oil extraction sites, works to eliminate off-site environmental damages and ensures proper reclamation of land used for mineral extraction. Serving as Virginia's Geological Survey, DMME develops and provides information about Virginia's diverse geology, natural hazards and mineral and energy resources.

As shown on the map below, mining is conducted across the Commonwealth in almost every county. In 2010, there were approximately 670 permitted operations that produced over 83 million tons of combined coal, crushed stone, aggregate, and other industrial minerals with an estimated value of \$3.1 billion. These operations employed approximately 7,700 Virginians.

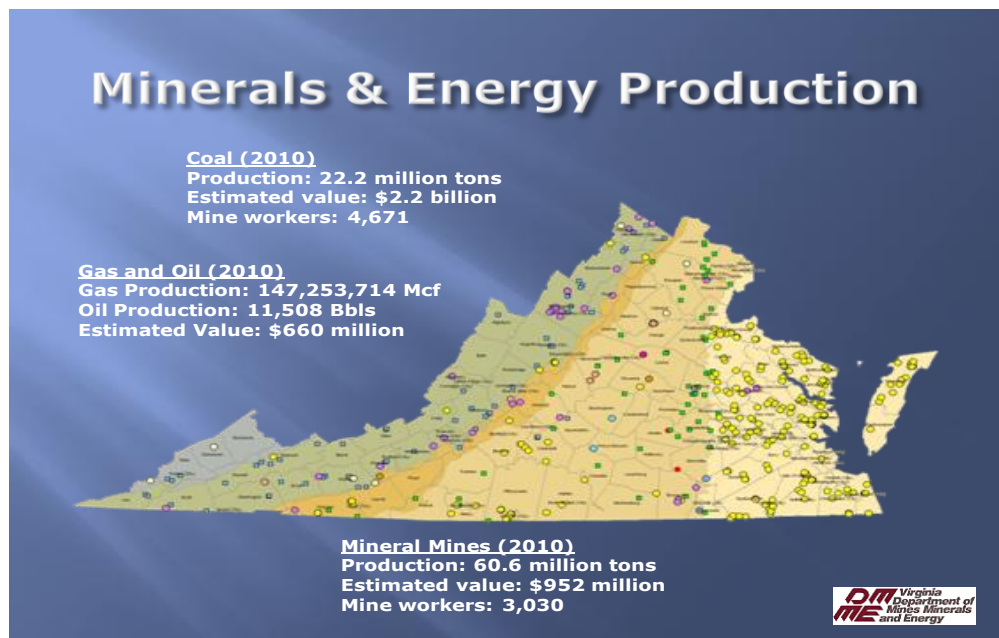


Figure 2

DMME has established a successful track record regulating the mining industry in Virginia, protecting the natural resources of the Commonwealth, and enhancing the safety of mine workers. Most of the advancements in mining and reclamation technologies that have evolved in recent years are considered applicable to any commodity that might be mined in Virginia. However, unlike other mineral commodities mined in Virginia, uranium-enriched rocks present unique challenges that encompass concerns for the environment, public health, and socio-economic impacts. Based upon these unique issues, if the moratorium is lifted, DMME would need new statutory authority and would need to develop a new comprehensive regulatory program for uranium mining. With regard to mine worker safety, DMME would need additional statutory authority to require a radiological protection plan and other necessary safeguards to ensure the health and safety of mine employees if uranium mining is allowed in the Commonwealth.

## DEQ

DEQ is the lead agency in Virginia for the protection of water quality and quantity, and air quality. DEQ has delegation for several federal programs including the Clean Air Act and the Clean Water Act. Therefore, if the moratorium is lifted, DEQ will have responsibilities at all stages of the life cycle of a uranium mining and milling operation, starting with a role in determining and documenting baseline environmental conditions, especially for the offsite environs. DEQ would have permitting, compliance and monitoring responsibilities during the operational phase. These responsibilities would include managing through permitting and compliance: stream and wetland impacts from construction, air emissions and water discharges, reviewing monitoring data provided by the operator, and collecting and reviewing ambient monitoring data from offsite.



### VDH

The mission of VDH is to promote and protect the health of all Virginians. This mission is reflected in VDH's Vision statement, "Healthy People in Healthy Communities." VDH is authorized to execute appropriate roles and responsibilities to this end. VDH's scope of authority includes:

- Ensuring clean, safe drinking water and protect the public from waterborne disease and water pollution;
- Preventing exposure to toxic substances and minimize exposure to radiation;
- Strengthening the culture of preparedness and responding in a timely manner to any emergency affecting public health; and,
- Promoting systems, policies and practices that facilitate improved health for all Virginians.

VDH's Division of Radiological Health (DRH) is designated as the state radiation control agency under Section 32.1-228.1 of the Code. DRH is responsible for protecting the public and the environment from unnecessary radiation exposure whether from the healing arts, research, educational institutions or industry. This requires a diverse staff with multi-disciplinary skills and extensive training. In 2009, the Governor entered into an agreement with the NRC where Virginia assumed responsibility for the regulation of radioactive material, ***but the agreement does not extend Virginia's authority to uranium milling***. In an Agreement State scenario DRH would assume responsibility for the regulation of uranium milling operations. This is further discussed in the Agreement State section of this report. Regulations regarding radioactive material use are contained in 12VAC5-481 "Virginia Radiation Protection Regulations" which were promulgated in 2008 and amended in 2009. These regulations were vetted and approved by the NRC for the regulation of radioactive materials licensees and apply to all persons who receive, possess, use, transfer, own, or acquire any source of radiation provided that they are not subject to regulation by the NRC. The NRC performs periodic reviews of Agreement State programs under the Integrated Materials Performance Evaluation Program (IMPEP) to ensure compliance. In November of 2010, the NRC performed the first evaluation of Virginia under this program during which the risk management plan (RMP) received a "satisfactory" grade.

VDH's Office of Drinking Water (ODW) conducts the Commonwealth's regulatory program for public water systems under the Safe Drinking Water Act (SDWA) and the Virginia Waterworks Regulations. This program regulates water supply systems, which provide piped water for drinking or domestic use to multiple users. ODW regulates the design and construction of public water supply systems, the staffing and operations of these facilities, and the sampling, monitoring, and reporting of water quality of the water distributed. Water quality standards include biological, chemical, and radiological components.

VDH's Office of Epidemiology (OEpi), through the statutory authority given to the VDH by the Code and regulations of the Board of Health, is required to collect, analyze and report incidence data on an extensive list of infectious diseases and investigate outbreaks and other public health emergencies. The Public Health Toxicology program conducts surveillance of toxic substances exposures and maintains a database of medical information documenting those exposures. VDH has a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) that provides a structure for conducting health assessments.

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VDH's Office of Environmental Health Services (OEHS) regulates private water wells under the provision of the "Private Well Regulations," 12VAC5-630-10 et seq. These regulations set minimum construction standards and horizontal setbacks from potential sources of contamination for all private water wells. Additionally, the regulations require bacteriological testing of the water at the time of initial construction or rework for all private residential drinking water wells (Class III wells). Revisions adopted in 2012 include minimum storage capacity and yield requirements for residential drinking water wells. These regulations do not address the chemical or radiological quality of the water from private water wells or mandate periodic on-going testing of the water from private wells.

OEHS also regulates summer camps and campgrounds. Summer camps are regulated under the "Regulations for Summer Camps," 12VAC5-440. These regulations require that all reasonable precautions be taken to prevent the pollution of swimming water by human excreta but do not set numerical water quality standards for natural water source swimming areas.

VDH's Office of Family Health Services (OFHS) is charged with providing timely, reliable and accurate data concerning the health status of families in Virginia. OFHS coordinates health risk surveys, including the Behavior Risk Factor Surveillance System survey (BRFSS), the Virginia Youth Survey, and the Pregnancy Risk Assessment Monitoring System (PRAMS). OFHS is also responsible for maintaining and analyzing the Virginia Congenital Anomalies Reporting and Education System (VaCARES), a registry of reported birth defects, as well as the Virginia Cancer Registry (VCR). Other data sources include birth certificates, death certificates, and hospital discharge data. OFHS uses this data to monitor chronic disease and understand and promote healthy behaviors and lifestyles in Virginia. OFHS has primary responsibility for conducting public education regarding disease prevention and control for non-communicable diseases.

VDH's Office of Minority Health and Health Equity (OMHHE) is responsible for research and analysis that defines disease distribution and social determinants of health; thereby identifying health equity issues related to public health outcomes.

### **VDACS**

The Virginia Department of Agriculture and Consumer Services (VDACS) is responsible for enforcing laws and regulations relating to consumer protection and the promotion of agriculture. The Department is located within the Governor's Secretariat of Agriculture and Forestry and has both economic development and regulatory responsibilities under state law. VDACS' employees work among the state headquarters office, field offices and five regional diagnostic animal health laboratories. VDACS would provide oversight on agricultural and consumer protection, and collaborate with other state agencies on environmental monitoring, sampling and analysis.

### **VDEM**

The Virginia Department of Emergency Management (VDEM) works with local, state and federal agencies and voluntary organizations to provide resources and expertise on emergency preparedness, response, recovery and mitigation. VDEM's role is discussed in the Emergency Response section of this report.

### DOLI

The Virginia Department of Labor and Industry (DOLI) promotes safe, healthy workplaces, best employment practices and job training opportunities with the goal of making Virginia a better place in which to work, live and conduct business. Worker safety at a mine or mill, though, is regulated by DMME and the Mine Safety and Health Administration (MSHA) which is discussed in the General Roles of Federal Agencies section.

## GENERAL ROLES OF FEDERAL AGENCIES

### NRC

The NRC focuses its regulatory actions on protecting the health and safety of the public and the environment during the active life of a uranium recovery operation and after the facility has been decommissioned. The NRC staff accomplishes this mission by performing the following activities:

- Developing regulations and guidance for the regulated community.
- Reviewing license applications and amendments.
- Developing environmental assessments (EAs) and environmental impact statements (EISs) to support the agency's reviews.
- Inspecting uranium recovery facilities.
- Reviewing decommissioning plans and activities.

Uranium milling and disposal of the resulting waste byproduct material by NRC licensees are regulated under Title 10, Part 20, of the Code of Federal Regulations (10 CFR Part 20), "Standards for Protection Against Radiation"; 10 CFR Part 40, "Domestic Licensing of Source Material"; and Appendix A to 10 CFR Part 40 which sets forth the criteria relating to the operation of uranium mills and the disposition of tailings or wastes produced as a result of the milling process. These criteria require uranium recovery facilities to control industrial hazards and address waste and decommissioning concerns. NRC regulations may be found at <http://www.nrc.gov/reading-rm/doc-collections/cfr>

If the moratorium is lifted, the Commonwealth may want to take authority of regulating uranium milling by amending its current Agreement with the NRC. The NRC has a documented process for a state to enter into this Agreement, which is titled SA-700, "Processing an Agreement" (<http://nrc-stp.ornl.gov/procedures/sa700.pdf>). There are four active Agreement States with uranium programs: Colorado, Utah, Texas and Washington. The last state to amend their Agreement for uranium milling regulation was Utah. The letter was submitted in 2001 and the Agreement was signed in 2004.

The NRC has a uranium program with necessary staff to perform licensing and inspecting. At this time, the NRC has approximately 10 individuals in their licensing branch and approximately 15 individuals in their environmental review branch. Utah, by comparison, has 7 individuals in their licensing/permitting section and 8 individuals in their compliance section. Amending the Agreement would allow Virginia to assume regulatory authority of uranium milling versus allowing the NRC to maintain its authority.

Under the scenario where Virginia would expand its Agreement State authority to regulate uranium milling, the NRC would delegate all regulatory authority to the Commonwealth. The NRC would perform periodic audits of the DRH radiation protection program for which

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it has delegated authority to ensure compliance with NRC requirements. The NRC would be available to DRH for consultation but would not be engaged in daily administration of the Radioactive Materials Program.

### **EPA**

The Environmental Protection Agency (EPA) is the lead agency regulating radon. The EPA is authorized under the 1988 Indoor Radon Abatement Act (IRAA) to establish a long-term goal that indoor air be as free from radon as the ambient air outside buildings. The law authorized funds for radon-related activities at the state and federal levels. States may enter into an EPA funded indoor Radon Program to provide information to the public regarding: radon standards, testing and mitigation. Currently, Virginia does not participate in this program.

The EPA is also authorized under the 1978 Uranium Mill Tailings Radiation Control Act (UMTRCA) to set generally applicable health and environmental standards to govern the stabilization, restoration, disposal, and control of effluents and emissions at both active and inactive mill tailings sites

The EPA has delegated and continues to have oversight of the Clean Water Act and the Clean Air Act, both of which are delegated to DEQ, and the Safe Drinking Water Act, which is delegated to VDH.

### **DOE**

Under UMTRCA, the Department of Energy (DOE) is charged with completing surface reclamation at inactive uranium mill tailings sites. Uranium tailings piles that meet certain criteria must be turned over to the DOE or the state, under 10 CFR Part 40.28, for custody of and long-term care, including monitoring, maintenance, and emergency measures necessary to protect the public health and safety.

### **MSHA**

The Federal Mine Safety and Health Administration (MSHA), an agency of the United States Department of Labor (DOL), administers the provisions of the Federal Mine Safety and Health Act of 1977. MSHA enforces occupational health and safety laws for all miners at coal and mineral mines as well as all mineral processing operations. If the moratorium were lifted and a uranium mine and/or milling operation were permitted and licensed in the Commonwealth, MSHA would be responsible for overseeing the safety and health of workers under 30 CFR. MSHA regulations provide exposure limits for radon, gamma radiation, silica, and diesel fumes.

#### IV. CONCEPTUAL STATUTORY AND REGULATORY FRAMEWORK FOR THE LIFE CYCLE OF URANIUM MINING AND MILLING

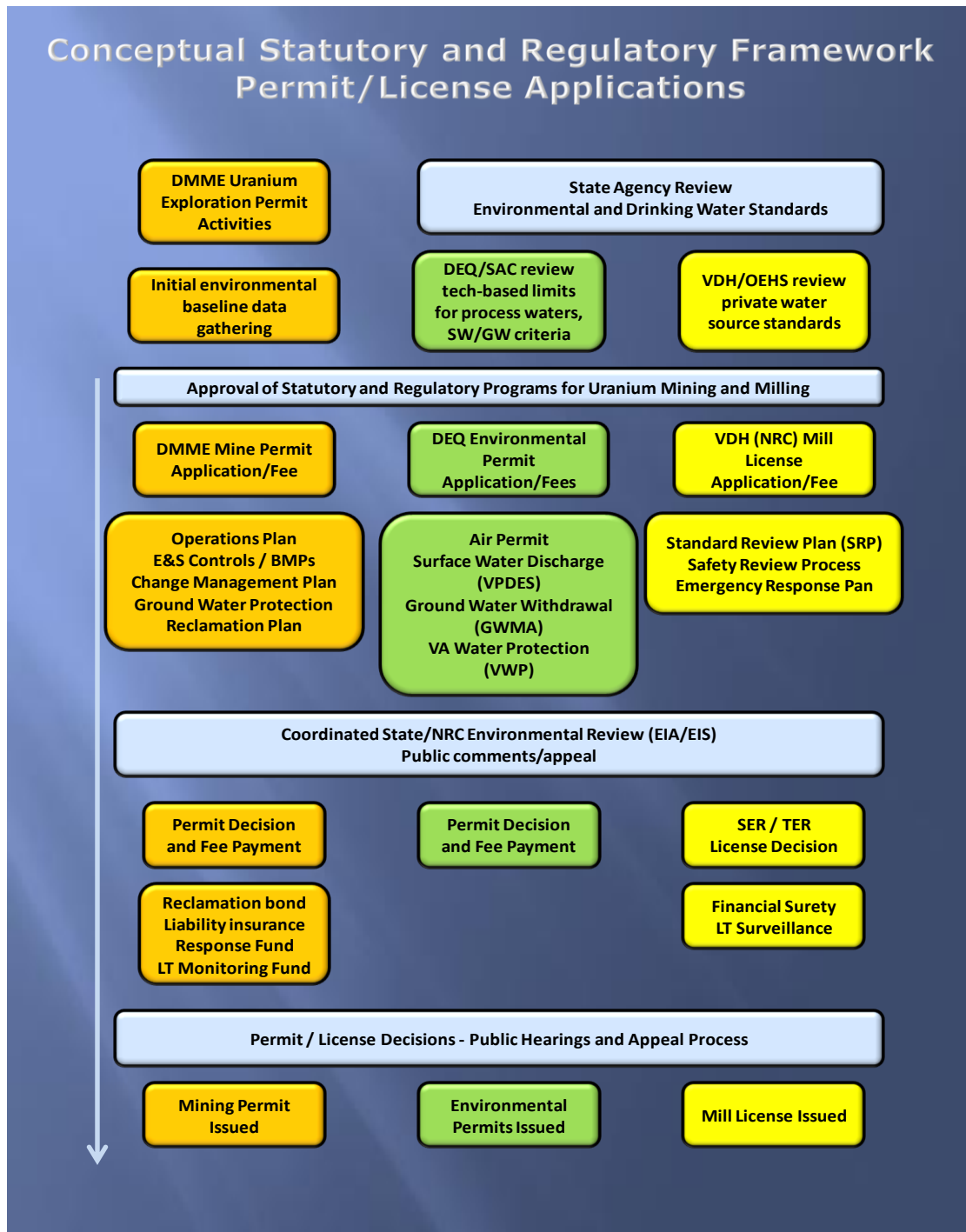


Figure 3

In order to provide a conceptual statutory and regulatory framework that would be needed if the moratorium on uranium mining were lifted in Virginia, the UWG looked at the full life

cycle of the uranium mining and milling process. Below is a description of each part of the process illustrated above. Statutory and regulatory authority, whether existing or needed to address gaps, are discussed for each state and federal agency that would potentially have a role in permitting, enforcing, and monitoring activities at a mine and/or mill site to maintain environmental, public and worker health and safety if uranium mining were allowed in Virginia.

## **REVIEW OF ENVIRONMENTAL AND DRINKING WATER STANDARDS**

### **Surface Water and Groundwater Standards**

If the moratorium is lifted and prior to any application for a uranium mining permit, DEQ would need to conduct a thorough regulatory review of its water quality standards to ensure they would be adequate to address potential impacts associated with uranium mining and/or milling activities.

Water quality standards consist of designated uses, water quality criteria and an anti-degradation policy. All state waters have been designated for the types of uses for which protection is needed. Criteria are numeric standards needed to protect those designated uses.

All surface waters are designated for recreational uses including swimming, the support of an indigenous population of aquatic life, and production of an edible and marketable natural resource (fish and shellfish consumption). Some surface waters are designated for public water supply and have additional criteria to protect water supplies. Several segments of the Banister River and Cherrystone Creek upstream from Chatham’s raw water intake, as well as Lake Gaston and the John Kerr Reservoir in Virginia, have been designated as public water supplies. Below are the current standards that would need to be reviewed:

#### **SURFACE WATER QUALITY CRITERIA 9VAC25-260**

<b>Parameter</b>	<b>Aquatic Life Acute</b>	<b>Aquatic Life Chronic</b>	<b>Human Health Public Water Supply</b>	<b>Human Health Other Surface Waters</b>
Gross Alpha Particle Activity			15 pCi/l	
Beta Particle & Photon Activity			4 mrem/yr	
Combined Radium 226 & 228			5 pCi/l	
Uranium			30 ug/l	
Zinc	120 ug/l	120 ug/l	7,400 ug/l	26,000 ug/l

**Figure 4**

**GROUNDWATER STANDARDS FOR RADIOACTIVITY 9VAC25-280**

<b>Constituent</b>	<b>Concentration</b>
Total Radium (Ra-226 & Ra-228)	5 pCi/l
Radium 226	3 pCi/l
Gross Beta Activity*	50 pCi/l
Gross Alpha Activity (excluding Radon & Uranium)	15 pCi/l
Tritium	20,000 pCi/l
Stontium-90	8 pCi/l
Manmade Radioactivity – Total Dose Equivalent	Combination of all sources should not exceed total does equivalent of 4 mem/yr

\*Used as a screening value only

**Figure 5**

If a review is initiated, Virginia should establish a Scientific Advisory Committee to review and make recommendations on the groundwater and surface water quality standards criteria for radioactivity. In addition, if the Scientific Advisory Committee is established, the committee should recommend a special standard that would establish public water supply criteria for surface waters downstream of any uranium mining and milling operation. Because of the importance of any Scientific Advisory Committee recommendations, a variance from the Governor's Executive Order to remove the time limitations for developing a draft regulation and allowing the Scientific Advisory Committee to work along with a Regulatory Advisory Panel should be requested. The latter is the stakeholder advisory group that would be required for the development of draft regulations. Regulatory authority would be needed, but no additional statutory authority would be needed for these recommendations.

**Technology-Based Limits for Mining and Milling Process Wastewater**

The following table has the federal uranium point source requirements (technology-based limits) for mining and milling process wastewater required by 40 CFR Part 440 and incorporated into the Virginia Pollutant Discharge Elimination System (VPDES) permit regulation, 9VAC25-31-10.

**WATER PERMITTING TECHNOLOGY, NEW SOURCE LIMITS EPA 40 CFR 440**

<b>Effluent Characteristics</b>	<b>Maximum</b>	<b>30-Day Average</b>
Chemical Oxygen Demand (COD)	200 mg/l	1—mg/l
Zinc	1000 ug/l	500 ug/l
Ra 226 (dissolved)	10.0 pCi/l	3.0 pCi/l
Ra 226 (total)	30.0 pCi/l	10.0 pCi/l
Uranium	4000 ug/l	2000 ug/l
TSS	30.0 mg/l	20.0 mg/l
pH	6.0 – 9.0	

**Figure 6**

The federal technology limitations are outdated and; therefore, development of Virginia new source technology limits should be included with the work of the Scientific Advisory Committee if the moratorium is lifted and a Scientific Advisory Committee is convened.

DMME would utilize these standards to ensure the protection of groundwater and surface water at mining operations if uranium mining were allowed in the Commonwealth.

**Private Water Supplies**

Through the Private Well Regulations, VDH’s OEHS regulates the location, construction and proper abandonment of private wells. The regulations also provide minimum yield and storage requirements for residential water wells. VDH does not have the authority to require private wells to be permanently abandoned using the standards set forth in the Private Well Regulations. The only water quality standard for private water wells in Virginia is the requirement that private drinking water wells are free of bacteriological contamination at the time they are approved for use. Bacteriological requirements do not apply to non-potable private wells such as agricultural wells. Also, VDH does not have the authority to implement additional water quality standards for private water supplies. If the moratorium is lifted, VDH would need the authority to further regulate private water supplies beyond the current bacteriological quality standards.

**URANIUM EXPLORATION ACTIVITIES**

The life cycle of a uranium mining operation begins with initial exploration activities that are currently authorized in Title 45.1, Chapter 21 of the Code. The existing statutes specifically define “exploration activity” as the drilling of test holes or stratigraphic or core holes of a depth in excess of fifty feet for the purpose of determining the location, quantity, or quality of uranium ore.

Lifting the current moratorium could result in an increase in exploration activities. Also, exploration techniques and technology have evolved since the existing statutes were enacted. For these reasons, the UWG recommends that if the moratorium is lifted, the General Assembly should amend Title 45.1 Chapter 21 to include all exploration activities that would involve any surface or underground disturbances.



## PERMIT /LICENSE APPLICATION MINE AND MILL

### MINE PERMITTING

# Permitting Process

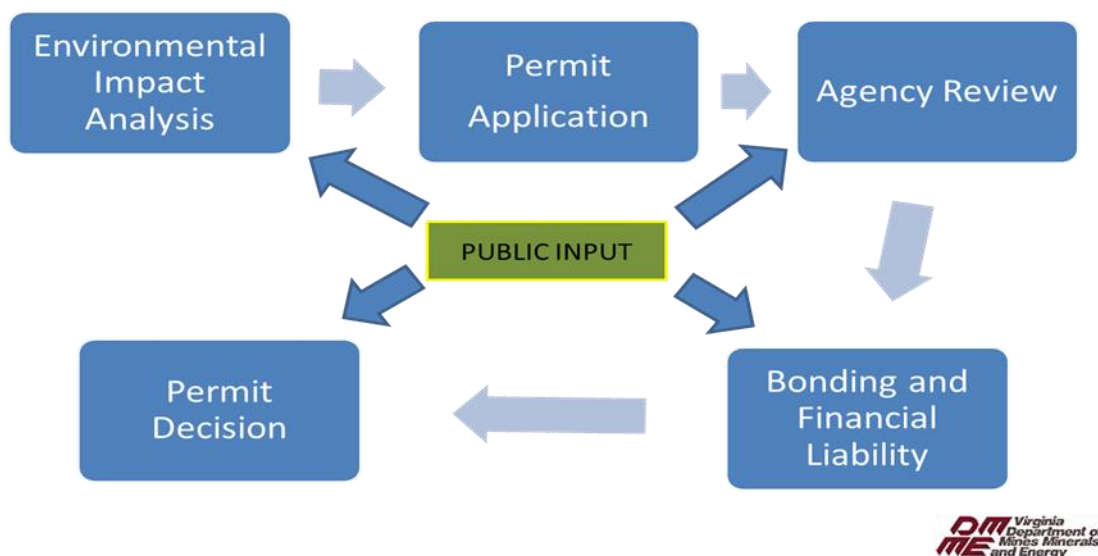


Figure 7

### Initiation of Permit Application

If the moratorium is lifted, the General Assembly would need to establish through statute DMME’s authority to develop regulations that set forth the components of a complete permit application. These components should include, but are not limited to: engineering designs, proof of required public notification, operations plan, reclamation plan, groundwater protection plan, and the completed EIA. These will be discussed in detail later in this report.

If the moratorium is lifted, the permitting process should begin when the operator initiates a mine permit application with DMME. The applicant should be required to provide a description of the planned operation, which would begin the EIA process that requires a comprehensive review of the effects of the proposed operation. The initiation of the permit application would also alert DMME as to the other permits that would be required in addition to the mine permit, in order to promote a collaborative approach among all permitting agencies.

Concurrently with a mine permit application, the operator would need to file for a mine safety license. The safety license process is governed by existing mineral mine safety statutes. Per these statutes, operators are required to pay a license fee and to maintain an emergency response plan. The license would not take effect unless and until a mine permit was issued. Once the license took effect, the operator would be bound to comply with all existing mineral mine safety laws and regulations.

## **EIA/EIS PROCESS**

If the moratorium is lifted, a regulatory program for uranium mining in Virginia, with or without an associated mill facility, should require a comprehensive range of environmental analyses that specifically address the unique challenges of mining radioactive source materials. In this regard, the consensus of recent studies (NAS, 2011; Chmura, 2011) together with internationally accepted guidelines for environmental performance standards (IAEA, 2010; IFC, 2006) make it clear that the EIA is a key best practice and a fundamental regulatory tool for assessing the potential impacts of proposed uranium mining developments.

The National Environmental Policy Act of 1969 (NEPA) establishes the national environmental policy and goals for the protection, maintenance, and enhancement of the environment and provides a process for implementing these goals by federal agencies. To be clear, NEPA regulations<sup>2</sup> apply to projects at any level of government in which federal funding is involved, or where work will be conducted by the federal government, or where a permit or approval from a federal agency is required. The NEPA process can result in one of three processes for environmental review: a categorical exclusion (CATEX), an environmental assessment (EA), or an environmental impact statement (EIS). The review process involves consultation with numerous state, federal and local agencies. A flow chart illustrating the generalized NEPA process is shown below.

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<sup>2</sup> 40 CFR 1500, <http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=a4dbf3c5f409d9b8469fe4009101a016&rgn=div5&view=text&node=40:34.0.3.3.1&idno=40>

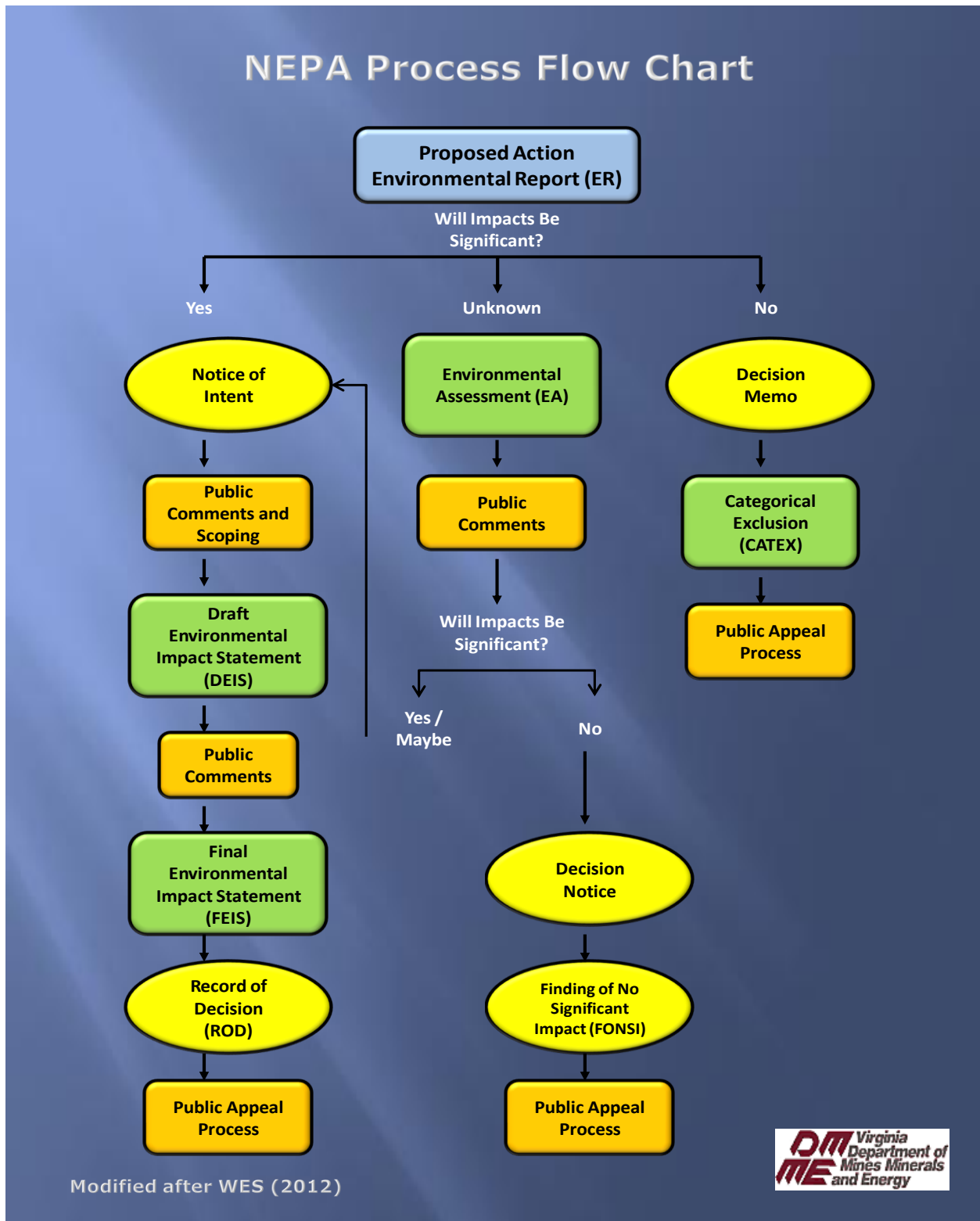


Figure 8

To the extent that mining developments on private lands are regulated by states and not the federal government, if the moratorium is lifted there would be no federal requirements for compliance with NEPA as part of the uranium mine permitting process. Therefore, any

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statute that results from the moratorium being lifted should establish the requirements for a uranium mining permit application and require an EIA that models the NEPA EIS requirements. That statute should also allow DMME to use the NEPA EIS performed as part of a combined mine/mill operation application if an applicant files for both a mine permit and a mill license at the same time.

Since the NRC has primary regulatory authority over uranium mill facility licensing actions, it is possible that potential proposed uranium mining activities would be subject to the requirements of NEPA if the mine is considered a “connected action.” The NRC EIS requirements and process are included in 10 CFR Part 51<sup>3</sup>. The NRC also maintains a guidance document titled “Regulatory Guide 3.8, Preparation of Environmental Reports for Uranium Mills.” This guide: “...identifies information needed by the NRC staff to assess the potential environmental effects of the proposed uranium mill and directly associated mining activities and establishes a format acceptable to the staff for its presentation.”

This is an important consideration for any combined uranium mining and milling operation in Virginia. If the moratorium is lifted and the NRC Agreement is not amended, the NRC would have primacy over the NEPA process for both the mine and mill and would apply its existing regulations. The various state agencies described in this report would become cooperating agencies with the NRC, be allowed to review the applicant’s environmental report and provide comments to the NRC. Any statutory framework that results from lifting the moratorium should include the ability to adopt any appropriate NRC NEPA decision documents (e.g., EIS), provided that the analyses and documents meet the Commonwealth’s program requirements. If, NRC Agreement is amended, the state EIS process would be fully regulated by the Commonwealth following the federal NEPA model.

Regardless of the decision to amend the Agreement, any regulatory framework for uranium mining in Virginia should anticipate the possibility of future mining that is not associated with a uranium mill licensing application. The EIA process would need to be included as a requirement of all standalone uranium mine permit applications, as well as significant amendments to existing uranium mine permits, and should closely follow the NRC NEPA model with DMME as the lead regulatory authority.

A summary of the NRC NEPA process was provided in the WES task report entitled, “Full Components of Environmental Impact Analyses.” The report also included key points for consideration in the development of a regulatory framework in Virginia if uranium mining is allowed in the Commonwealth. Based upon WES’ report findings together with additional information gathered by the UWG, if the moratorium is lifted a conceptual statutory framework for uranium mine permitting should include the following key elements for the EIA process:

- Baseline data submitted by the applicant that encompasses a full assessment of environmental, social, and health conditions that may be affected by uranium mining operations;

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<sup>3</sup> 10 CFR Part 51 “Environmental Protection Regulations for Domestic Licensing and Regulated Regulatory Functions,” <http://www.nrc.gov/reading-rm/doc-collections/cfr/part051/>.

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- The state EIA process should follow the federal NEPA model for the licensing of uranium mill sites by the NRC described under 10 CFR Part 51; this model is initiated by the applicant's Environmental Report (ER), which would provide the basis for a tiered assessment with three potential levels of review including, a) CATEX, b) environmental assessment (EA), and c) full EIA;
- A minimum of one year of data collection and monitoring would be expected so as to account for variations in seasonal baseline conditions; this could occur concurrently with other permit application activities;
- Provisions for timely availability of all EIA documents, and public review and comment should be included at multiple stages of the EIA review process, including the notice of intent, initial scoping, draft review, and final review prior to a decision on the permit application;
- Review and approval of the EIA findings should be conducted as a coordinated process between state agencies, with final approval granted prior to the issuance of the DMME mining permit;
- There should be a mechanism for the full recovery from the permit applicant of all costs associated with the EIA review process, including the costs for third-party contractors if needed;
- Specific or prescribed standards and criteria for many of the components of the EIA, such as area surrounding the mine permit boundary to be assessed, number and placement of monitoring locations, frequency of sample collection, etc., could be established in regulations;
- For mine permit actions that are connected with mill licensing actions, the combined impacts of mining and milling would need to be considered following the NRC NEPA requirements under 10 CFR Part 51 (if DMME is a cooperating agency with NRC).
- Description of the proposed mining actions (and associated milling actions if applicable);
- Description of key environmental parameters for a specified area surrounding the mine permit boundary, including:
  - Site description, population distribution, socio-economic status and trends; environmental justice concerns, public transportation infrastructure and use;
  - Land use, agriculture (livestock and crop production, dairies, pasturelands);
  - Regional archeological, historic, scenic, cultural resources;
  - Background radiation surveys;
  - Geology and soils;
  - Host rock, waste rock, overburden, and ore characterization (geochemical, radiological, hydrogeologic, mineralogical);
  - Groundwater quality, location of uppermost and hydraulically connected aquifers, hydraulic gradient, recharge characteristics;
  - Inventory of public and private water sources (would need to be coordinated with VDH);
  - Surface water quality, stream flow amounts, stream channel dimensions;
  - Ecology (terrestrial and aquatic, vegetation, biota surveys, endangered species, riparian/wetlands);
  - Site specific meteorological data (Probable Maximum Precipitation (PMP), Probable Maximum Flood (PMF), wind speed/direction, precipitation, evaporation, RH, temperature, extreme events);
  - Air quality data (PM10, PM2.5, total dust, radioparticulates, radon, direct gamma);
  - Seismology
  - Any other parameters identified in the scoping process.

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- Environmental effects of site preparation, facilities construction and commencement of mining activities;
- Environmental effects of mine operations (and mill, if a combined operation);
- Environmental monitoring methods, schedules, frequency, site criteria, results from predictive modeling of air and hydrology;
- Cumulative impact analysis;
- Short and long-term impacts of site reclamation;
- Alternatives to the proposed action (including No Action);and
- Risk/benefit analysis.

These components constitute a comprehensive list of environmental factors that could be impacted from a uranium mining and/or milling operation. This process would allow for the necessary risk assessment of proposed activities and for appropriate engineering designs to be established, thereby mitigating the risks identified in the analysis to the extent achievable. The EIA process would also establish baseline conditions against which monitoring data could be measured once operations commenced and continue through reclamation and decommissioning. A comprehensive EIA would enhance coordination among the agencies involved as they consider the entire lifecycle of a proposed combined operation.

Any statutory framework for uranium mining should include multiple opportunities for public input throughout the complete lifecycle of the operation. Specific opportunities should be defined in the environmental assessment process, the mine permitting process, ongoing environmental monitoring, significant permit modifications or renewals, enforcement actions, and bond release of areas disturbed by mining.

### Operations Plan

If the moratorium is lifted, statutory authority should be provided to require a complete operations plan as part of the mine permitting process. This plan would describe the method of mining to be employed (surface, underground, in situ leach (ISL), etc.), the equipment to be used, the required facilities and structures, and the location of those facilities and structures. It would also describe all water supply and dewatering systems, any ventilation or airborne pollutant control systems, and any other information, which would assist in evaluating the safety and environmental protections provided by the applicant. The operations plan would need to:

- Address the probable hydrologic consequences of the proposed mining activities on both the quantity and quality of surface water and groundwater, including storm events and mine dewatering.
- Include information to obtain and comply with required DEQ permits for water discharge (VPDES), a groundwater withdrawal permit under the Groundwater Management Act (GWMA), and air quality.
- Provide a groundwater protection plan to control and monitor the effects of mining operations on groundwater. The operations plan should also identify alternative sources of water which would be available for replacement or mitigation of impacts on existing sources.
- Include a plan for identifying and separating non-mineralized waste from mineralized waste. Uranium mining activities can potentially generate large volumes of “mineralized” and “non-mineralized” mine waste rock. Mineralized waste rock is material that has chemical and/or radiological characteristics that would necessitate

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management to protect human health or the environment. The geochemical characterizations of overburden, ore, and non-ore host rock in the EIA would provide the basis for mine waste rock management. The plan would need to include protocols for sampling, testing, sorting, and transporting waste rock. Testing should include geochemical analysis, ABA, and leach testing to determine the potential for the release of toxic, acid-forming, or radioactive materials. Criteria for site selection and design of mine waste storage areas should also be included in the EIA. Consideration should be given to the preferential placement of waste rock in existing mine voids as part of the mine reclamation process.

- Performance standards would need to be established for non-mineralized waste rock disposal that include structural stability, seismic design stability, dust controls, and surface water diversion and control. Non-mineralized waste rock disposal sites should be designed and periodically reviewed during construction by a licensed professional engineer.
- Performance standards would need to be established for mineralized waste rock disposal that include structural stability, seismic design stability, dust controls, surface water diversion and control, internal water control, encapsulation of toxic, acid-forming, or radioactive materials, and cover requirements to minimize radon release. Designs should include the “As Low As Reasonably Achievable” (ALARA) concept to minimize radiological exposure to mine workers and the environment. They should also include surface water and groundwater protection plans and periodic monitoring requirements for both surface water and groundwater. The sites should be designed by a licensed professional engineer. Periodic inspection and certification of construction in accordance with the design by a licensed professional engineer should be required.
- Address the management of ore and waste storage facilities since the management of ore and waste storage facilities would be a critical component in the protection of air, surface water, and groundwater resources.
  - If the moratorium is lifted, the operator(s) of a combined mine and mill site may propose storage of mill tailings in mined areas (either surface mine pits or underground mine workings). Disposal of tailings in mine workings would have the potential to improve the isolation of radionuclides and other toxic materials from the environment, but would also have the potential to impact groundwater. In either case, the affected workings would fall under the control of the NRC (or the VDH, if Agreement Status for milling were obtained), and would require coordination of the mining plans and the mine permit with the substantial requirements for tailings disposal of that agency. It would also place the affected portion of the mine permit under the jurisdiction of the mill permitting agency.
- Include a characterization of all mined materials to insure that all toxic, radioactive, or acid forming materials are identified and handled in a manner that will prevent environmental degradation.
- Provide for the management of surface water within the area affected by the mining operation. Plans would need to be developed with the concept that all surface water should be diverted from contact with any toxic or acid forming materials to the extent possible. Erosion and sediment controls need to be identified as part of the operations plan.
  - Performance standards for the design, construction, and operation of all facilities that conduct or store surface water would need to be established by regulation. These standards should ensure that facilities could withstand extreme climatological events. The regulatory program would also need to include specified design storm event criteria for engineering designs as a function of the design life. Designs of all

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significant structures should include evaluation of performance under a PMP event. All such facilities should be designed and constructed under the supervision of a licensed professional engineer, and should include stability and seismic stability analyses.

- Include a thorough on-site monitoring plan. This plan would need to include surface water and groundwater monitoring to validate the probable hydrologic consequences data and provide timely indications of any changes in water quantity and quality. These monitoring plans should be reviewed with DEQ and VDH.
- Address requirements for continued process operations, monitoring and facility maintenance during a temporary cessation of mining. Historically, many mines have suspended operations for a period of time because of poor market conditions.
- Provide a comprehensive radiological protection plan for all mine workers. The principal sources for radiation exposure to miners are radon gas and gamma radiation from radionuclides. MSHA regulations provide exposure limits to miners<sup>4</sup>. Current Virginia mine safety regulations also regulate radon exposure to underground miners<sup>5</sup>. The plan would need to address worker exposure to radon and gamma radiation, and provide details of worker exposure monitoring and records of individual worker exposure. Standards for worker exposure would need to be established in conjunction with VDH. This plan should incorporate the concept of ALARA, an internationally accepted best practice, to provide additional reductions in worker exposure. This plan and exposure standards should be harmonized with the mill worker standards required by the NRC<sup>6</sup>.

### Change Management Plan

Given the possible life of a uranium mine of greater than 30 years, it is anticipated that there will be advances in technology and changes in mine operation. If the moratorium is lifted, a structured change management plan should be required of the mine operator to provide a formal process of periodic review and plan adaptation to reflect operational experience and incorporate improvements in technology and achievable standards.

### Reclamation Plan

If the moratorium is lifted, any statute and regulations for mine permit application requirements should include operator provisions for a reclamation plan, which should contain a complete plan for the timing and sequencing of mining, and the steps taken to provide reclamation over the life of the mine. Contemporaneous reclamation should be required whenever possible. Criteria for the reclamation of open pits should be provided by regulation to minimize the amount of exposed high wall and to insure long-term stability.

The reclamation plan would need to provide detailed delineation of the post-mining land use. Consideration should be given to the placement of perpetual easements on land titles to

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<sup>4</sup> 30 CFR Part 57

<sup>5</sup> 4 VAC 25 -40- 3290 through 3320.

<sup>6</sup> 12VAC5-481-640 which incorporates 10 CFR 20.1201



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assure acceptable post-mining land use for waste disposal areas and other areas which may be sensitive to further disturbance.

The plan would also need to contain cost estimates for 3<sup>rd</sup> party reclamation to provide a basis for sufficient reclamation bonding. Reclamation bonding should be required and in place for the complete reclamation of a mine area before that area is disturbed. Estimates should be reviewed on an annual basis to ensure bond adequacy.

A mechanism modification of bond amounts should exist to allow for changes in mining and/or reclamation plans, and to allow for bond increases as a function of increased risk (operator violations, etc.). Criteria for bond release would need to be provided in a regulatory program. These criteria should address performance standards for acceptable reclamation completion, including air and water quality. The criteria should also include an opportunity for public input prior to bond release.

If the moratorium is lifted, the resulting statutory framework would need to contain authority to access reclamation bonds expeditiously in the event the operator fails to meet permit requirements. Post-mining land use determination should include consideration of local and state land use plans and programs.

Any requirements for reclamation plans should require the operator to incorporate measures to mitigate the release of contaminants including:

- Capping of waste disposal areas as soon as possible to minimize impact on surface water and groundwater;
- Minimizing the infiltration of water into the waste materials to reduce leachate generation;
- Installation of vegetative covers as soon as practicable; and
- Ongoing monitoring and refinement of the closure plans.

### **Collaboration and Review by Other Agencies**

If the moratorium is lifted, the regulatory framework should include a mechanism to provide an integrated and multidisciplinary collaboration between agencies for mine permit review. This should include environmental, engineering, health, safety, monitoring, and legal resources.

### **Best Management Practices**

There are recommendations for Best Management Practices from the International Atomic Energy Agency (IAEA), the International Radiation Protection Association, the World Nuclear Association, and other recognized organizations. Those recommendations include the following subject areas during the design, operation and reclamation (closure) of mine facilities:

- Surface water;
- Groundwater;
- Air;
- Waste Rock;
- Mine water storage ponds;

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- Embankments; and
- Seismic design.

If the moratorium is lifted, those practices should be incorporated into a regulatory program.

If the moratorium is lifted, risk, hazard, and operations analyses should be a requirement of the operations and reclamation plans. The regulatory program should include requirements that all significant facilities be designed by licensed professionals of the appropriate discipline. The regulatory program should include requirements that the design of all significant structures include stability analysis and seismic protection analysis.

If a permitting process is established, public involvement should take place throughout the entire process. As discussed earlier, the public would have many opportunities to participate in the EIA. Once a permit application is received, all documents submitted in support should be posted online for public review and comment. This process should be repeated for future amendments to or renewals of permits. A public hearing should be held prior to the initial permitting decision. Notices of public hearings would need to be posted on the Virginia Regulatory Town Hall as well as the participating agencies' websites.

### **Mill License Application**

Under their current program, the NRC reviews an applicant's qualifications, design safety, environmental impacts, operational programs, and site safety when a uranium recovery program application is submitted to the agency. An application for a licensee to possess and use source material for uranium milling or for the conduct of any other activity which the Commission has determined will significantly affect the quality of the environment shall be filed at least 9 months prior to commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by any required ERs per 10 CFR 40.31(f). Based on information filed by the applicant followed by extensive NRC evaluations including assessing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the NRC makes a determination regarding the issuance of the proposed license accompanied by any appropriate conditions to protect environmental values. Commencement of construction prior to this conclusion is grounds for denial of a license to possess and use source and byproduct material in the plant or facility.

The NRC uses Regulatory Guide 3.5, "Standard format and content of license applications for uranium mills" to provide applicants with guidance on the format and content of an application for uranium mills. The NRC is developing a Standard Review Plan (SRP) for conventional uranium mill and heap leach facilities. The SRP "...provides guidance for the detailed safety (technical) review of new and renewal license applications and amendment requests associated with conventional uranium mills and heap leach facilities. NRC staff will use information in this SRP, once approved, in the review of applications for new facilities, renewals, and amendments.

An applicant must clearly demonstrate the manner in which the requirements and objectives in applicable sections of 10 CFR Part 20 and 10 CFR Part 40 have been addressed. Guidance for addressing NEPA requirements for the licensing of uranium recovery operations is contained in NRC Regulatory Guide (NUREG)-1748, Environmental Review Guidance for Licensing Actions Associated with Nuclear Material Safety and Safeguards (NMSS)

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Programs (NRC, 2003). Use of the SRP will enable consistent quality and uniformity in NRC staff reviews. In the license application review, the NRC staff must determine whether operations will be conducted in an acceptable manner and in compliance with applicable regulations.

Figure 9 outlines the general safety review process for obtaining a new license, renewal of an existing license, or an amendment to an existing license. This SRP is intended to cover only those aspects of the safety review associated with the licensing of conventional uranium mills or heap leach facilities. The first step is submittal of an application by an applicant. After all documents have been properly submitted, typically a technical report and an ER, the NRC staff then conducts acceptance reviews to evaluate whether sufficient information is contained in the application documents to conduct detailed reviews. For safety reviews, the focus is on the applicant's technical report. If the application and supporting documents are not sufficient for a detailed safety review, then the staff will not docket the application and supporting documents. If the application and supporting documents are sufficient for a detailed safety review, then staff will docket the application and supporting documents. The next step is conducting a detailed examination of the docketed documents for acceptability or inadequacy of information. If appropriate, staff will develop requests for additional information (RAIs) for incomplete, inadequate, or unclear information in the docketed documents.

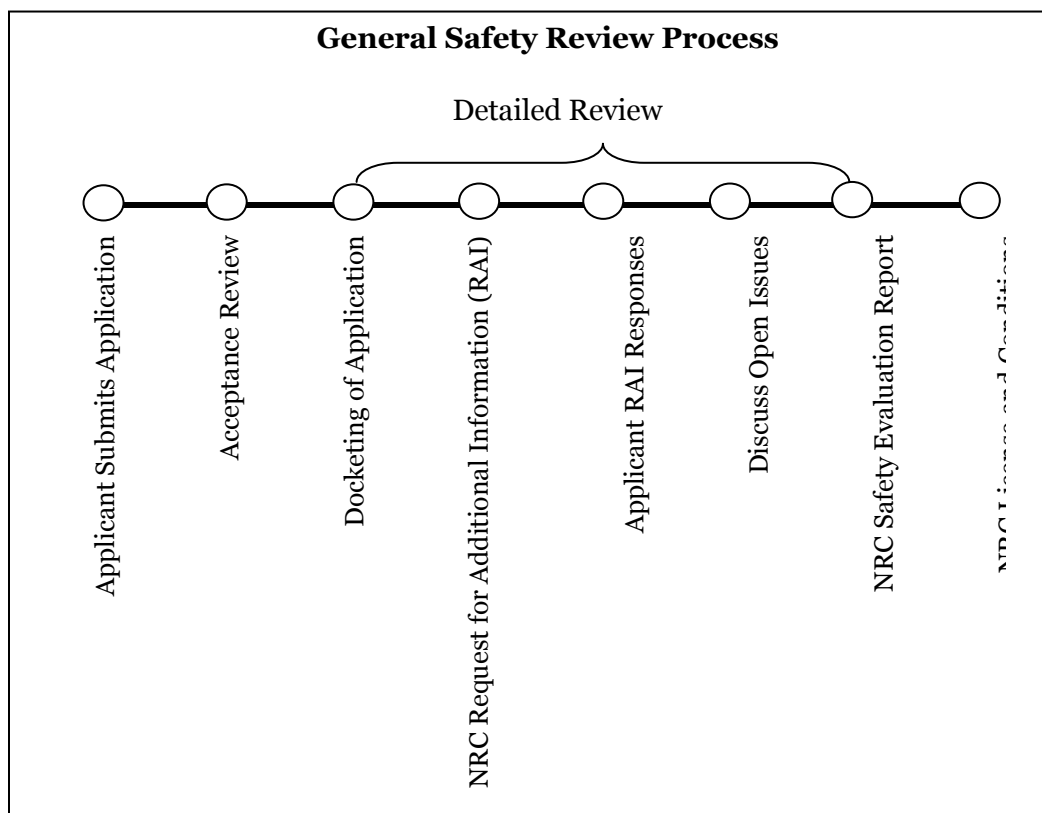


Figure 9

The staff typically issues RAIs when the information given in a license application is not sufficient for staff to make a licensing decision. The applicant will supplement the docketed application package by responding to the RAIs from the NRC. If staff still finds the

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information to be incomplete, inadequate, or unclear, then the staff discusses these open issues with the applicant to give the applicant another opportunity to provide the necessary information. The staff documents its determination of whether the proposed activities protect public health and safety and comply with regulations in a Safety Evaluation Report (SER) or Technical Evaluation Report (TER), depending on the licensing action. If necessary, license conditions may be established after discussions with the applicant to protect public health and safety and ensure compliance with regulations. In the SER or TER, if staff finds that operations can be conducted in accordance with regulations and in a safe manner, then a license is issued, which may contain license conditions. If the staff finds that operations will be unsafe, then a license will not be issued. A source material application also may be denied or rejected under specific instances during the review process. For example, applicant failure to demonstrate compliance with requirements in accordance with 10 CFR 40.31(h) or refusal or failure to supply information staff requested to complete the review in accordance with 10 CFR 2.108 is also grounds for denial of the application.”

A uranium mill application goes through a rigorous process before the applicant is granted a license. The applicant must submit all the proper documentation to ensure it will meet the requirements of 10 CFR Part 40. These documents are reviewed by highly specialized personnel including: hydrologists, health physicists, geologists, chemists and biologists. These reviewers will be verifying that the applicant’s proposed facilities contain at least the information which comes from the International Atomic Energy Agency (IAEA) Publication 1403 “The long term stabilization of uranium mill tailings.”

Prior to a license being issued, the NRC is required to provide an opportunity for the public to submit written comments and participate in a public hearing. These activities are followed by a written determination based upon the NRC’s findings and evidence presented during the public comment period. Virginia agencies would also be provided an opportunity to participate in this comment and hearing process to ensure the NRC considers state-specific concerns and conditions the Commonwealth believes should be included in a permit.

If the moratorium is lifted and the Agreement with the NRC is amended to include uranium milling, equivalent regulations and procedures to the NRC’s application and review process, including the EIS requirements would be need to be enacted and followed.

### **Emergency Response**

In their license application, applicants must also include procedures that address all types of accidents/incidents that can occur at the mine and/or mill and during transportation. These procedures will be reviewed and approved by the regulatory authority.

In Virginia, the foundation for a unified emergency preparedness and response plan is the Commonwealth of Virginia Emergency Operations Plan (COVEOP) and its various Hazard-Specific and Support Annexes are available at <http://www.vaemergency.com/em-community/plans/2012COVEOP>.

The Basic Plan describes the Commonwealth’s overall concept of operations for emergency response and recovery; enumerates hazards that may result in significant adverse consequences; identifies agencies with essential primary and support emergency management functions; and, defines emergency prevention, preparedness, response and

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recovery duties and responsibilities of local governments, nongovernmental organizations (NGO) and private partners. Hazard-specific Annexes address contingency or hazard situations requiring specialized response and recovery procedures. These describe policies, situations, concepts of operations and responsibilities pertinent to incidents such as hurricanes, acts of terrorism or nuclear/radiological emergencies. One example is the Commonwealth of Virginia Radiological Emergency Response Plan (COVRERP), which describes provisions for responding to and recovering from nuclear and radiological events of an accidental nature.

VDEM is the lead coordinating agency for the state's response to large-scale emergencies, radiologic or otherwise. VDH, the state radiation control agency pursuant to Section 32.1-229 of the Code, is responsible, in part, for developing programs to adequately respond to radiation emergencies and coordinating such programs with VDEM. VDH collaborates with VDEM on emergency plans, preparedness, training, exercises and response tactics for large-scale events involving radiological/nuclear material, and responds to licensee-related or other small radiological material incidents that can be managed by VDH staff trained in accident mitigation and emergency response. Similarly, DMME is responsible for the oversight of incident response at a mining facility. If the moratorium is lifted, DMME would serve as subject matter experts and utilize its existing emergency response protocols for incidents involving a uranium mine. Additional support, if needed for a large-scale emergency, would be coordinated by VDEM in their role as the Commonwealth's lead coordinating agency for emergency response.

If the moratorium is lifted without amending the Agreement with NRC, the NRC would serve as the lead federal agency for incidents at the mill. If the moratorium is lifted and the Agreement with the NRC is amended, VDEM would serve as the lead coordinating agency if the event necessitates a multi-jurisdictional or statewide response, and VDH would continue its hazard-specific lead in managing the emergency response efforts relating to the mill.

Essential components of preparedness include a facility response plan and a plan to deal with transportation incidents. A milling owner/operator, like any radioactive material licensee, is required to develop an emergency response plan, which must be vetted and approved by the licensing authority as part of the licensing process. Transportation incidents involving mill product (yellowcake), should they occur, would be deemed hazardous materials events. The risk associated with a yellowcake spill is a "low-consequence event." A transportation incident begins with local responders who determine the amount of response necessary to mitigate the situation. Local responders would request assistance through VDEM. The licensee is required to contact the licensing agency informing them of the incident, status of the response and cause of the accident. The licensing agency is responsible for evaluating the cause and corrective actions to be taken.

Emergency Plans should include emergency notification and communications requirements, both critical elements of a comprehensive emergency preparedness program. The Commonwealth, and in particular the lead and primary support agencies involved in a response effort, would need to be prepared in advance, through the availability of adequate staff, training, exercises and redundant communications to respond quickly and effectively. This includes disseminating protective action decisions and alerting the public about potential threats, if appropriate.

Emergency responders and medical practitioners in the area of any potential uranium mining and milling operation would need to be prepared to treat illnesses, contamination or

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exposures resulting from an emergency. Accordingly, a collaborative emergency management program involving robust plans, equipment, training and exercises should be instituted among the key stakeholders, meaning the facility owner/operator, workers, local and state response agencies, treatment providers and volunteers if uranium mining or milling occurs in the Commonwealth.

### **Environmental Permits Needed**

Both uranium mining and milling operations would need environmental permits from DEQ. The mill would need DEQ permits regardless if it was regulated by the NRC or by Virginia as an Agreement State for milling. Below is a description of each of these permits.

#### **Air Permitting**

Radioactivity requirements for air emissions are regulated by EPA under the National Emissions Standards for Hazardous Air Pollutants (NESHAP) program. Virginia has not taken delegation of these NESHAPs and would need to in order for Virginia to permit all aspects of air emissions from a potential mine and/or mill. Virginia Air Pollution Control Law Article 6 would require permits for all other aspects of proposed mining and milling operations such as crushing, screening, haul roads and engine emissions. The air permit would have to be issued before construction could begin. There are some exceptions to this preconstruction requirement, such as access roads.

In order for DEQ to take delegation, the State Air Pollution Control Board would need to add radionuclides and radon to the list of toxics regulated under the state air toxics program. In addition, DEQ would permit and enforce all of the currently regulated emissions from potential mining and/or milling operations such as crushing, screening, haul roads and engine emissions, plus radon and radionuclides. Mandatory Prevention of Significant Deterioration pre- and post-construction monitoring would provide important baseline information by which to measure any changes. Regulatory authority would be needed, but no additional statutory authority would be needed for Virginia to take delegation of the NESHAPs for radon and radionuclides.

#### **Water Permitting**

DEQ has three water permitting programs potentially applicable to uranium mining and milling:

- VPDES – regulates point source discharges to surface waters.
- Groundwater withdrawal permit – GWMA regulates any withdrawal of groundwater greater than 300,000 gallons per month within a groundwater management area.
- Virginia Water Protection (VWP) – provides for wetlands and stream protection, and requires a permit for new surface water withdrawals greater than 300,000 gallons per month

In an industrial setting, point source discharges are any waters with the potential to have pollutants conveyed by a pipe or ditch to state waters. These discharges are usually made up of process water (water used in an industrial operation) and industrial storm water

(rainwater runoff from an industrial site). Both are regulated as point sources through VPDES permits.

### **Surface Water Discharge Permitting**

If the moratorium is lifted, DEQ would be responsible for permitting any process wastewater and storm water discharges to state waters from a mine or mill. Process wastewater includes both mine dewatering and any discharge associated with processing from a mill. Two factors would go into determining the effluent limits (quality of the water to be discharged) and the level of treatment needed.

First, the proposed discharge would be evaluated with respect to the technology-based limits, which are regulatory minimum levels of treatment required by the EPA for process wastewater. The table in Figure 6 has the federal uranium new point source requirements (technology-based limits) for mining and milling process wastewater required by 40 CFR Part 440 and incorporated into the VPDES permit regulation, 9VAC25-31-10.

Second, any discharge would also have effluent limits set at a level to ensure that there is no reasonable potential to violate water quality standards in the state waters receiving the discharge. Therefore, the water quality standards discussed previously would be key to the protection of water quality.

The 1984 study recommended, “No process water should be allowed to be discharged from either the mill or the tailings facility.” While it may be possible to prohibit the discharge of process water from a potential mill, some dewatering of mill tailings ponds may be necessary because of Virginia’s positive water balance and the need to maintain freeboard for rain events. A proposed milling and mining site should have a comprehensive water management program covered under a VPDES permit. All excess water from any potential mine dewatering, tailings management and any storm water that would come in contact with waste rock storage and a mill licensed area would need to be stored and released only if it meets both:

- Any special standard water quality criteria established through the work of an appointed Scientific Advisory Committee that would provide public water supply protection of surface waters downstream from any potential uranium mining and milling operation, and
- Virginia new source technology limits for process wastewater.

### **Groundwater Permitting**

The stringent regulatory requirements for protection of groundwater at hazardous and solid waste facilities provide the basis for the groundwater protection requirements under an NRC license for uranium milling operations. If a release of contaminants to groundwater has occurred, owners and operators of such facilities are responsible for monitoring and clean-up even beyond the facility boundary.

The State Water Control Board’s anti-degradation policy for groundwater would serve as the performance standard for the engineering of controls and BMPs that could minimize the potential for impacts to groundwater in other DEQ permitting programs.

*9VAC25-280-30. Antidegradation policy for groundwater.*

*If the concentration of any constituent in groundwater is less than the limit set forth by groundwater standards, the natural quality for the constituent shall be maintained; natural quality shall also be maintained for all constituents, including temperature, not set forth in groundwater standards. If the concentration of any constituent in groundwater exceeds the limit in the standard for that constituent, no addition of that constituent to the naturally occurring concentration shall be made. Variance to this policy shall not be made unless it has been affirmatively demonstrated that a change is justifiable to provide necessary economic or social development, that the degree of waste treatment necessary to preserve the existing quality cannot be economically or socially justified, and that the present and anticipated uses of such water will be preserved and protected.*

DEQ also has a groundwater withdrawal permitting program, which regulates withdrawals of groundwater greater than 300,000 gallons per month within a designated groundwater management area. If the moratorium is lifted, mine dewatering could be regulated by this program if a groundwater management area were created by regulation. This is the only permitting program Virginia has that is designed to protect regional as opposed to site-specific groundwater quantity and quality. Its purpose is to protect groundwater supplies, but it also offers some protection to neighboring wells for both quantity and quality. It has a provision that provides for a legal assumption of liability on the part of the permit holder, if a well within the zone of influence is impacted either in quantity or quality.

If the moratorium is lifted, SWCB should establish a groundwater management area in the area of a proposed uranium mining and milling operation. This would offer protection for public and private wells near a mine from the impacts of mine dewatering. In addition, the permitting requirement would apply to all groundwater users withdrawing more than 300,000 gallons per month within the new groundwater management area. Regulatory authority would be needed, but no additional statutory authority would be needed for this recommendation. The management and monitoring of groundwater quality and quantity at a proposed uranium mine and mill would need to be specified in the mining permit by DMME and the milling license by either the NRC or Virginia under an agreement with the NRC.

## **Groundwater Dewatering**

If the moratorium is lifted, the applicant for a mine permit and mill license would be required to provide groundwater flow modeling. However, there is a significant lack of information needed to build a groundwater flow model anywhere along the eastern flank of the Blue Ridge. Any model under these circumstances would be of limited value except perhaps in identifying where significant data collection efforts are needed. The fault systems have only been mapped in a very limited way and this work would need to be completed by a qualified expert of which there are very few and would likely take considerable time (potentially a multi-year effort). This is also true for identifying the high yielding rock fractures that serve as the primary source of groundwater for water supplies in the area. In general, using existing groundwater flow modeling packages would not be recommended under fractured rock conditions. The primary exception would be when there is enough data so that the fractured rock flow system can be designed to appear as a network of interconnecting pipes. Validating any model built under these data-poor conditions would be extremely difficult because of the assumptions that would need to be made.



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Requiring the applicant do the modeling would work most effectively if: 1) there was an existing government model that could be down-scaled by the consultant without changing its basic assumptions; or 2) there was both a government model and a consultant model allowing productive triangulation of model simulations when there is high system uncertainty. Therefore, if the moratorium is lifted, a multi-county scale groundwater flow model should be built in conjunction with the United States Geological Survey for evaluating mining impacts from dewatering. To complete such a model, sub-regional characterization of the fault system, strategically located groundwater level monitoring wells, age dating from these wells, and strategic surface water gauging would be necessary.

The State Water Control Board's anti-degradation policy for groundwater would be the standard for the engineering design requirements in all potential uranium mining and milling permits and licenses. Additional resources would be required, but no additional regulatory or statutory authority would be needed for these recommendations.

### **Virginia Water Protection (VWP) Permit Program**

The VWP permit program administered by DEQ was developed for wetlands and stream protection, and it requires a permit for new surface water withdrawals greater than 300,000 gallons of water per month. If the moratorium is lifted, any mining and/or milling operation in Virginia would have some stream impacts and would require a permit. It is possible that mine dewatering could provide water needed for the operation, so a surface water withdrawal may not be needed. If the construction of a mine and/or mill would result in stream or wetland impacts the operator would have to get a VWP permit from DEQ and a 404 permit from the US Army Corps of Engineers prior to taking any impacts. No changes would be needed to this program specific to uranium mining or milling.

### **Environmental Permitting Public Participation**

All individual DEQ permits are public noticed at the draft stage with a 30-day comment period. If DEQ receives 25 individual requests for a hearing, a hearing and an additional comment period are held. The final decision on the permit is then in the hands of the appropriate citizen board, the State Water Control Board for water permits and the State Air Pollution Control Board for air permits. A summary of all of the public comment is received by the board, and anyone commenting has the right to comment before the board. The board would make the final decision on the permit.

### **APPLICATION FEE PAYMENTS**

DMME's present fee schedule does not fully allow for recovery of the cost to process and review permit applications. If the moratorium is lifted, any statutory framework for uranium mining permits should provide authority for DMME to recover all costs of initial permit review, permit modification, and permit renewal through fees attached to the permit application from the mine operator.

Mill license applicants must pay the NRC the full cost of reviewing the application and environmental reports before a license is issued. The NRC details the payment process in [10 CFR170.12](#). The NRC currently uses a rate of \$257 per hour as stated in [10 CFR 170.20](#).

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The Radioactive Materials Program is self-supported by the licensing fees charged to applicants and annual license fees. Similar fees would need to be put in place for a uranium mill applicant and licensee.

DEQ currently has fees to support its permit programs. For most of DEQ's programs the fees only cover a portion of the costs for the programs. To recoup all the costs of these programs for any potential uranium mine and/or mill, these fees would have to be increased for those permits.

## **PERFORMANCE BOND AND LIABILITY INSURANCE**

### **Mining**

If the moratorium is lifted, a strong financial assurance program would be critical to any statutory and regulatory framework created for the mining of uranium in order to protect the public from financial obligations for actions or inactions resulting from the operation. Such a program would need to take into consideration the complete life cycle of the mining from exploration through reclamation and decommissioning of the mine. Key components of a financial assurance statute would require 1) a performance or reclamation bond based on third party performance of required reclamation work; 2) liability insurance sufficient to provide coverage for personal and economic injury as well as property and natural resource damage protection; 3) a uranium response fund which would be readily accessible to the Commonwealth to respond to the release or threatened release of any pollutant or contaminant into the environment from the mining operation; and 4) a long-term environmental monitoring fund or trust which would assure financial resources for monitoring surface water and groundwater and air quality during and after reclamation and decommissioning of the mine. Each of these components should be funded by the operator and established prior to the commencement of operations.

If the moratorium is lifted, several factors need to be taken into consideration when developing any financial assurance statutory and regulatory framework for the mine. Funds should be in a reasonably liquid form so that they can be readily transferred into cash. The operator's personal property or equipment should not be used for assurance as their value could quickly diminish or disappear completely in the event of a default or bankruptcy.

Funds should be readily accessible, payable only to the regulatory authority (or authorities), dedicated to the project reclamation and only released at the request of the regulatory authority. The regulatory authority should have the statutory authorization to receive forfeited financial assurance mechanisms and to use them for reclamation. Potential financial assurance providers should be pre-screened to assure they have the financial capacity to pay the financial assurance amount should the operator forfeit the financial assurance mechanism.

The public should be given notice and an opportunity to comment prior to accepting the initial financial assurance mechanism, any changes to the assurance due to major permit revisions, and final mechanism release. The financial assurance mechanism should not be used to release the operator from its reclamation responsibilities. The financial assurance mechanism acts as a guarantee to the public to prevent the public from having to pay for the cost of reclamation should the operator default.

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Any statutory and regulatory framework addressing performance bonds would need to include the types of financial instrument acceptable to the Commonwealth, duration of the bonding period, terms for release of portions or all of the performance bond, and the bond release process as well as access for the public to participate in both the initial bonding and bond release process.

Three forms of financial instruments should be considered as viable options for performance bonds on uranium mines. These are letters of credit, surety bonds, and cash deposits, or negotiable bonds, or certificates of deposit.

- **Irrevocable Letter of Credit** An irrevocable letter of credit (ILOC) is an unconditional agreement between a bank and an operator to provide funds to a third party on demand. In this case, the third party would be DMME. An ILOC includes the terms and conditions of the agreement between the operator and the agency, with reference to the reclamation program and the agreed-upon costs. Any changes to the ILOC require the consent of all parties involved.
- **Surety Bond** A surety bond—also known as a payment bond or a performance bond—is an agreement between a surety company and an operator to provide funds to a third party under certain circumstances. In this instance, the third party would be DMME. A surety bond includes the terms and conditions of the agreement between the operator and the regulatory authority with reference to reclamation plans and programs, agreed-upon costs, and conditions for the release of the bond. Any changes to a surety bond require the consent of all parties involved.
- **Cash Deposits (negotiable bonds, certificates of deposit)** Cash deposits can be in the form of cash, a bank draft, or a certified check. The funds would be placed in a dedicated account of the state treasury. In some cases, they would be placed in a dedicated account under the management of the financial institution. The regulatory authority would hold signatory authority. Another form of cash deposit is a certificate of deposit (CD) written in the favor of the regulatory authority.

Though properly administered performance bonds assure that reclamation of the mine site would be completed without the financial burden falling on the public, they do not cover certain costs including:

- Release or threatened release of contaminants from the operation;
- Inspections, investigations assessments, health and environmental studies incurred by the Commonwealth;
- Damages, destruction, or loss of natural resources; and
- All damages to property caused by a release.

These costs would be borne by the operator through a liability insurance policy. Therefore, it would be necessary to assure that the statutory and regulatory framework put in place if the moratorium is lifted require the operator to provide a certificate issued by an insurance company authorized to do business in the Commonwealth certifying that the applicant has a public liability insurance policy in force for the permit prior to issuance of new permit or at permit renewal until such time as the permit is terminated. The amount of the liability policy should be determined by DMME based either on a risk analysis protocol required as part of the permitting process or on a fixed amount established through law. The liability policy should be reviewed yearly to determine if adjustments in the policy coverage should

be amended due to changes in the level of risk exposure for the mining operation and/or inflationary considerations.

All of the financial assurance instruments discussed above should be in place before operations commence to ensure resources are in place to reclaim any impacted areas in the event the operator is longer financially viable.

If the moratorium is lifted, two additional funds should be considered in a statutory and regulatory framework for uranium mining in order to protect the public from incurring financial obligations associated with 1) long-term monitoring costs and 2) possible long-term mine related mitigation and emergency response expenses. Costs not covered by the performance bond or liability insurance instruments will require readily available and liquid funding to address these issues. The structure of such funding could be handled by setting up sinking funds through a fee or tax levied on the extracted uranium ore. The initial funding for each could be established through a surety bond submitted by the operator in an amount determined by law. These monies would then be available to DMME/DEQ to provide long-term monitoring after mine decommissioning and release of the performance bond and permit, or to finance the cost of mitigation for unanticipated events once the permit has been released.

### **Milling**

A uranium milling licensee is required to cover the cost of decontamination and decommissioning of the mill, and long-term monitoring. The NAS report stated that the World Bank developed a guidance document based on financial surety. This document is titled "Guidelines for the Implementation of Financial Surety for Mine Closure." This document contains the following summary:

- *Premature termination during construction.* Project termination for technical or financial reasons can be mitigated by adequate completion guarantees that premature termination and abandonment will trigger an obligation by the guarantor to implement, or fund a third party to implement, a satisfactory closure program.
- *Material changes made to closure requirements and objectives.* During mine life, material changes can largely be avoided by agreeing to a clear, transparent, up-front, realistic, and approved definition of post-operational land use, the environmental performance standards to be met within a specified period of time, and sign-off procedures to be followed.
- *Material changes to the project and processes.* These changes may have implications with regard to mine closure requirements and related costs. Mine closure plans, the related cost implications, and financial guarantees should be subject to a periodic review process, so that the implication of any material change can be assessed and addressed. This would also mitigate the risk of significant over- or undercapitalization of the closure funds and bolster guarantees that should reflect the life of the mining project based on proven reserve estimates.
- *The risk of financial failure.* The financial failure of the mining company and organizations involved (such as the holders of the cash reserve, trust fund, and so on) can be mitigated by establishing non-accounting provisions to monitor financial performance, separate the financial structure for the closure fund from that of the

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company, allow only investments of closure funds in financial instruments, provide “assured” future payment, and spread the risk across financial vehicles to secure closure funds.

- *The danger of closure funds being redirected.* This can be mitigated by using a non-fungible financial structure and a certification process; for example, involving a trustee, keeping closure funds from being used for unrelated work (such as additional drilling), or repaying loans in a default situation.
- *The government might continue operating an “inherited” project.* This could occur without due consideration given to profitability and environmental implications, which would have otherwise required the implementation of mine closure activities. Experience seems to suggest that funding limitations may discourage the government from implementing mine closure in the absence of available funds earmarked for this purpose.

These recommendations are already present in the NRC regulations for the milling operation under 10 CFR Part 40, Appendix A, Criterion 9 and 10. These regulations require that financial surety arrangements be established by each mill operator, prior to the commencement of operations, to assure that sufficient funds will be available to carry out: the decontamination and decommissioning of the mill and site and for the reclamation of any tailings or waste disposal areas to levels which allow unrestricted use of these areas upon decommissioning; and, the reclamation of tailings and/or waste areas in accordance with established technical criteria; and the payment of the charge for long-term surveillance and control. The licensee's surety mechanism is reviewed annually by the Commission to assure that sufficient funds would be available for completion of the reclamation plan if the work had to be performed by an independent contractor.

The amount of surety liability should be adjusted to recognize any increases or decreases resulting from inflation, changes in engineering plans, activities performed, and any other conditions affecting costs. Regardless of whether reclamation is phased through the life of the operation or takes place at the end of operations, an appropriate portion of surety liability must be retained until final compliance with the reclamation plan is determined. This will yield a surety that is at least sufficient at all times to cover the costs of decommissioning and reclamation of the areas that are expected to be disturbed before the next license renewal. The term of the surety mechanism must be open ended, unless it can be demonstrated that another arrangement would provide an equivalent level of assurance. This assurance would be provided with a surety instrument which is written for a specified period of time (e.g., 5 years) yet which must be automatically renewed unless the surety notifies the beneficiary (the Commission or the State regulatory agency) and the principal (the licensee) some reasonable time (e.g., 90 days) prior to the renewal date of their intention not to renew. In such a situation, the surety requirement still exists and the licensee would be required to submit an acceptable replacement surety within a brief period of time to allow at least 60 days for the regulatory agency to collect.

It is important to note that proof of forfeiture must not be necessary to collect the surety so that in the event that the licensee could not provide an acceptable replacement surety within the required time, the surety shall be automatically collected prior to its expiration. The conditions described above would have to be clearly stated on any surety instrument, which is not open-ended, and must be agreed to by all parties.

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The NRC requires a minimum charge of \$250,000 (1978 dollars, currently about \$900,000) to cover the costs of long-term surveillance must be paid by each mill operator to the general treasury of the United States or to an appropriate state agency prior to the termination of a uranium or thorium mill license. If site surveillance or control requirements at a particular site are determined to be significantly greater based on a site-specific evaluation, a variance in funding requirements may be specified by the Commission. In any case, the total charge to cover the costs of long-term surveillance must be such that, with an assumed 1 percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The total charge will be adjusted annually prior to actual payment to recognize inflation. The inflation rate to be used is that indicated by the change in the Consumer Price Index (CPI) published by the U.S. DOL, Bureau of Labor Statistics.

If Virginia requests an amendment to the Agreement with the NRC and is approved to regulate uranium milling, these regulations would need to be included in our current radiation regulations, 12VAC5-481. The regulatory authority is listed as the third party on the Financial Assurance mechanism so that if the licensee were to go bankrupt or cease to exist, the agency would have access to the money ensuring the decontamination and decommissioning of the facility is performed. The Financial Assurance mechanism must be reviewed and approved by the regulatory agency and the Office of the Attorney General (OAG).

### **PERMIT/LICENSE/ MODIFICATIONS/AMENDMENTS/RENEWALS**

#### **Mining**

If the moratorium is lifted, any statutory and regulatory framework should allow all significant permit modifications to be subject to the state EIA process. Depending on the nature of the modification, any one of the three pathways could be utilized to review the environmental impact of the modification. As with the initial permit, all documents submitted to support the modification should be posted online for public review.

#### **Milling**

The same process used for processing an application for a mill license must be performed for any major amendment, renewal or termination of that license.

### **APPEALS PROCESS**

#### **Environmental Permits**

Challenges to a DEQ permit issued under the authority of any of the three regulatory Boards, or by DEQ on the Boards' behalf, are procedurally governed by Rule 2A of the Rules of the Supreme Court, Appeals Pursuant to the Administrative Process Act. Generally, the challenge begins with the party appealing a permit decision filing with the agency secretary a notice of appeal signed by the appealing party or that party's counsel. The Notice of Intent must be filed within 30 days after issuance of the permit (33 days if the permit is transmitted by mail).

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Per the judicial review sections of the basic laws of the three regulatory Boards a challenge may be initiated by the applicant or any person who has participated, in person or by the submittal of written comments, in the public comment process related to a final decision of the Board or Director and who has exhausted all available administrative remedies for review of the Board's or Director's decision, if such person meets the standard for obtaining judicial review of a case or controversy pursuant to Article III of the United States Constitution. A person shall be deemed to meet such standard if; (i) such person has suffered an actual or imminent injury which is an invasion of a legally protected interest and which is concrete and particularized; (ii) such injury is fairly traceable to the decision of the Board and not the result of the independent action of some third party not before the court; and (iii) such injury will likely be redressed by a favorable decision by the court. (The judicial review sections of the three regulatory Boards are: Sections 10.1-1318, 10.1-1457 and 62.1-44.29).

### **Mining**

If the moratorium is lifted, those who disagree with the mine permit application decision would be able to avail themselves of the procedures established in the APA to appeal the permit decision. The statutory language should provide standing to any applicant or any person with an interest which is or may be adversely affected and who has participated in the formal hearing, and who is aggrieved by the decision of DMME.

### **Milling**

Under the NRC's current regulations, an entity must submit an application to the NRC to become licensed to use or operate a facility that uses nuclear materials. The NRC staff reviews the application using standard review plans to ensure that the applicant's assumptions are technically correct and that the environment will not be adversely affected by the operation of the facility. NRC appeals are accommodated in 10 CFR Part 51 for performance of the EIS as well as 10 CFR Part 40, Appendix A as it relates to the licensing of uranium recovery facilities.

## **MONITORING AND SURVEILLANCE**

### **Agency Monitoring**

If the moratorium is lifted and uranium mining and/or milling takes place in the Commonwealth, an effective monitoring program would need to be put in place. In order for a monitoring program to be effective, it would need to encompass the complete life cycle of the facility. Baseline data would need to be gathered before operations commenced. On and off-site monitoring would be necessary during operations, through reclamation and decommissioning. In the case of tailings storage and management, monitoring would need to occur indefinitely.

Ambient monitoring of air and water would be needed throughout the operations of the mine and/or mill. Ambient monitoring of air and water quality would provide an additional margin of safety in ensuring that the facility is in compliance with its permits. In addition, it would provide an early notice of any pollution leaving the site prior to it becoming a significant environmental problem. There are also a number of public health risks posed by uranium mining and/or milling for which VDH would need to engage in active data

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collection and monitoring during the permitting, operation and closure phases of uranium mining and/or milling activity.

### **Air Quality Monitoring**

DEQ operates an extensive Air Quality Monitoring Program which monitors for criteria pollutants such as ozone and particulate matter as well as hazardous air pollutants. DEQ has extensive experience in performing particulates monitoring – large particles (TSP), coarse particulates (PM<sub>10</sub>) and fine particulates (PM<sub>2.5</sub>), which is very similar to the monitoring that would be needed for radionuclides. In addition, DEQ operates three radiation monitors for the federal government.

If the moratorium is lifted, Virginia should require comprehensive ambient air monitoring on uranium mining and/or milling sites with monitoring equipment installed and operated by the operator. Virginia would need to evaluate the existing air-monitoring network to determine if existing sites are sufficient to provide an early warning of offsite impacts. The monitoring would need to include radon, radionuclides and radiation. DEQ would need additional monitoring technology to undertake monitoring of radon, radionuclides and radiation. The monitoring of radon and radiation could also be handled by VDH. Additional resources would be required, but no regulatory or statutory authority would be needed for these recommendations.

### **Hydrogeologic Environments**

Virginia has five physiographic provinces: the Appalachian Plateau, Valley and Ridge, Blue Ridge Mountains, Piedmont and Coastal Plain. Physiographic provinces are related to the geology of the underlying bedrock, among other controlling factors. Bedrock with radionuclide characteristics is present in almost every part of the Commonwealth. The underlying geology of the Foothills consists largely of resistant metamorphic and igneous rock. The National Research Council of the National Academies' "Uranium Mining in Virginia," published in 2012, provides a good overview of Virginia uranium occurrences and the related geology.

Due to Virginia's geology, there are no aquifers that underlie the entire Commonwealth. Aquifers are typically hydrologically controlled as separate units within each physiographic province. Within the Piedmont Foothills, groundwater is typically found near surface and within deep bedrock fractures. Saprolitic soils overlay the bedrock and often an uppermost or "water table" aquifer is found within the soil horizon. Deeper groundwater is contained within fissures and joints within the bedrock.

If the moratorium is lifted and uranium mining is proposed, each uranium deposit within the Commonwealth would have its own unique hydrology and would have to be studied within the permit application process.

### **Drinking Water Monitoring**

If the moratorium is lifted, implementation of the SDWA and the Radionuclide Rule of the Virginia Waterworks Regulations would allow VDH's ODW to provide adequate protection to the general public with regard to radionuclides within public drinking water supplies.



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The Radionuclide Rule allows for reduced monitoring “If the average of the initial monitoring results for each contaminant is below the detection limit” (EPA, 2001) or if the average of the initial monitoring concentrations are below the Maximum Contaminant Level (MCL). ODW recommends that public waterworks within the area defined to be at risk through groundwater modeling developed during the baseline sampling period should be monitored at a quarterly frequency (i.e. non-reduced).

ODW would need to work with DMME and DEQ to develop the area defined to be at risk through groundwater modeling for monitoring based on scientific data provided through the permit application process for a proposed mine and/or mill.

### Groundwater Monitoring

The use of groundwater modeling is an accepted best practice. If the moratorium is lifted and uranium mining and/or milling is proposed, an effective model would consider such impacts as mine dewatering, groundwater quality and quantity. Groundwater monitoring requirements would need to be consistent with respect to the mine and/or mill and should be coordinated by DMME, DEQ and VDH.

If a program is put in place, groundwater monitoring should be developed on the basis of predictive modeling done as part of the EIA review. This modeling should address the following parameters:

- Groundwater basin boundaries;
- Media type;
- Water bearing hydrologic units;
- Confining units and flow barriers;
- Groundwater flow directions;
- Groundwater recharge areas;
- Groundwater discharge areas;
- Surface water bodies;
- Groundwater and surface water interactions;
- Riparian vegetation;
- Pumping and injection wells;
- Water budget; and
- Other relevant factors

Monitoring should extend beyond the predictive areas of disturbance, and should be coordinated with DEQ and VDH. A monitoring plan should be adopted that includes information on the criteria to be monitored, the frequency of monitoring, the methods of monitoring, and the protocols for the collection and transmittal of data.

These requirements would also need to be coordinated with DEQ through the establishment of a groundwater management area that encompasses the proposed mine and/or mill site. Establishing such an area would establish the mine and/or mill operator’s liability if private water supplies within the groundwater management area were impacted with respect to quantity or quality as the result of the operator’s activities. Further, operators could be required to submit mitigation or corrective action plans to establish how impacted private water supplies would be replaced.

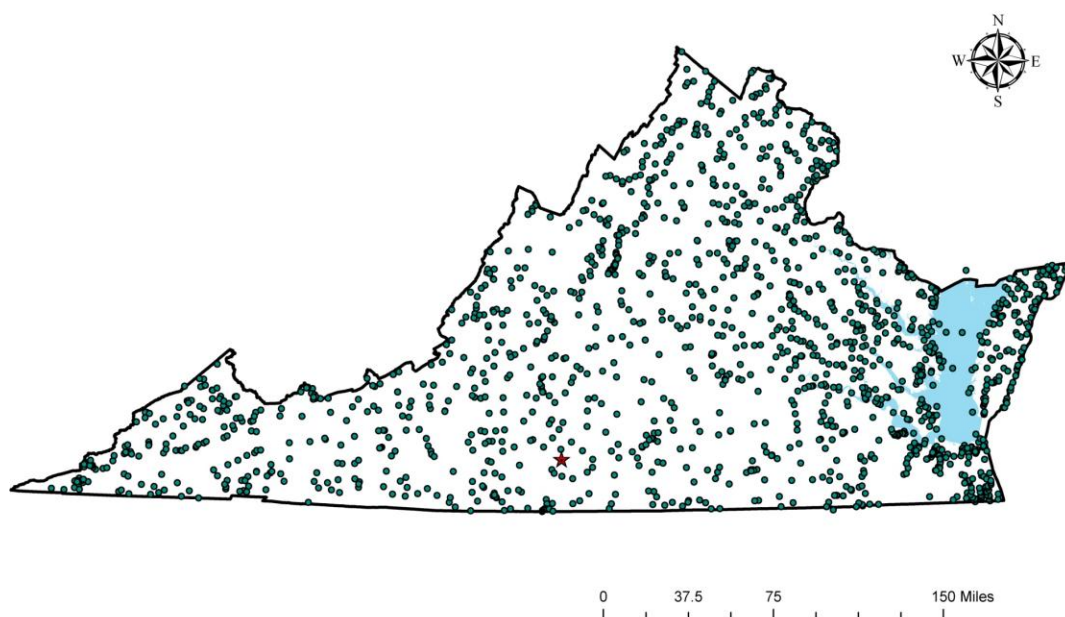
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If the moratorium is lifted, establishing an effective groundwater monitoring program would be essential to protecting public health and safety. A comprehensive hydrological characterization would need to be performed as part of the environmental report prior to the commencement of mining operations. Monitoring program requirements would have to be developed considering the results of the hydrological analysis. An important component of groundwater protection is the use of best practices in engineering design for the structures utilized on the mine site. Also, monitoring should occur near onsite areas of waste rock and ore stockpiles. Requiring the isolation of ore stockpiles would help protect groundwater. Isolation of waste rock stockpiles is generally not required in other states but could be an additional method to help protect groundwater.

### Surface Water Monitoring

DEQ has one of the largest ambient water quality trace element monitoring programs in the nation. DEQ developed ultra-low level sampling and analytical methods for trace elements and since 1997 has analyzed more than 4,400 samples at more than 1,800 sites for trace elements. The following elements, both dissolved and total, are monitored in the water column: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, magnesium, manganese, mercury, nickel, selenium, silver, thallium, zinc.

VADEQ Monitoring Stations with Trace Element Data  
1997 to present



SOURCE:  
U.S. Department of Commerce, U.S. Census Bureau, Geography Division, 2008.  
Virginia Department of Conservation and Recreation, 2010.  
Virginia Department of Environmental Quality, Water Quality Monitoring and Assessment, 2010.

Figure 10

If the moratorium is lifted, DEQ would need to add uranium and radionuclides to its Trace Element Monitoring Program in order to establish what the natural background concentration of total and dissolved uranium is in the surface waters of the Commonwealth.

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Monitoring would be necessary at random freshwater free flowing sites sufficient to determine the distribution and occurrence of uranium on our rivers and streams. Routine stream monitoring in the watershed where mining and/or milling is occurring would occur would be used to establish background natural fluxes of target parameters as well as to ensure compliance with discharge limits and in-stream water quality standards prior to, during, and after all potential mining and/or milling operations. Additional resources would be required, but no regulatory or statutory authority would be needed for these recommendations.

Under normal operating conditions during the construction and operation of a uranium mine and/or mill, state and federal regulations would require up-stream runoff to be diverted around the mine and/or mill site. Site runoff, mine waters, and process liquids would be required to be contained on site and treated to remove hazardous chemicals and radionuclides prior to release offsite.

### **Private Water Supplies**

If the moratorium is lifted, an applicant/licensee (with the consent of the property owner) should be required to sample and analyze on a monthly basis private water supplies within the area defined to be at risk through groundwater modeling developed during the baseline sampling period. Such sampling, analyses and timely reporting should be required to continue on a periodic basis from the end of the baseline sampling program, as required by the EIS until the permit and/or license for the mine and/or mill is either granted or denied by the regulatory authority and then continue through operations. Statutory and regulatory authority, and additional resources would be needed to implement these recommendations.

If the moratorium is lifted, VDH should establish water quality standards for private water supplies within the area defined to be at risk through groundwater modeling developed during the baseline sampling period. This should be coordinated with any action by DEQ to establish a Scientific Advisory Committee to review and make recommendations on the groundwater criteria. Statutory and regulatory authority and additional resources would be needed to implement these recommendations.

Additionally, if the moratorium is lifted, VDH should require that any private water supply, within the area defined to be at risk through groundwater modeling developed during the baseline sampling period, that is found to be unsuitable for use, either through contamination or lack of production, to be properly and permanently abandoned, in order to eliminate potential pathways for groundwater contamination. Statutory and regulatory authority and additional resources would be needed to implement these recommendations.

VDH would also need to perform a case-by-case evaluation of the risks to specific cisterns resulting from a significant accidental release, with potential mitigation by the facility operator.

### **Recreational Use of Water**

The VDH OEHS regulates summer camps and campgrounds. Both types of facilities may provide swimming areas in natural waters (i.e., streams or lakes). Bathing areas in natural waters are addressed only to the extent that the regulations for summer camps state, "care should be taken to prevent pollution of swimming waters from human excreta..." VDH has

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no regulatory standard for swimming areas in natural waters and no authority to restrict access to swimming areas when water quality standards are not met.

If the moratorium is lifted, VDH should establish water quality standards for swimmable surface water. Such standards would need to protect public health with an adequate margin of safety. This process should be coordinated with DEQs proposal to establish a Scientific Advisory Committee to review and make recommendations on the groundwater and surface water criteria for radioactivity. VDH would need the authority to establish water monitoring requirements for all water quality standards at summer camps and campgrounds.

If the moratorium, VDH should update its list of diseases pursuant to Section 32.1-35 to include diseases related to exposure to radionuclides as diseases that require reporting. In addition, Section 35.1-10 of the Code would need to be amended to explicitly authorize the Commissioner to prevent access to waters at summer camps and campgrounds and beaches when levels exceed the developed water quality standards for swimmable surface water.

### **Epidemiologic Surveys**

If the moratorium is lifted, VDH should evaluate the types of epidemiologic surveys and studies that would be needed to protect public and worker safety at a proposed mine and/or mill site. Previous epidemiologic studies conclusively demonstrate that uranium miners have an increased risk of lung cancer due to inhalation of the short-lived radon decay products. The risk is greater with increased exposure. Smoking is a major confounding factor. Individual epidemiologic studies have reported increased risk of other adverse health effects such as leukemia and non-malignant respiratory disease but lung cancer is the only effect consistently demonstrated in all studies. The National Institute for Occupational Safety and Health (NIOSH) has conducted studies since 1950 on the health of uranium miners. This study found strong evidence for an increased risk for lung cancer in uranium miners (NIOSH 2012). EPA says that intake of uranium exceeding EPA standards can lead to increased cancer risk, liver damage, or both. Long term chronic intakes of uranium isotopes in food, water, or air can lead to internal irradiation and/or chemical toxicity (EPA 2012). A study conducted on Navajo uranium miners revealed that 16 of the 17 people admitted to the hospital from 1965 to 1979 suffered with lung cancer (Gottlieb et al, 1982). Another study conducted from 1969 to 1982 demonstrated that lung cancer in Navajo men was due to uranium mining (Samet et al, 1984). Archer, 1981 conducted a study in which 15 different mining groups (uranium, iron, lead and zinc) were analyzed. The results of this study showed that health risks associated with uranium mining is greater than those risks associated with uranium mills.

Epidemiologic studies do not demonstrate increased risk of cancer in mill workers with no mining experience but one study indicated a potential increased risk of non-malignant respiratory disease and renal toxicity. No significant human health impacts due to uranium recovery operations were demonstrated in the most recent epidemiologic studies of surrounding communities. An epidemiological study conducted in Karnes County, Texas concluded that no unusual patterns of cancer mortality could be seen in Karnes County over a period of 50 years, suggesting that the uranium mining and milling operations had not increased cancer rates among residents (Boice Jr et al, 2003).

The epidemiologic studies involving populations surrounding uranium recovery are, by necessity, ecologic studies, which mean that there are no specific individual exposure data. Inferences with regard to exposure are based on location. Since members of the public are

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not individually monitored, exposure must be presumed based on other factors. The NAS, National Research Council recently published Phase 1 of its Analysis of Cancer Risks in Populations near Nuclear Facilities (NAS, 2012). If the moratorium is lifted, VDH should conduct an ecologic study of multiple cancer types in populations living near the facilities and a case-control study of cancers in children born near such facilities.

### Human Health Effects

VDH would be responsible for the monitoring of human health effects if the moratorium is lifted. Several previous reports have discussed potential human health effects of uranium mining and milling. In 2011, the NAS completed a report titled “Uranium Mining in Virginia.” This report contains a section titled “Potential Human Health Effects of Uranium Mining, Processing, and Reclamation.” At the end of this section they listed several findings, which were reviewed by VDH. VDH also reviewed other reports and studies to understand this issue. The following is a summary of VDH’s findings regarding steps that would be needed to mitigate the risk of human health effects.

### Conceptual Site Models (CSM)

CSMs describe, in general, the pathways for exposure to human and ecological receptors. Pathway descriptions are required to be included in specific NRC license applications and cannot be fully represented by generic CSMs. The CSMs provide a description of the potential pathways of exposure to members of the public from normal operation of a uranium mine and mill. It does not show site-specific pathways. Dust control measures, pollution prevention devices on stacks, ore storage pads and tailings impoundment liners, and water diversion channels would minimize off-site impacts from mine and mill operation. A complete explanation and figures indicating the potential pathways of exposures can be found in WES Interim Report #1 that was completed under the VDH contract. This report can be found on the UWG website (<http://www.uwg.vi.virginia.gov/>).

**Potential Pathways of Public Exposure by Source**

Source	Constituent	Pathway	Potentially Complete	Comment
Underground Mine	Radon	Inhalation	Yes	Radon is vented from the underground mine workings
Underground Mine	Radionuclides, metals	Ingestion of groundwater or surface water	Yes	The probability of ingestion of groundwater is low depending on hydrologic parameters
Open Pit Mine	Radon	Inhalation	Yes	Radon emanates from exposed ore in the pits
Open Pit Mine	Radionuclides, metals	Fugitive Dust Inhalation	Yes	Dust resulting from excavation or blasting operations; will be mitigated by water spray as needed
Ore storage (Applies in all cases to Open Pit Mine, Mill, Underground Mine)	Radionuclides, metals	Fugitive Dust Inhalation	Yes	Dust is generally mitigated by water spray

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Source	Constituent	Pathway	Potentially Complete	Comment
Ore storage	Radon	Inhalation	Yes	Radon emanates from exposed stored ore
Ore storage	Radionuclides, metals	Ingestion of groundwater and impacted food from deposition of dust	No	The ore storage pad will be lined to prevent leaching to groundwater so the pathway for release is possible but unlikely; direct ingestion of impacted groundwater is unlikely; environmental monitoring will provide early warning.
Ore storage	Radionuclides, metals	Ingestion of surface water and impacted food from irrigation	No	Diversion channels prevent runoff from off-site to enter storage area; surface water runoff on-site is diverted to the storm water pond. No exposure under normal operating conditions
Ore storage	Radionuclides, metals	Dermal exposure to impacted water	No	Same as above; naturally occurring radionuclides are not readily absorbed through skin
Waste Rock piles (Applies in all cases to open pit and underground mines)	Radionuclides, metals	Fugitive Dust Inhalation	Yes	Potential dusting off of waste rock piles mitigated using water spray; concentrations of radionuclides in waste rock are lower than for ore; therefore, air particulate constituent concentrations will be lower and may be in the range of background.
Waste rock piles	Radon	Inhalation	Yes	Radon emanates from waste rock with slightly elevated uranium concentration
Waste rock piles	Radionuclides, metals	Ingestion of groundwater and impacted food	Yes	Leaching of hazardous constituents from the waste rock
Waste rock piles	Radionuclides, metals	Dermal exposure to water	No	Naturally occurring radionuclides are not readily absorbed through the skin; therefore internal deposition is unlikely. Direct contact with skin through water is not a hazard for radionuclides.
Waste rock piles	Radionuclides, metals	Ingestion of surface water and impacted food	No	Surface runoff will be diverted to the storm water pond; no exposure under normal operating conditions

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Source	Constituent	Pathway	Potentially Complete	Comment
Waste rock piles	Radionuclides, metals	Ingestion of soil from eroded piles	No	No public access to the waste rock piles
Waste rock piles	Radionuclides, metals	Dermal exposure to soil	No	No public access: naturally occurring radionuclides are not readily absorbed through the skin.
Mine Crusher/screen	Radon	Inhalation	Yes	Radon released during ore crushing.
Mine Crusher/screen	Radionuclides, metals	Fugitive dust inhalation	Yes	Fugitive dust will be controlled by water spraying as necessary
Haul roads	Radionuclides, metals, fugitive dust	Inhalation	Yes	Mitigated by use of dust control techniques
Haul roads	Radionuclides, metals	Ingestion of water from surface runoff	No	Runoff water will be diverted to the storm water pond
Mill – ore dump, conveyor, crusher	Radionuclides, metals	Fugitive Dust Inhalation	Yes	Water sprays will mitigate fugitive dust; dust from crushing (grinding) will be mitigated by dust-collecting bag house if necessary
Mill – ore dump, crusher, conveyor, mill building exhaust	Radon	Inhalation	Yes	Radon released when ore is disturbed or crushed.
Mill – ore dump, conveyor, crusher	Radionuclides, radon	Ingestion food impacted by dust deposition	Yes	Stacks will have pollution control devices installed as necessary to mitigate dust release
Mill building – chemical separation	Process chemicals	Spill - Inhalation of suspended soils from dried spills	No	Spill will be cleaned up before it dries
Mill building – chemical separation	Process chemicals	Spill – ingestion of water from runoff	No	Runoff is diverted to the storm water pond.
Mill Building – yellowcake dryer	Uranium	Inhalation of stack emissions	No	A modern system will use a vacuum dryer with zero particulate emissions, as described by the NRC in NUREG 1910 (NRC, 2009); experience with vacuum dryers at ISR facilities demonstrates no emissions.

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Source	Constituent	Pathway	Potentially Complete	Comment
Mill building – yellowcake dryer	Uranium	Ingestion of food impacted by stack emissions	No	The dryer will be a modern vacuum dryer with zero stack emissions (NUREG 1910)
Tailings storage	Radon	Inhalation	Yes	Radon emissions are minimized by water cover and limiting the uncovered tailings area
Tailings storage	Radionuclides, metals	Inhalation	Yes	Wet tailings will not be re-suspended
Tailings storage	Radionuclides, metals	Ingestion	Yes	Wet tailings will not be re-suspended; no significant off-site deposition
Tailings storage	Radionuclides, metals – leaking from storage facility	Ingestion Inhalation	No	Tailings disposal cells will be lined; limited area for tailings disposal; tailings covered to prevent infiltration after facility is at capacity

Figure 11

The specific Constituents of Concern are listed below, along with the principal organ affected and a brief description of the adverse health impact associated with the constituent.

### Constituents of Concern, Pathway and Affected Organs

Constituent	Route of Exposure	Principal Affected Organ(s)	Potential adverse health effect
<b>Radionuclides</b>			
Natural uranium	Inhalation	Lung	Increased risk of lung cancer
Natural uranium	Ingestion	Kidney	Kidney damage; possible kidney cancer
Natural uranium	Dermal absorption	Kidney	Kidney damage
Th-230	Inhalation	Lung, bone	Increased risk of lung, bone cancer
Th-230	Ingestion	Bone and liver	Increased risk of bone, liver cancer
Ra-226	Inhalation	Bone	Increased risk of bone cancer
Ra-226	Ingestion	Bone	Increased risk of bone cancer
Rn decay products	Inhalation	Lung	Increased risk of bone cancer
Pb-210	Ingestion	Bone	Increased risk of bone cancer
Po-210	Ingestion	Bone	Increased risk of bone cancer
<b>Metals (with over 0.01% in ore)</b>			
Zinc	Inhalation, ingestion	Blood	Essential element; overexposure may cause decrease in erythrocyte copper
Lead	Inhalation, ingestion	Central nervous system	Forgetfulness, irritability, tiredness, headache, fatigue
Strontium	Inhalation, ingestion	Not applicable	No known harmful effects



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Constituent	Route of Exposure	Principal Affected Organ(s)	Potential adverse health effect
Manganese	Inhalation, ingestion	Central nervous system (CNS)	Essential element; but at high exposures, CNS effects
Barium	Inhalation, ingestion	Kidney	Nephropathy
Copper	Inhalation, ingestion	Liver, kidney, blood forming organs	Liver and kidney damage, anemia, immunotoxicity, developmental toxicity; concentration is homeostatically controlled in the body.
<b><i>Specific metals with 0.01% or less in ore (included because of potential toxicity)</i></b>			
Arsenic (0.001%)	Inhalation	Lung	Increased risk of cancer
Arsenic (0.001%)	Ingestion	Skin	Hyperpigmentation; keratosis
Chromium (up to 0.004%)	Inhalation, ingestion	Respiratory tract	Irritation, asthma; carcinogenic – lung cancer, stomach cancer
Molybdenum (up to 0.01%)	Inhalation, ingestion	CNS, liver, kidney, joints	Essential element, but overexposure can cause CNS effects, liver disease, gout-like disease
Vanadium (up to 0.01%)	Inhalation, ingestion	Respiratory tract, GI tract	Airway irritation, diarrhea, cramps, nausea
<b><i>Equipment emissions</i></b>			
<i>Diesel fumes</i>	Inhalation	Lung, mucous membranes	Increased risk of lung cancer; irritation of eyes, nose, throat and lungs; inflammation of the lungs aggravates chronic respiratory symptoms and asthma.
<b><i>Dust</i></b>			
Nuisance dust	Inhalation	Respiratory tract, skin	Irritation of eyes and nasal passages, injury to the skin or mucous membranes; possible exacerbation of asthma.
Silica	Inhalation	Lungs, immune system	Silicosis, lung cancer, complicates pulmonary tuberculosis; potential autoimmune disease, renal disease
<b><i>Process chemicals</i></b>			
Organics (tertiary amines, decanol, acrylamide, kerosene, etc.)	Inhalation	Neurological systems, liver	Possible increased risk of cancer, liver damage, possible effects on the reproductive systems
Corrosives (acids and bases)	Inhalation (dermal exposure for workers only)	Skin, Lung	Irritation, lung damage

Figure 12

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The CSMS are designed to depict normal operating conditions. Under accident or off-normal conditions or releases, pathways that are not normally important could contribute significantly to exposure by members of the public. For example, a failure of a pollution control device on the crusher stack, or loss of containment in the yellowcake dryer, could release significant quantities of airborne contaminants. Catastrophic floods could release tailings or stored ore into adjacent water bodies. A NAS report states that the risk posed by release of tailings under such circumstances “is small and inconsequential compared with other impacts of such catastrophic events” (NAS, 1986); however, such impacts and the probability of occurrence are site-specific and must be considered in any facility license or permit application.

Conditions that have the potential to be related to uranium mine/mill operations are presented below:

### Diseases/Conditions Potentially Related to Uranium Mine/Mill Operations

Exposure	Disease/Condition	Acute/Long-Term	Baseline Data*
Heavy metals	Kidney disease (nephrotoxicity)	Acute and long-term	Diabetes, pre-existing kidney disease
Dust (PM10, PM2.5, diesel exhaust)	Asthma, pneumoconiosis, silicosis	Acute (asthma), Long-term (pneumoconiosis, silicosis)	Asthma** Chronic Obstructive Pulmonary Disease (COPD)** Smoking rates
Radon	Lung cancer	Long-term	Baseline radon Smoking rates
Other radionuclides	Cancer Birth defects	Long-term Mid-Long-term	Cancer & congenital anomalies data

Figure 13

\* For establishing base rates of disease in community or “confounders” for new disease-related to exposures

\*\* Underlying disease may be exacerbated by dust exposure

### Population-Based Human Health Surveillance and Monitoring

If the moratorium is lifted, the reduction of human risks would be accomplished through the characterization of potential contaminant sources, and the ability of engineering designs to contain potential sources that might result in physical and/or environmental damage.

Cancer outcomes are already reported and are part of the VDH’s “Comprehensive Cancer Control Project,” with statistics updated and reported annually. Similarly, VDH maintains a registry of “congenital anomalies,” Code Section 32.1-69.1. VDH’s Chronic Disease Prevention, Health Promotion, and Oral Health service area is charged with implementing programs that address chronic diseases, including cancer and diabetes, both of which would be conditions of interest with respect to mining and milling exposures for workers and the public (cancer as a long-term health outcome, diabetes as a confounder or exacerbating condition). Statutory authority to “administer and provide a comprehensive program of

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preventive, curative, restorative and environmental health services,... and collect and preserve health statistics” is provided by Code Section 32.1-2. Code Sections 32.1-70 and 32.1-71 require VDH to maintain a population-based central cancer registry based on reports from hospitals, clinics, pathology laboratories, and physicians.

Asthma statistics (including statistics on work-related asthma) have been collected and reported by health districts through the Centers for Disease Control and Prevention (CDC)-funded “Asthma Control Project” that resulted in a state Asthma Control Plan and a state Asthma Coalition. Funding for this collaborative effort ended in 2010, but basic prevalence data continues to be collected through the BRFSS. These data are sampled at the health district level and thus may not be valid for estimating prevalence rates within a county or locality. It would be possible to oversample residents in a specific area to allow for estimates at the county or locality level. However, unless the sample size was very large, it would not likely have sufficient power to identify small changes in the prevalence of asthma (or other conditions) within a small geographic area.

The Toxic Substance-related Illness Surveillance Program has two separate databases which are maintained within the Public Health Toxicology Program. The first contains information on children, age 15 years or younger, with an elevated blood lead level of greater than or equal to 10 micrograms of lead per deciliter of whole blood ( $\mu\text{g}/\text{dL}$ ). The information is reported to VDH by physicians, laboratories, hospitals, and medical facilities. Statistical analysis is performed on the number of reported cases by race, sex, age, range of elevation, population rates, locality, and health district. The second database contains information on adults whose diagnostic test results indicate a possible exposure to a toxic substance. Examples of the toxic substance reports include blood or urine test results for exposure to lead, cadmium, mercury or arsenic. Information is also provided on individuals diagnosed with asbestosis or pneumoconiosis. The data are collected from physicians, laboratories, hospitals and other state agencies.

Baseline data and trends for smoking rates, diabetes and related conditions may be obtained through the annual BRFSS and National Adult Tobacco Survey (NATS). As noted above, these data are sampled at the health district level, and therefore, may not be statistically valid for county-level trends. Additional data on kidney disease and other potential health outcomes of concern could be obtained through an analysis of Virginia Health Information’s (VHI) hospital discharge data and death certificate data. In that case, hospitalizations and deaths would be analyzed as proxy measures for the occurrence of health conditions, given the absence of reliable means of tracking the incidence of all potential health outcomes of concern.

Specific data not currently addressed in statutes or regulation would be needed in order for VDH to conduct epidemiological surveillance and analyses of uranium mining and recovery impacts on human health. Currently, VDH has sufficient authority to evaluate public health impacts in the Commonwealth. However, VDH may need additional authority to collect data necessary to monitor human health impacts that may be associated with uranium mining and milling. For example, an individual’s occupation may need to be recorded to establish trends in worker health effects. The current list of diseases pursuant to Code Section 32.1-35 does not include diseases related to exposure to radionuclides, and certain toxins relating to uranium mining and recovery may need to be added to the toxic substance list in order for VDH to collect private health information from those exposed to such agents if uranium mining and milling occurs in the Commonwealth. Studies of the health of the population living near any potential mining or milling operation should be conducted

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initially and reassessed at regular intervals to identify any changes in health status. VDH would conduct further assessments if the data indicates human health hazards exist. VDH could also conduct a study of multiple cancer types in populations living near the facilities and a case-control study of cancers in children born near such facilities. VDH would need to consider baseline health studies of the population in the vicinity of any proposed uranium recovery facility. Such studies should then continue if such a facility became operational.

The Commonwealth of Virginia has specific instructions for the reporting of laboratory testing of biosamples in cases of suspected chemical/toxin exposure or illnesses attributed to toxic exposures. Under Section 32.1-36 of the Code, and VDH's "Regulations for Disease Reporting and Control" 12VAC5-90, laboratory directors are required to report the following for suspected "Toxic substance-related illness": "Blood or urine laboratory findings above the normal range, including but not limited to heavy metals, pesticides, and industrial-type solvents and gases. Speciation of metals should be reported, if applicable and available, when blood or urine levels are elevated in order to differentiate the chemical species (elemental, organic, or inorganic)."

### Virginia Cancer Registry (VCR) Authorization and Purpose

The VCR is a population-based disease surveillance registry that collects cancer incidence data. Code Section 32.1-70 authorizes the registry and defines who is required to report cancer cases. VDH, in its "Regulations for Disease Reporting and Control" 12VAC5-90, defines what cancers are reportable and what data are required in reports. The Code and the regulations charge VCR with collecting all reports of reportable cancers among the state's entire population.

**Methods:** The Code Section establishing the VCR states that hospitals, clinics, and independent laboratories in Virginia must report cancer cases to VCR. Physicians must report if it is known that a case is not reported from another state source. The registry collects the reports and develops abstracts from them. An abstract is a synoptic compilation of the information reported to VCR. Staff store case reports in a database and extract needed data for analyses. Common purposes are investigating potential cancer clusters, providing aggregated, statistical information to aid policy and practice, and creating sets of records that researchers use in cancer studies.

**Products:** The most common VCR product is aggregated statistical analyses. VCR employs methods and measures in general use. The most common are case counts, age-adjusted and crude rates, and rates bracketed by confidence intervals. Less common but also useful are rate ratios, analysis by census tract, and analysis using geocoded addresses.

Aggregated data are stratified by cancer site, demographic and geographic categories, and stage at diagnosis. An example is "Age-Adjusted Cancer Rates and Counts, Pittsylvania County, Virginia, by Sex, 2000 - 2009". The statistics in this table include rates and case counts for all cancer cases among patients whose residence at diagnosis is Pittsylvania County, whose date of diagnosis falls within the interval 2000 to 2009, and whose gender is known. Similar aggregated data would be available for other areas.

Residents who are sufficiently apprehensive about the number of cancer cases diagnosed in their communities often contact the registry. The concern is about a perceived cancer cluster. Broadly, VCR takes the following steps: 1) educate the residents regarding what cancer clusters are; 2) produce a statistical summary that addresses the issues the citizen

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raises; 3) communicate with the epidemiologist in whose district the resident lives; 4) take part in any investigation that the administrators of the health district decides is necessary. VCR is a partner in these investigations, not the leader; and, 5) contribute to meetings, reports, and other responses as each investigation may require.

**Limitations:** VCR data are confidential medical records. Therefore, data are not available for public inspection. Only the State Health Commissioner has the authority to qualify and to allow individuals access to patient-level data. Public health employees in Virginia are the primary persons with a need to access VCR records. Individual cancer patients, or their verified representatives, can request their VCR records, but staff redacts these records to meet restrictions Virginia law imposes.

VCR records patient demographics, disease diagnostic, and treatment data. The records are not a complete medical history. So, for example, co-morbid conditions and their possible relationships with cancer cannot be described using VCR data.

Data are collected through the end of the first course of treatment and vital status is updated annually for all patients whose deaths are related to cancer. VCR does not contain complete, beginning-to-end abstracts of cancer cases; it is an “incidence registry,” that is, it captures data on newly diagnosed cancers in Virginia.

### **Baseline Rates of Lung Cancer, Silicosis and Radon-Associated Health**

**Problems:** Information about population smoking rates, occupational or recreational exposures to silica dust, and radon levels in buildings within a geographic area provide useful information for assessing the component of disease causation that may be attributable to new environmental exposures. An assessment of tobacco use within a health district is available through the annual BRFSS. It may be possible to infer rates of occupational exposure to silica from DOLI statistics. Radon levels, designated as “radon zones” are available for each state through the EPA’s “Map of Radon Zones” available at <http://www.epa.gov/radon/zonemap.html> . More specific information may be available through state resources for Virginia counties and communities.

### **Other Available Data to Establish Baseline Rates for Conditions of Concern:**

VDH’s “congenital anomalies” database includes data on any infant diagnosed with a congenital anomaly. The data includes the specific disorder identified, and contains the infant’s current address; therefore, VDH can link reported birth defects with specific locations. The ability to obtain state-wide hospital discharge data thorough an existing contractual arrangement with VHI should provide data to determine baseline rates for severe exacerbations of conditions of concern including respiratory conditions (including asthma, chronic obstructive pulmonary disease or COPD) and kidney disease. Hospitalization baseline rates for respiratory conditions such as asthma and COPD are particularly important for identifying short- and long-term exacerbations of these conditions as a result of potential fugitive dust exposures from a mining or mill site if uranium mining and milling is allowed in Virginia. Baseline rates of diabetes-related kidney disease, in particular, are important for determining whether increased reports of kidney disease are related to heavy metal exposures or other conditions. A limitation of this data is that current regulations only require the reporting of hospital data to VHI. Patients requiring only outpatient care are not reported. VDH will be able to track and report diagnosis and treatment for these conditions at all levels of care once the statewide health information exchange has been implemented.

**Need for Retrospective or Other Studies to Determine Baseline Rates:** If the moratorium is lifted and baseline rates for the conditions described above have not been determined, it would be useful to establish these baselines for any county where uranium mining and/or milling may occur. These baselines would be needed to determine whether any conditions that are reported after the start-up of uranium mining or processing operations exceed baseline rates and/or existed prior to the start of these operations.

**Necessary Changes or Enhancements to Cancer, Congenital Malformation Reporting:** Paracelsus is credited with first articulating that the 'poison is in the dose', which for radiation epidemiology translates as 'the lower the dose, the lower the risk' and, as an important corollary, the lower the dose, the greater the difficulty in detecting any increase in the number of cancers possibly attributable to radiation (Boice 2012).

This principle is important in evaluating the adequacy of population-based registries of cancer and birth defects, when trying to detect long-term health outcomes from exposure to low levels of radiation or toxins, especially in small, rural populations. Poverty and low socio-economic status have been associated with somewhat higher cancer rates, in general (Kavachi and Lochner, 2000).

VDH maintains statewide registries for both cancer and birth defects that provide appropriate baseline data for evaluating incidence rates and identifying long-term trends and/or occurrences of disease clusters, rare cancers or unusual congenital malformations. It is worth noting, in this context, that Brugge and Buchner, in their 2011 review of research on uranium-related health effects did not find any *in vivo* research that supported uranium-related genotoxicity (Brugge and Buchner, 2011).

### Environmental Monitoring

Under current NRC regulations, a licensee for a mill site is responsible for the performance of on-site monitoring and the availability of results for review by the regulating authority and general public. Monitoring devices are now available that display and communicate location and real-time data.

Environmental monitoring plans submitted by an applicant should contain the elements listed below:

- Representative measurements of concentrations of constituents in environmental media such as air, water, vegetation, domestic food products, soil, radiation and meteorology;
- Adequate coverage of the areas of interest, such as watersheds, counties, property, green spaces including recreational parks;
- Adequate continuing measurement of background concentrations of constituents identified in baseline studies;
- Representative measurements of direct gamma radiation; and
- Acquisition of adequate data on which to base exposure and dose estimates for members of the public, including minority and disadvantaged populations.

An environmental monitoring program is one of the most important elements in a radiation protection program. A well-designed and properly implemented program provides assurance that unexpected or accident-related changes in environmental concentrations of toxicants associated with a facility's operations will be detected early. This allows for quick response by the facility operator, the regulatory agency and responders.

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Specific environmental monitoring issues include:

**Radon:** According to EPA, “[r]adon is the number one cause of lung cancer among non-smokers.... Overall, radon is the second leading cause of lung cancer. Radon is responsible for about 21,000 lung cancer deaths every year. About 2,900 of these deaths occur among people who have never smoked.”

The EPA estimates the average indoor radon level to be about 1.3 pCi/L, and about 0.4 pCi/L of radon is normally found in the outside air. The EPA recommends that countermeasures be taken to reduce radon exposure when inside measurements indicate levels of 4 pCi/l (picoCuries per liter) or higher. Because there is no known safe level of exposure to radon, EPA also recommends that Americans consider fixing their home for radon levels between 2 pCi/L and 4 pCi/L.

Radon monitoring requirements for underground uranium mines that would need to be implemented if the moratorium is lifted are specified in 30 CFR 57.5037. The frequency of monitoring is dependent on the measured radon decay product concentrations. All mines would be required to measure radon concentration in exhaust mine air. If concentrations greater than 0.1 working level (WL) were found in the exhaust air from underground uranium mines, radon decay product concentration measurements representative of the worker’s breathing zone would be required every two weeks in all working areas. If concentrations greater than 0.3 WL are found, measurements would be required to be taken every week. If the initial exhaust air concentration is less than 0.1 WL, exhaust air measurements would be required monthly. The required monitoring frequencies for non-uranium mines are somewhat less stringent. The maximum allowable concentration for miners without adequate respiratory protection is 1.0 WL. If the level is greater than 10.0 WL, protection using a self-contained breathing apparatus (SCBA) is required.

The maximum allowable annual radon decay product exposure to an underground miner under MSHA regulations is 4.0 working level months (WLM). The WLM is the concentration in WL multiplied by the number of hours of exposure and divided by 170 hours, the hours in a normal working month. NIOSH issued a recommendation based on the results of epidemiologic studies of lung cancer in miners that the exposure limit should be set at 1.0 WLM per year (NIOSH, 1987). Mine operators are required to submit to MSHA annually a record of all miner exposures. MSHA regulations include a caveat stating that if the EPA recommends an exposure limit different from the 4.0 WLM per year and the President approves it, the MSHA limit will be changed.

The NRC limits the amount of radon that may be released from a uranium mill under 10CFR Part 40, Appendix A, Criterion 6 which states: “limit releases of Radon-222 from Uranium byproduct materials, and Radon-220 from Thorium byproduct materials, to the atmosphere so as not to exceed an average release rate of 20 picocuries per square meter per second (pCi/m<sup>2</sup>s) to the extent practicable throughout the effective design life determined pursuant to (1)(i) of this Criterion.”

NRC regulations provide for the following:

**Direct Gamma Radiation and Beta Radiation Surveys:** Gamma radiation surveys are performed throughout any licensed mill semi-annually to determine where radiation areas must be posted and to assess whether personal dosimetry is required. Radiation areas, i.e.,

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areas where an individual might receive a radiation dose of 0.005 rem in one hour, are required to be surveyed quarterly.

Beta dose rate surveys are required in areas where aged yellowcake may be stored for several weeks or more, allowing the shorter-lived beta emitting decay products of uranium-238 to build in from the decay of the parent uranium.

**Radionuclides in Airborne Particulate Matter:** Surveys for uranium ore dust are conducted in ore handling areas of a mill to demonstrate compliance with the occupational dose limits, meet the “airborne radioactivity area” posting requirements, determine what precautions are needed to meet the limits, and to determine whether airborne concentrations of radiation materials are being kept ALARA. Yellowcake areas are surveyed by a combination of general air sampling and personal breathing zone sampling.

**Surface Contamination Surveys:** Surface contamination surveys are conducted in areas such as change rooms, break rooms, control rooms, lunchrooms and offices. The limits for surface contamination are specified in NRC Regulatory Guide 8.30. In addition, while there are no regulatory standards for surface contamination in restricted areas, contamination levels should be assessed to prevent contribution to airborne radioactive levels and contamination of personnel. Specific contamination levels for restricted area surfaces that are considered ALARA are suggested in NRC Regulatory Guide 8.30.

All equipment that has been in the restricted area must be surveyed prior to release and must meet the contamination limits specified in NRC Regulatory Guide 8.30 and, in some cases, incorporated into facility licenses. Some Agreement States have adopted the release limits into their regulations even though the release limits are not defined in NRC regulations. Individuals must survey for contamination prior to leaving a controlled or restricted area to prevent the spread of contamination to unrestricted areas. The goal for skin contamination is equal to background levels.

Other surveys such as of packages prepared for shipment, ventilation systems, and respirators are also described in the NRC Regulatory Guide 8.30.

**Animals, Crops, Vegetation and Fish Sampling:** Where a significant pathway to humans is identified in individual licensing cases, animals, vegetation, crops and fish (edible portion) samples are collected. Crops and forage vegetation are sampled at least three times during the grazing season in grazing areas in three different sectors having the highest predicted airborne radionuclide concentration due to conventional uranium mill operation. At least three samples are collected at the time of harvest or slaughter or removal of animals from grazing for each type of crop (including vegetable gardens) or livestock raised within the approved sampling area around the conventional uranium mill. Fish samples are collected semiannually from bodies of water that may be subject to seepage or surface drainage from potentially contaminated areas. Animal, crop, vegetation, and fish samples are analyzed for Ra-226 and Pb-210.

**Soil Sampling:** Surface soil samples are collected annually using a consistent technique at each of the locations chosen for air particulate samples. Soil samples are analyzed for natural uranium, Ra-226, and Pb-210.



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**Sediment Sampling:** Sediment samples are collected annually from surface-water locations. Sediment samples are analyzed for natural uranium, Th-230, Ra-226, and Pb-210.

The DRH utilizes the Environmental Monitoring program to sample and analyze several types of media around the North Anna and Surry Nuclear Power Stations, Babcock & Wilcox facility and the Naval Station. The samples include gamma exposure, air, water, soil, silt, vegetation, milk and fish. Results are published quarterly and a yearly report is created and posted on DRH's webpage. If a uranium mine and mill were in operation, environmental monitoring around these sites should be included in the Environmental Monitoring Program. DRH would be expected to provide environmental monitoring around uranium mines/mills similar to what it now conducts around other NRC licensed nuclear fuel cycle facilities in Virginia:

- Human Health Surveillance and Reporting; and
- Reporting Protocols for Chemical/Toxic Exposures.

### Worker Dose Monitoring and Reporting

A mill license must comply with 10 CFR Part 20.1101 to include provisions that are consistent with keeping radiation doses ALARA. For example, a specific license may include a license condition that would constrain worker doses to less than 600 mrem per year. Constraints are not dose limits but can be set such that exceeding the constraint would require the operator to conduct an investigation and report to the state with a plan for reducing the worker exposures. At the present time, there are no NRC regulations that require routine reporting of radiation doses for workers at uranium mills except to report an individual their personal exposure. Agreement State and NRC inspectors routinely review worker doses during compliance inspections and dose distributions are generally reported in the annual ALARA audit. DRH could require, by regulation or license condition, mill licensees to report doses annually. Doses that exceed the regulatory limit of 5 rem per year must be reported to the Agreement State or the NRC, as appropriate.

Personal dosimetry is required for individuals who might receive a radiation dose in excess of 10% of the applicable limit in one year. Most uranium facilities use optically stimulated luminescent (OSL) dosimeters or thermoluminescent dosimeters (TLDs) to monitor workers. These dosimeters are generally worn for a month (for pregnant women) or a quarter then returned to the vendor for analysis. There are real time dosimeters available that are used in some facilities. These dosimeters can be connected to a computer to provide an instant reading of an individual's dose. However, few if any current uranium mining or milling facilities use the devices. Self-reading pocket dosimeters or electronic dosimeters are often issued to site visitors who will spend only a few days in the mill.

### Bioassay Measurements

Urine bioassay measurements are required for most uranium mill workers at a frequency based on their potential for exposure. For example, yellowcake workers are generally monitored weekly while other workers less likely to be exposed are monitored bi-weekly, monthly or quarterly depending on the potential for intake of uranium. The laboratory reporting limit for bioassay measurements is 0.005 mg/L. It is rare for a mill worker to have a real bioassay measurement exceeding that value. In most cases, a bioassay sample that exceeds 0.005 mg/L is the result of inadvertent contamination. Those issues are resolved by

re-sampling the individual. The action limit is 0.015 mg/L; however, many facilities investigate any bioassay sample greater than the laboratory reporting limit of 0.005 mg/L.

### Work Space Monitoring

This section focuses on worker protection in uranium recovery facilities, specifically addressing monitoring and record keeping. Worker monitoring requirements and exposure limits in existing federal regulations and guidance are different in some aspects for uranium mines and mills. Worker radiation protection at mines is the responsibility of MSHA. Workers at operating uranium mills are under the jurisdiction of MSHA for most safety and health aspects and the NRC or an Agreement State for radiation protection. The NRC has no jurisdiction over uranium mines. An interagency agreement between MSHA and the Occupational Safety and Health Administration (OSHA), dated 3/29/79, specified the responsibilities of each of the agencies in relation to mineral mining and milling (DOL, 1979). Workers at operating uranium mills are required to hold MSHA training certificates. MSHA regulations cover all aspects of physical safety at mine and operating uranium mills.

Air quality monitoring requirements for surface and underground, metal and non-metal mines are contained in 30 CFR 56 and 30 CFR 57, respectively. Requirements for monitoring for radon and diesel fumes are specified in the MSHA regulations for underground mines. Details of other monitoring programs for mines are left to the operator to develop with the caveat that the programs must be capable of detecting health hazards and concentrations of airborne contaminants in excess of the 1973 Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH). DMME has adopted the 1996 ACGIH TLVs.

In contrast to mining requirements, acceptable monitoring schedules and procedures for worker monitoring at uranium mills are defined in Regulatory Guide 8.30. NRC Regulatory Guides are not mandatory but deviations from their provisions generally must be shown to be at least as protective.

### Direct Radiation Exposures

Current MSHA regulations require annual gamma radiation surveys in underground uranium mines. Gamma radiation exposures must be measured using personal dosimetry if the average gamma radiation measurement from the survey is greater than 2.0 milliroentgen (mR) per hour. The maximum allowable gamma radiation dose to a miner is 5 rem per year. The NRC and Agreement States require personal monitoring and dose tracking at a potential annual dose of 500 mrem or approximately 0.2 mR per hour.

### Silica

The only specific requirement in 30 CFR Parts 56 & 57 with regard to monitoring for airborne dusts is that “dust, gas, mist, and fume surveys shall be conducted as frequently as necessary to determine the adequacy of control measures.” Otherwise, there are no regulatory standards for monitoring for silica in underground or surface mines. The MSHA Program Policy Manual (MSHA, 2012) does not add specific guidance except to note that MSHA will determine whether surveys are adequate to determine that controls are effective in reducing exposures to airborne contaminants. The types of surveys are not specified in either the regulation or the manual. However, the manual does note that the surveys should be conducted in accordance with established scientific principles. The silica standard

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applicable to mines under MSHA is the 1973 TLV, 0.1 mg/m<sup>3</sup>. MSHA issued a notice of proposed rulemaking in April 2010. The proposed rule-making does not appear to include specific sampling requirements. NIOSH has recommended an exposure limit of 0.05 mg/m<sup>3</sup>.

MSHA determines whether dust, mist, gas and fume surveys are conducted frequently enough to determine whether controls are effective in reducing exposures to airborne contaminants. Sampling frequency should be greater for results that approach the standard (TLV) and may be determined by changes in mining operation, work schedules, maintenance of controls, or other factors that would affect concentrations of constituents in air (USDOL, 2012).

While MSHA does not specify frequency or methods for complying with the general requirement, best practices at some mines include personal dust monitoring using lapel or breathing zone samples. Samples are generally analyzed for radionuclides (gross alpha) but not necessarily for respirable dust or silica.

### **Diesel Fumes**

The MSHA requirements for exposure to diesel particulate matter (DPM) are contained in 30 CFR Part 57.5060. DPM consists of solids, liquids, and vapors; burned and unburned hydrocarbons; oxides of sulfur, nitrogen; metal fragments, metal oxides and other substances. Diesel fumes are ultrafine particles that can cause irritation of eyes, nose, lungs, throat, lightheadedness and nausea. Diesel fumes have recently been formally classified as a carcinogen. Diesel fumes are difficult to measure. However, carbon components can accurately be measured at low concentrations. Therefore, the diesel standard is based on total carbon (0.16 mg total carbon per cubic meter).

As with the general requirements for air sampling, mine operators must monitor as often as necessary to effectively determine whether the average personal full-shift airborne exposure to DPM exceeds 0.16 mg/m<sup>3</sup>. There are no specific requirements for periodic measurements or particular types of measurements. Compliance is maintained by requirements on sulfur content of diesel fuel and limits on fuel additives as well as requirements for maintenance of diesel-powered equipment, including emission control devices.

### **Noise**

Noise is a potential hazard in all mines. The Noise Standard, 30 CFR Part 62, applies to all mining activities including metal and non-metal mines as well as mills that are covered under MSHA. The standard requires that mine operators evaluate each miner's noise exposure to determine compliance with the 8-hour Time Weighted Average (TWA8) permissible exposure level of 90 dBA with an action level of 85 dBA TWA8. Miners whose exposure exceeds the action level must be enrolled in a Hearing Conservation Program (HCP) and must have annual audiograms in addition to a baseline audiogram in accordance with procedures described in 30 CFR Part 62.

## **Biological Hazards**

There are no requirements in MSHA regulations for monitoring potential biological hazards such as mold or pollens except as they are covered under the general requirement that monitoring be conducted as frequently as necessary to determine the adequacy of control measures.

## **Tracking Mine Worker Cumulative Exposures**

**Radiation Exposures:** Direct gamma radiation exposures are tracked for underground miners in areas where the average radiation exposure rate exceeds 2 mR/hr and personal dosimetry is required. Otherwise, MSHA regulations contain no requirements for tracking gamma doses at lower exposure rates.

Radon decay product exposures are tracked for all underground uranium miners under MSHA, 30 CFR 57.5040, but not for surface miners. Mine operators are required to report annually to MSHA individual exposures to radon decay products (“daughters”) and keep records with respect to each individual’s time-weighted average current and cumulative exposure.

**Nuisance Dust, Silica and Other Airborne Chemical Constituents:** There are no specific requirements for tracking individual worker exposures to nuisance dust or silica. In contrast to radiation exposures (gamma, radon, and radionuclides in airborne particulate matter), the allowable exposures are based on an 8-hour average concentration so no individual exposure tracking over time is necessary. Exposure to diesel fumes is not tracked on an individual miner basis.

Medical monitoring, in the form of chest x-rays, is required to be offered to miners exposed to silica; but while participation is encouraged, it is not required. Mine operators must report any cases of silicosis or other occupational lung disease to MSHA if a medical diagnosis is made or compensation awarded.

**Bioassay for Mines:** There are no specific bioassay requirements for uranium mines in MSHA regulation. However, it is best industry practice to periodically collect urine bioassay samples from miners and analyze them for uranium as a method of determining intake of uranium.

**Noise Exposure:** The results of audiometric testing must be reported to the miner and maintained by the mine operator and must be tracked on an individual miner basis.

## **Tracking Mill Worker Radiation Dose**

The maximum allowable radiation dose to a uranium mill worker is 5 rem per year under NRC and Agreement State regulations. The committed effective doses from inhalation of radon decay products and inhalation of radionuclides in airborne particulate matter, as well as the effective whole body dose from direct radiation are summed to obtain a total effective dose equivalent (TEDE). The radiation monitoring requirements are designed to demonstrate compliance with the dose limit and to provide assurance that doses are being kept ALARA. Radiation doses to mill workers rarely exceed 1 rem per year. Radiation monitoring requirements for uranium mill workers are described in detail in NRC Regulatory Guide 8.30

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Tracking worker doses is required if the annual dose is likely to exceed 10% of the annual dose limit of 5 rem TEDE with all sources and pathways summed. A dose report (NRC Form 5 or equivalent) is provided to the worker and must be available for inspection by the NRC or Agreement State. There is no requirement to routinely report individual doses to the NRC or Agreement State unless the annual dose exceeds 5 rem. Licensees are required to perform an ALARA Audit each year. The Audit Report generally includes the distribution of facility worker doses for the calendar year but no individual doses.

## **COMPLIANCE**

### **DMME Compliance**

If the moratorium is lifted, each permitting or licensing agency will be responsible for monitoring and inspections necessary to assure compliance with their individual regulations; however, DMME should be the lead coordinating agency for these activities on the mine site. Statutory and regulatory provisions should clearly identify those areas where either through statute, memoranda of understanding or other devices DMME would acquire the authority to monitor groundwater, surface waters, or air quality. Cooperation with DEQ and VDH in establishing groundwater, surface water and air quality standards for the mine permit and for worker health and safety would be necessary to ensure an effective and efficient process.

To assure compliance with laws and regulations promulgated for the mining and/or milling of uranium in the Commonwealth, a strong program will be essential. Key components in a statutory and regulatory framework should include:

- Coordination of inspections and monitoring functions between all agencies having permitting and licensing authority;
- Right of entry upon the site to make unannounced inspections of any activities, monitoring equipment, or any required records;
- Authority to order immediate cessation of activities to prevent or eliminate an imminent danger to the health or safety to employees or the general public; or to prevent significant harm to land, air or water resources;
- Authority to revoke or suspend the permit when a pattern of violation exists or the permittee fails to comply with orders of the division which could adversely affect the health or safety to mine employees or the general public; or to prevent significant harm to land, air or water resources;
- Provisions for appeal of violations through the Administrative Process Act;
- Public access to all inspection, monitoring, and violation records; and
- Public notification and participation for all hearings resulting from enforcement actions taken against the operator.

Statutory and regulatory authority as well as additional resources would be needed to implement these recommendations.

### **NRC/VDH Compliance**

A core detail of regulatory compliance is the inspections of licensees by the NRC:

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“Inspections of uranium recovery facilities licensed by the U.S. Nuclear Regulatory Commission (NRC) are essential to ensure that they conduct their operations in compliance with applicable regulatory requirements. The inspection frequency for a given facility is based on the potential radiation hazard of the licensee's program, so that the licensee that presents the greatest risk to the health and safety of the public and the environment requires the most frequent inspections. In general, however, inspection frequencies range from several times per year (for operating facilities) to once every 2 years (for facilities in standby mode or decommissioning).

NRC inspections focus on those areas that are most important to safety and security, using objective measures of performance. In general, these inspections address a variety of topics, including management organization and controls, radiation protection, chemical processes, radioactive waste management, emergency preparedness, fire safety, environmental protection, and onsite construction. Specific information about these inspections can be found in the NRC's Inspection Manual.”

During the inspection the regulator verifies that the licensee is conducting their operations in accordance with regulations, their procedures, license conditions and the operation is not negatively impacting the environment and public health. These inspections typically take multiple days to complete and include visual observations of personnel performing operations, performing confirmatory surveys and environmental samples, and reviewing documentation. If the licensee is found to be in violation of any regulations, license conditions or not following procedures, the regulatory authority will follow their procedures, which may include notice of written violations, a hearing, a fine or an order, depending on the severity of the violation.

If analysis indicates that the licensee has impacted the environment or public health, immediate actions would be requested to be performed to identify the cause and take corrective actions to cease. Follow-up mitigation actions would be required to return the environment to original conditions and take any and all actions to reduce public health affects which may include decontamination, medical screening, monitoring and healing to name a few.

Worker training is a major component of an active milling operation. A licensee is required to provide initial training and then annual refresher training to workers. The suggested training includes the following basic topics:

- Fundamentals of health protection: toxic and radiologic hazards of exposure to uranium and its decay products, routes of entry and why exposures should be kept ALARA;
- Radiation safety: protective clothing, respiratory protection, work rules, decontamination;
- Radiation protection systems: ventilation, housekeeping, radiation safety aspects of process equipment, standard operating procedures, security and access control, electronic data gathering and storage, automated processes;
- Health protection measurements: air sampling, bioassay, contamination surveys, personal dosimetry;
- Radiation protection regulations: regulatory authorities, worker rights (10 CFR 19), radiation protection requirements (10 CFR 20); and,
- Emergency procedures.

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Depending on the complexity of the site and the potential for exposure, initial radiation worker training can take anywhere from four hours to several days. At some sites OSHA Hazardous Waste Operations and Emergency Response training is also required. Annual refresher training is required for all workers. The refresher training is generally an abbreviated version of the initial training but may include discussion of situations that have occurred in the past year.

In addition to the basic radiation worker training, all women of childbearing age must be trained in risks of pre-natal radiation exposure as per NRC Regulatory Guide 8.13. NRC Regulatory Guide 8.29 also provides information on risks of radiation exposure. However, it is outdated and facilities generally use more current information in discussing risks with workers.

### **DEQ Compliance**

If the moratorium is lifted, DEQ should provide for onsite inspections for the water and air permitting programs on a frequent basis, and the inspectors should receive specialized training in uranium mining and milling. The review of data reported by the operator is a significant part of the DEQ's compliance programs. Both air and water permits require the reporting of data collected by the operator on the operator's air emissions and water discharges. DEQ spells out the type of data collected, how it will be collected and the frequency of collection within the operator's DEQ issued permits. The integrity of this data is protected by criminal penalties for falsification of these data submittals. Many of the violations DEQ discovers are within this reported data, such as exceeding the limits on air or water pollution.

### **Enforcement**

If the moratorium is lifted, the statutory and regulatory framework should be constructed to make the enforcement and compliance activities self supporting and not an obligation to the public. Any costs for inspections of permits or for enforcement of the law and regulations should be borne by the permittee. This could be accomplished through an annual permit anniversary fee calculated in an amount not to exceed the actual expenses incurred annually for these activities.

In order to prevent or eliminate an imminent danger to the health or public safety, or to prevent significant harm to land, air, or water resources DMME should be given the authority to order immediate cessation of mining activities. This action is essential where either through inspection or investigation DMME determines that a condition or practice exists, or that the permittee is in violation of any condition of any regulations or condition of permits applicable to air or water quality which creates an imminent danger to the health or safety of the public, or causes or can be anticipated to cause significant environmental harm to land, air or water resources. This authority should specify that the order remain in place until such time as the condition or practice has been abated, or until the order ceasing mining activities has been modified, vacated or terminated by DMME. Where the cessation order will not completely abate the imminent danger DMME should be given the authority to impose obligations on the operator that requiring whatever actions necessary to abate the imminent danger or the significant environmental harm.

DMME should also be given the authority to revoke or suspend the permit of an operator based on a pattern of violation. This action should be available to DMME where an operator

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exhibits the inability to comply with the law, regulations, or permit conditions and DMME determines that a pattern of violation exists and finds that the violations are caused by the unwarranted failure of the operator to comply or that the operator willfully caused the violations. Authority should be granted to DMME to issue such orders requiring the operator to show cause why the permit should not be suspended or revoked, provide the operator with the opportunity for a formal public hearing, and upon failure of the operator prevail in showing why the order should not be up held, authorize DMME to suspend or revoke the permit.

Any enforcement actions taken by DMME for violations of law, regulation, or permit condition should require mandatory civil penalties. To assure strict compliance, DMME should be given the authority to levy mandatory fines for violations of law, regulation, or permit conditions. These fines should be of sufficient monetary value to encourage compliance and be equitable with civil penalties levied by DEQ. Statutory provisions should be developed to 1) require mandatory civil penalties, 2) prescribe the methodology for determining the amount of any civil penalty, and 3) establish the maximum penalty to be levied. Provisions should be put in place establishing a formal review of penalties prior to assessment by DMME. These should include informal and formal public hearings in accordance with the Administrative Process Act.

If the moratorium is lifted, the statutory and regulatory framework should also provide provisions for criminal penalties where the actions of the person or permittee show a willful and knowing disregard for the law or regulations. These actions could include uranium mining or exploration without first obtaining a permit or after a permit has expired or after its suspension or revocation; violating conditions of a permit; or failure or refusal to comply with the regulations or orders or issued by DMME. Additional offences that should be considered include similar actions taken by a corporation or its agents and false statements, or misrepresentation of records, reports, plans or other documents filed or required to be maintained by the law. Criminal penalties for these actions should be fixed and established in law.

Any program established upon the moratorium being lifted should maintain transparency, provide for public participation, and assure the public of full compliance of the uranium mining operation by making all monitoring and inspection reports, investigation reports, violations and enforcement actions readily available to the public. Public participation should also be available for actions taken by DMME in any hearings pertaining to imminent danger cessation orders, pattern of violation show cause orders, or formal hearing involving issuance of notices of violation, which come under the Administrative Process Act.

If the moratorium is lifted, the General Assembly should grant additional authority to issue orders requiring mandatory civil penalties to the owner, operator and/or responsible individuals for the violation of law, regulations, permit conditions, and specific activities that will be subject to criminal prosecution. Any monies collected through civil charges or penalties should be directed to a fund specific for the regulation of uranium mining and milling operations. Statutory and regulatory authority and additional resources would be needed to implement these recommendations.



## **RECLAMATION/CLOSURE**

### **Bond Release (Mine)**

If the moratorium is lifted, the public should be given notice and an opportunity to comment prior to accepting the initial financial assurance mechanism, any changes to the assurance due to major permit revisions, and prior to final mechanism release. The financial assurance mechanism should not be used to release the operator from its reclamation responsibilities. The financial assurance mechanism acts as a guarantee to the public to prevent the public from having to pay for the cost of reclamation should the operator default.

Any statutory and regulatory framework addressing performance bonds should include the types of financial instrument acceptable to the Commonwealth, duration of the bonding period, terms for release of portions or all of the performance bond, and the bond release process as well as access for the public to participate in both the initial bonding and bond release process.

### **Mill Closure**

The activities of decommissioning nuclear facilities means safely removing a facility or site from service and reducing residual radioactivity to a level that permits either of the following actions:

- Release the property for unrestricted use, and terminate the license.
- Release the property under restricted conditions, and terminate the license

To provide for the disposal, long-term stabilization and control of uranium mill tailings in a safe and environmentally sound manner, and to minimize or eliminate radiation health hazards to the public, Congress enacted UMTRCA. Under Title I of the UMTRCA, the U.S. DOE or the pertinent state is responsible for cleanup and remediation, as well as long-term care and maintenance of Title I disposal and processing sites, under a general license.

The licensee is required to submit the reclamation plan in the initial application. During the life of the license the licensee is required to ensure the plan is maintained and submit any changes to the regulatory changes for review and approval. Terminating the license involves a process in which a determination is made regarding confirmation that all applicable reclamation requirements have been met. This includes ensuring completion of stabilization work for the tailings consistent with the accepted reclamation plan, and a determination that the licensee has complied with all standards applicable to land structures and groundwater cleanup. The aspects of license termination addressed in this review process included mill decommissioning, decontamination and disposal; surface soil cleanup and post cleanup verification; mill tailings surface stabilization; and groundwater corrective action. Compliance with these four aspects of reclamation, taken together, forms the basis for the NRC staff finding that the design and groundwater cleanup program meet applicable requirements, that the design and cleanup program have been acceptably completed at the sites and that the licensee has met the applicable requirements.

The NRC's proposed SRP for conventional uranium mills contains guidelines for the decontamination of facilities and termination of the license. The instructions in this guide specify the radionuclides and radiation exposure rate limits which should be used in

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decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use.

The mill reclamation plan must also be submitted as part of the application. Information regarding the design basis and review for license termination is included. It is the licensee's responsibilities to submit the necessary documentation to the regulator showing that the facility has been decommissioned to regulatory limits and that the environment has not been negatively impacted. The documentation must include sampling analysis and surveys. These samples and surveys will be the same as what was performed pre-licensing and during the operations phase. To ensure the environment is returned to the pre-operational conditions, the baseline data will be utilized. It is the regulator's responsibility to perform confirmatory samples and surveys and ensure that all the regulatory limits have been met and that the licensee has met all their requirements before license termination. The termination process also includes public participation before completion. The NRC maintains a website, which includes documentation on each site. One example of such is <http://www.nrc.gov/info-finder/decommissioning/uranium/is-homestake.pdf>.

For uranium mills, the NRC requires that all revisions to the operations or reclamation plans be thoroughly documented and cost estimates (with the basis) detailed for NRC review and approval.

All costs (unit and total) must be estimated on the basis of independent third party contractor costs (including overhead and profit in unit costs or as a percentage of the total). Equipment owned by the licensees and the availability of licensee staff should not be considered in the estimate to reduce cost calculations. All costs must be based on current year dollars. The NRC staff review may include a comparison of unit cost estimates with standard construction cost guides and discussions with appropriate State or local authorities (e.g., highway cost construction). The licensees provide supporting information or the basis for selection of the unit cost figures used in their estimates.

At a minimum, all cost estimates for unrestricted or restricted release of a site must meet all nine of the following conditions:

- The cost estimate meets the applicable regulatory requirements in 10 CFR 40.36(d), 40.42(e), and 40.42(g)(4)(v);
- The cost estimate is based on documented and reasonable assumptions;
- The unit cost factors used in the cost estimate are reasonable and consistent with NRC cost estimation reference documents;
- The cost estimate includes costs for labor, equipment and supplies, overhead and contractor profit, sampling and laboratory analysis, and miscellaneous expenses (e.g., license fees, insurance, and taxes);
- The cost estimate applies a contingency factor of at least 25 percent to the sum of all estimated costs;
- The cost estimate does not take credit for (a) any salvage value that might be realized from the sale of potential assets during or after decommissioning or (b) reduced taxes that might result from payment of decommissioning costs or site control and maintenance costs;
- The means identified for adjusting the cost estimate and associated funding level over the life of the facility and any storage or surveillance period is adequate;
- The cost estimate reflects decommissioning under appropriate facility conditions; and

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- The cost estimate includes costs for all major decommissioning and site control and maintenance activities, including (a) planning and preparation, (b) decontamination and/or dismantling of facility components, (c) packaging, shipment, and disposal of radioactive wastes, (d) a final radiation survey, (e) restoration of contaminated areas on facility grounds (if necessary), and (f) site stabilization and long-term surveillance (if necessary).

The NRC requires that its licensees supply sufficient cost information for the NRC to verify that the financial assurance accounts are adequate to cover all necessary decommissioning activities required under the license (Criteria 9 of 10 CFR Part 40, Appendix A). Cost estimates are submitted to NRC with the initial license application or reclamation plan. Cost estimates are calculated on the basis of completion of all activities by a third party. Unit costs, calculations, references, assumptions on equipment, and operator efficiencies are provided.

Licensees are required to adjust cost estimates annually to account for inflation and changes in reclamation plans. The annual submissions are in the form of requests for amendment to licenses.

Licensees must submit revised sureties incorporating adjustments to the cost estimates for inflation 90 days before each anniversary of the effective dates of the financial assurance instruments (typically on an annual basis). The adjustments are made using the inflation rate indicated by the change in the CPI published by the U.S. DOL, Bureau of Labor Statistics.

### **Mill Financial Assurance Release**

Once the license is terminated, the Financial Assurance for decommissioning will be terminated and returned to the licensee. If Virginia requests to amend the Agreement to include uranium mill authority, it will be required to have a decommissioning program and compatible regulations.

## **POST-CLOSURE MONITORING/LONG-TERM SURVEILLANCE**

If the moratorium is lifted, monitoring should continue even after mining and/or milling operations have ceased, the reclamation bond for the mine has been released and the mill site has been decommissioned. Any statutory and regulatory framework that may result from the lifting of the moratorium should contain a mechanism for long-term monitoring funded by the operator to ensure the community that air, surface water, and groundwater continue to be protected.

Once the license is terminated, the land that the milling operation resided on will be turned over to either DOE or the state. The custodial agency is then required to perform monitoring and analysis for long-term care. 10 CFR Part 40, Appendix A, Criterion 10 states that the licensee is responsible for providing the financial surety for long-term care to the regulatory authority. The NRC turns over the land and responsibility to DOE for long-term care. The DOE provides the NRC with monitoring data for analysis review.

If the moratorium is lifted, DEQ's authority to enforce their permits would end when mining and/or milling operations ceased. However, DEQ could enforce against the property owner

for violations of water quality standards if it can be shown that the closed site caused the violation.

## **V. AGREEMENT STATE DISCUSSION**

Only the Governor of Virginia can submit a request to the NRC for amending the Agreement to include uranium milling authority. If the Governor were to do so, VDH would need to amend its statutory authority in Title 32.1 sections 227 through 238 and include the necessary uranium authority that the NRC maintains under 42 USC 2021. DRH would also need to amend current radiation protection regulations, 12VAC5-481, to include the necessary compatible regulations in 10 CFR Parts 40 and 51. NRC regulations contain compatibility requirements to ensure the harmonizing of use throughout the United States.

If the Governor sought to amend the Agreement with the NRC to include uranium milling, it would likely take at least three years to amend the Agreement. Such an initiative involves a significant dedication of staff hours to create the program, write the necessary statutes and regulations, document and submit required information to the NRC, coordinate and attend public meetings.

If Virginia became an Agreement State for the purposes of regulating uranium milling, positions would need to be created in the DRH to perform the licensing and inspecting of a uranium mill. The number of individuals must be sufficient to complete the tasks in a timely manner and have specific knowledge and experience to license and inspect. There are classes available to aid in these individual's knowledge but there are a limited number of individuals with current experience licensing and inspecting uranium mills.

Start up funds would need to be identified in order to hire staff, purchase necessary equipment and provide training. Once the program was functioning, these costs would be borne by the licensee through application fees, amendment fees and inspection fees, if imposed by the state. Equipment needed for the new staff would include: office equipment, computers, vehicles, and survey and monitoring equipment.

DRH has estimated that it would need approximately 1.5 full time employees (FTEs) and \$100,000 per year to re-institute a radon program, 1 additional FTE and \$45,000 per year for the Environmental Monitoring Program if the moratorium is lifted and about eight (8) additional FTEs and \$1 million per year to amend the agreement and maintain the uranium milling program.

If Virginia amended its Agreement and took over regulation of uranium milling activity, all radioactive material license applications for uranium milling would be submitted to DRH, which would administer all aspects of the licensing and regulation of uranium milling, siting, design, construction, operation and reclamation uranium milling in the Commonwealth. DRH would consult with the DMME and DEQ for specific expertise regarding selected aspects of license applications. DRH would adopt and implement NRC regulations either by reference or through specific rulemaking. This includes the requirements of 10 CFR Part 20 (Radiation Protection) which are already incorporated by reference into Virginia's statutes, 10 CFR Part 40 (Uranium Mill Tailings), and 10 CFR Part 51 (NEPA). VDH may also establish additional more stringent requirements, with NRC approval, though the normal rulemaking process.

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If the NRC maintains authority over uranium milling, Virginia agencies (i.e., VDH, DMME, DEQ) would be included in the EIS and application review process. The NRC would communicate routinely on notifications, inspection reviews, license reviews, amendments and renewals, and adverse incidents. VDH, DMME and DEQ would continue to maintain a role in emergency response with the NRC and VDEM.

## VI. COMMUNITY INVOLVEMENT

All regulatory actions will follow the public participation requirements of the APA. This includes: public comment at the Notice of Intended Regulatory Action stage; the establishment of a Regulatory Advisory Panel with stakeholders to help draft the regulation; and, public comment and hearing(s) on the proposed and final regulations. In addition, VDH and DEQ have citizen boards that hold the authority to adopt regulations and provide an additional opportunity for public comment. The public may sign up on the Virginia Regulatory Town Hall (<http://townhall.virginia.gov>) to be notified by email of regulatory actions, meetings, and public hearings. The public also may post comments regarding specific regulatory actions in public forums found on the Virginia Regulatory Town Hall.

Any statutory framework should include multiple opportunities for public input throughout the complete lifecycle of the mining and/or milling operation. Specific opportunities should be defined in the environmental assessment process, the permitting processes, ongoing environmental monitoring, significant permit modifications or renewals, enforcement actions, and termination of operations.

To ensure the transparency of environmental monitoring data, Virginia could require that any uranium mining and/or milling operation develop a data management system that allows the agencies and the public to have timely access to the environmental data collected by the facility. All environmental data collected by the agencies would be made available in a similar manner. A local community oversight committee to review and monitor environmental data could be established and supported by the state. In addition, any uranium mining and/or milling operation could be required to develop a Community Involvement Plan laying out an ongoing process for public involvement.

Robust community involvement would begin with rulemaking, include participation in the EIS and application review process and continuing through the decommissioning and license termination process. The community could participate in the licensing and pre-operational phases by attending meetings, providing comments and participating on advisory committees such as the Scientific Advisory Committee that was mentioned in the section of this report dealing with recreational use waters. The public should take an active role in the environmental review process, including participation in the scoping process and review of the draft EIS. Members of the community should also consider participating in public health studies to determine pre-operational baseline data, and continue their participation through the operational and post-operational phases. Their participation will assist health professionals in identifying the existence of possible long-term health effects associated with a uranium mining and uranium recovery facility.

The community could also participate in educational forums regarding radiation exposure control, radon attenuation and disease prevention. During the operation phase, community involvement typically includes meetings involving presentations and questions and answers regarding licensing amendments, renewals and inspections. These meetings generally

include presentations on procedures, environmental monitoring reports, personal exposure reports, radiation surveys and inspection findings.

## **VII. RESOURCES**

### **DMME**

If the moratorium is lifted, DMME anticipates utilizing existing staff such as geologists, hydrologists, ecologists, engineers and GIS specialists to review the initial mining permit. DMME staff is well versed in reviewing the various components necessary to obtain a mine permit. To ensure seamless communication during the review process, DMME would work closely with experts from VDH and DEQ and outside consultants as necessary.

If operations commenced, DMME would anticipate needing 5 FTEs in the areas of mine inspection, mine engineering, hydrogeology and other technical specialists. An initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$1,000,000 per year in personnel, administrative and equipment costs. These costs could eventually be covered through permit and license fees paid by the operator.

### **VDH**

If the moratorium is lifted, VDH would be impacted by a demand for increased services and regulatory activities particularly in communities and areas where uranium mining and milling activities occurred. Five offices and one division within VDH have been identified as organizational units that would be impacted by increased workloads and citizen expectations if uranium mining were to be conducted in Virginia. Those organizational units are:

- Division of Radiological Health (DRH);
- Office of Drinking Water (ODW);
- Office of Epidemiology (OEpi);
- Office of Environmental Health Services (OEHS);
- Office of Family Health Services (OFHS); and
- Office of Minority Health and Health Equity (OMHHE)

DRH is presently organized, staffed, and equipped to administer the radiation control activities for the Commonwealth for users of radioactive materials and other sources of ionizing radiation. If the moratorium on uranium mining is lifted, uranium mines are opened, and the milling of the ore is conducted, there would be an increase in workload for DRH even if the NRC remained the regulatory agency for the licensing and regulation of any uranium mills proposed within Virginia. A radon program, for instance, would need to be instituted to help educate workers and the public about the risks associated with radon exposure as well as on techniques to mitigate dose.

If the Commonwealth were to become an Agreement State for byproduct material, there would have to be a major increase in staffing and funding for DRH before the NRC would approve an Amended Agreement for the Commonwealth to be given the authority to license and inspect uranium mills. There would have to be additional legislation enacted, regulations promulgated, staff hired and trained, and equipment acquired in order to satisfy the requirements of the NRC. It is estimated that at least three years would be necessary to

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complete these processes and receive NRC approval for the Amended Agreement. A regulatory program for byproduct material and uranium mills must include professional expertise not commonly found in radiation control programs.

DRH has estimated that an additional 2.5 FTEs and \$145,000 annually would be necessary if the mining moratorium is lifted. If Virginia were to become an Agreement State for uranium, an estimated 8 DRH FTEs and \$ 1,000,000 would be required. These figures do not include provisions for additional administrative, business management, Human Resources or other positions needed for personnel support.

Similarly, other programs within VDH would experience a need for additional staffing and funding if the mining moratorium were to be lifted. These would result whether or not Virginia were to become an Agreement State for regulation of byproduct material and uranium mills. For example, ODW has estimated it would need an additional 0.5 FTE and about \$40,000 of additional annual funding. OEpi has estimated it would need an additional 4 FTEs and \$360,000 annual funding for epidemiologists, health educators, and data managers. If there was a desire to oversample BRFSS data for a local area, OEpi would need approximately 500 surveys per area sampled at an additional cost of about \$25,000 - \$30,000 for each area. OEHS has estimated it would need an additional 6 FTEs and \$1,858,848 annual funding for additional annual sampling and analyses of private water wells, assuming that VDH would bear the costs of sampling and analyses.

### DEQ

If the moratorium is lifted, DEQ would anticipate utilizing existing staff such as hydrologists, engineers and biologists to review and issue various environmental permitting, compliance and monitoring reviews. To ensure seamless communication during the review process, DEQ would work closely with experts from VDH and DMME and outside consultants as necessary.

If operations commenced, DEQ would anticipate needing 4 FTEs in the areas of environmental permitting, compliance and monitoring. An initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$800,000 per year in personnel, administrative and equipment costs. These costs could eventually be covered through permit and license fees paid by the operator.

*Appendix A*  
*Governor McDonnell's January 19<sup>th</sup> Directive*



## 2012 Uranium Working Group Report



### COMMONWEALTH of VIRGINIA

Office of the Governor

Robert F. McDonnell  
Governor

January 19, 2012

The Honorable James Cheng  
Secretary of Commerce and Trade  
Patrick Henry Building  
1111 E. Broad Street  
Richmond, VA 23219

The Honorable Doug Domenech  
Secretary of Natural Resources  
Patrick Henry Building  
1111 E. Broad Street  
Richmond, VA 23219

The Honorable Bill Hazel, M.D.  
Secretary of Health and Human Resources  
Patrick Henry Building  
1111 E. Broad Street  
Richmond, VA 23219

Re: Establishment of Uranium Working Group

Dear Secretaries Cheng, Domenech, and Hazel:

As you know, the General Assembly may take up various legislation regarding uranium mining in Virginia. I have asked them not to take any action this session to allow us time to further evaluate the law and science concerning the mining of uranium, so that the legislature can make well informed policy decisions in the future. Thus, I am writing, pursuant to the authority provided in Article V, Section 8 of the Constitution of Virginia, to direct that you establish a Uranium Working Group from the staff of the Department of Mines, Minerals and Energy (DMME), the Department of Environmental Quality (DEQ), and the Virginia Department of Health (VDH) to provide a scientific policy analysis to help the General Assembly assess whether the moratorium on uranium mining in the Commonwealth should be lifted, and if so, how best to do so. The recent National Academy of Sciences (NAS) report entitled, "Uranium Mining in Virginia – Scientific, Environmental, Human Health and Safety, and Regulatory Aspects of Uranium Mining and Processing in Virginia," and the Chmura "Economics and Analytics Socioeconomic Impact Study" report, identify important questions related to the health and safety of workers, the public, and the environment, as well as the possible impact of uranium mining on the socioeconomic vitality of the areas near potential mining sites. These issues must be addressed before an informed determination about whether uranium mining and milling should be conducted in the Commonwealth.

Patrick Henry Building • 1111 East Broad Street • Richmond, Virginia 23219  
(804) 786-2711 • TTY (804) 828-1120  
[www.governor.virginia.gov](http://www.governor.virginia.gov)

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The Honorable James Cheng  
The Honorable Doug Domenech  
The Honorable Bill Hazel, M.D.  
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Specifically, I would like the working group to accomplish the following tasks:

1. Establish a draft statutory and conceptual regulatory framework that could be used to govern all aspects of mining and milling uranium in Virginia using the complete life cycle analysis discussed in the NAS Report, and provide for regular and structured analyses of conditions and operation in a collaborative and highly structured management and regulatory system. In doing so please evaluate:
  - a. Requirements for meteorological and climatological data regarding the impact and frequency of natural catastrophic events at the most likely potential mining/mill site in Virginia
  - b. Monitoring of water and air quality by DEQ
  - c. Requirements for the operations and reclamation plans to be submitted with a mine permit application
  - d. Necessary health and safety standards for employees at the mine and mill sites
  - e. Standards for the safe disposal of mine waste
  - f. A framework for enforcement to ensure compliance with health, safety, and environmental standards.
  - g. Fee structure, or other funding options, to provide sufficient support for the requisite robust regulatory framework
  - h. Any other issues that may arise that would assist in establishing a comprehensive, statutory/regulatory framework
2. Assess whether the Virginia framework needs to be more stringent than existing federal regulations to reflect Virginia's population density, rainfall and temperate climate, water table levels, and unique geography.
3. Analyze the resources and expertise needed for VDH, DMME, and DEQ to implement and enforce the regulatory programs, as appropriate.
4. Establish the process by which all three agencies would adopt a unified emergency preparedness and response plan that would define their respective roles and identify the resources needed for implementation.

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5. Establish the parameters of an active epidemiological surveillance program for VDH to monitor the communities surrounding the most likely mining site, neighboring communities, and coordination with border states as necessary, concerning any short and long term health impacts.
6. Determine the measures necessary to proactively protect the public and worker health, including monitoring for both occupational and community-related impact, and how such measures would be implemented and reviewed.
7. Plan for the reinstatement of VDH's radon program, funding for which was eliminated as part of a 2009 budget reduction, so sufficient epidemiological studies can be conducted that assess community risk or control for background radon (and smoking), as prior studies were ecologically (not epidemiologically) focused.
8. Determine the standards for groundwater and surface water that might need to be implemented, and determine whether new monitoring programs need to be developed and implemented by DMME, DEQ, Department of Conservation and Recreation (DCR) and VDH.
9. Determine if additional resources are necessary to support new water monitoring programs and enforcement once the regulations are implemented.
10. Determine what additional statutory/regulatory authority might be needed to ensure water quality in private wells.
11. Determine in conference with the U.S. Nuclear Regulatory Commission (NRC) the standards necessary for the regulation of uranium milling operations pursuant to an amended agreement with the NRC and whether the Governor should send a letter of intent to the NRC seeking amendment.
12. Meet with governmental entities that currently regulate active uranium mining and/or milling operations and review their regulatory programs. Review pertinent information research and studies, the World Nuclear Association, International Atomic Energy, and International Radiation Protection Association, and any other expert source having information of value.
13. Define parameters for a full environmental impact analysis with input from the public for any proposed uranium mining and milling site.

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14. Establish a coordinated plan for conducting meaningful public outreach and input at all stages of the process in order to keep the public informed during permitting, construction, operation of the mine and mill, reclamation of the mine, and closure/decommissioning of the mine and mill.
15. Evaluate engineering designs and best management practices to prevent the release of radionuclides into ground and/or surface waters. Also, perform an on-site analysis with appropriate experts to ensure all necessary issues that may be unique to the Coles Hill site have been considered.
16. Ensure implementation of an “As Low As Reasonably Achievable” (ALARA) standard for the design and management of the mine, mill, and tailings containment into the statutory/regulatory framework.
17. Evaluate the World Bank Guidance on Financial Surety and develop a financial assurance program for uranium mining and milling to ensure appropriate closure and decommissioning, and determine the amount of surety or other assurance instruments (i.e., insurance emergency fund) necessary to guarantee that all needed monitoring, maintenance, emergency response and future design improvements can be made.
18. Extensively consider and seek public input regarding:
  - a. impacts on local and statewide economic development and measures that may be taken to prevent negative impacts, and capture potential opportunities for positive impact, and
  - b. the protection of existing businesses, industries, individuals and property that may be impacted by a potential uranium mine/mill site and a process for the assessment of impact and appropriate response.

In completing their work, the Uranium Working Group may ask the Chief of Staff to request assistance from any other executive branch agency, as well as supplemental funding for private sector expertise, to ensure all necessary resources are available for a thorough analysis. In order to ensure transparency and an opportunity for public review and input, I am instructing the working group to periodically present its findings and recommendations on the draft statutory framework and conceptual regulations at public meetings of the Uranium Subcommittee of the Coal and Energy Commission throughout the next year, and present their findings to the Coal

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and Energy Commission by December 1, 2012. Thank you for your prompt and thoughtful attention to this matter.

Sincerely,



Robert F. McDonnell

cc: The Honorable William J. Howell, Speaker of the House of Delegates  
The Honorable Thomas K. Norment, Senate Majority Leader  
The Honorable David J. Toscano, Member, Virginia House of Delegates  
The Honorable Richard L. Saslaw, Senate of Virginia  
The Honorable Martin L. Kent, Chief of Staff to Governor McDonnell  
Maureen Matsen, Sr. Advisor on Energy to Governor McDonnell  
Director Conrad Spangler, Department of Mines, Minerals and Energy  
Director David Paylor, Department of Environmental Quality  
Commissioner Karen Remley, MD, Department of Health

## Attachment 1 Index of the Governor's Directive Items

1. Establish a draft statutory and conceptual regulatory framework that could be used to govern all aspects of mining and milling uranium in Virginia using the complete life cycle analysis discussed in the NAS Report, and provide for regular and structured analyses of conditions and operation in a collaborative and highly structured management and regulatory system. In doing so please evaluate:
  - a. Requirements for meteorological and climatological data regarding the impact and frequency of natural catastrophic events at the most likely potential mining/mill site in Virginia:
    - *Site specific meteorological data (Probable Maximum Precipitation (PMP), Probable Maximum Flood (PMF), wind speed/direction, precipitation, evaporation, RH, temperature, extreme events) - **page 24.***
    - *These standards should ensure that facilities could withstand extreme climatological events. The regulatory program would also need to include specified design storm event criteria for engineering designs as a function of the design life. Designs of all significant structures should include evaluation of performance under a PMP event. All such facilities should be designed and constructed under the supervision of a licensed professional engineer, and should include stability and seismic stability analyses - **page 26.***
    - *If the moratorium is lifted, risk, hazard, and operations analyses should be a requirement of the operations and reclamation plans. The regulatory program should include requirements that all significant facilities be designed by licensed professionals of the appropriate discipline. The regulatory program should include requirements that the design of all significant structures include stability analysis and seismic protection analysis – **page 29.***
    - *Based on information filed by the applicant followed by extensive NRC evaluations including assessing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the NRC makes a determination regarding the issuance of the proposed license accompanied by any appropriate conditions to protect environmental values – **page 29.***
  - b. Monitoring of water and air quality by DEQ:
    - *Groundwater monitoring should be developed on the basis of predictive modeling done as part of the EIA review. Monitoring should extend beyond the predictive areas of disturbance, and should be coordinated with DEQ and VDH. A monitoring plan should be adopted that includes information on the criteria to be monitored, the frequency of monitoring, the methods of monitoring, and the protocols for the collection and transmittal of data – **page 44.***
    - *These requirements would also need to be coordinated with DEQ through the establishment of a groundwater management area that encompasses the proposed mine and/or mill site. Establishing such an area would establish the mine and/or mill operator's liability if private water supplies within the groundwater management area were impacted with respect to quantity or quality as the result of the operator's activities – **page 44.***
    - *DEQ would need to add uranium and radionuclides to its Trace Element Monitoring Program in order to establish what the natural background concentration of total and dissolved uranium is in the surface waters of the*

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*Commonwealth. Monitoring would be necessary at random freshwater free flowing sites sufficient to determine the distribution and occurrence of uranium on our rivers and streams – **page 45.***

- *DEQ operates an extensive Air Quality Monitoring Program which monitors for criteria pollutants such as ozone and particulate matter as well as hazardous air pollutants - **page 43.***
  - *If the moratorium is lifted, Virginia should require comprehensive ambient air monitoring on uranium mining and/or milling sites with monitoring equipment installed and operated by the operator. Virginia would need to evaluate the existing air-monitoring network to determine if existing sites are sufficient to provide an early warning of offsite impacts – **page 43.***
- c. Requirements for the operations and reclamation plans to be submitted -with a mine permit application
- *If the moratorium is lifted, statutory authority should be provided to require a complete operations plan as part of the mine permitting process. This plan would describe the method of mining to be employed (surface, underground, in situ leach (ISL), etc.), the equipment to be used, the required facilities and structures, and the location of those facilities and structures. It would also describe all water supply and dewatering systems, any ventilation or airborne pollutant control systems, and any other information, which would assist in evaluating the safety and environmental protections provided by the applicant – **page 25.***
  - *If the moratorium is lifted, any statute and regulations for mine permit application requirements should include operator provisions for a reclamation plan, which should contain a complete plan for the timing and sequencing of mining, and the steps taken to provide reclamation over the life of the mine– **page 27.***
- d. Necessary health and safety standards for employees at the mine and mill sites
- *The Federal Mine Safety and Health Administration (MSHA), an agency of the United States Department of Labor (DOL), administers the provisions of the Federal Mine Safety and Health Act of 1977. MSHA enforces occupational health and safety laws for all miners at coal and mineral mines as well as all mineral processing operations. If the moratorium were lifted and a uranium mine and/or milling operation were permitted and licensed in the Commonwealth, MSHA would be responsible for overseeing the safety and health of workers under 30 CFR Part 56 & 57 of the federal regulations. MSHA regulations provide exposure limits for radon, gamma radiation, silica, and diesel fumes - **page 15.***
  - *Virginia mine safety regulations also regulate radon exposure to underground miners. The plan would need to address worker exposure to radon and gamma radiation, and provide details of worker exposure monitoring and records of individual worker exposure. Standards for worker exposure would need to be established in conjunction with VDH. This plan should incorporate the concept of ALARA, an internationally accepted best practice, to provide additional reductions in worker exposure. This plan and exposure standards should be harmonized with the mill worker standards required by the NRC - **page 27.***
  - *Radon monitoring requirements for underground uranium mines that would need to be implemented if the moratorium is lifted are specified in 30 CFR 57.5037. The frequency of monitoring is dependent on the measured radon decay product concentrations. All mines would be required to measure radon concentration in exhaust mine air - **page 58.***



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- *A mill license must comply with 10CFR20.1101 to include provisions that are consistent with keeping radiation doses ALARA. For example, a specific license may include a license condition that would constrain worker doses to less than 600 mrem per year. Constraints are not dose limits but can be set such that exceeding the constraint would require the operator to conduct an investigation and report to the state with a plan for reducing the worker exposures - **page 60.***
  - *Worker monitoring requirements and exposure limits – **refer to pages 60 – 64.***
- e. Standards for the safe disposal of mine waste
- *If the moratorium is lifted, statutory authority should be provided to require a complete operations plan as part of the mine permitting process. This plan would describe the method of mining to be employed (surface, underground, in situ leach (ISL), etc.), the equipment to be used, the required facilities and structures, and the location of those facilities and structures – **page 25.***
  - *Performance standards would need to be established for non-mineralized waste rock disposal that include structural stability, seismic design stability, dust controls, and surface water diversion and control. Non-mineralized waste rock disposal sites should be designed and periodically reviewed during construction by a licensed professional engineer – **page 26.***
  - *If the moratorium is lifted, the operator(s) of a combined mine and mill site may propose storage of mill tailings in mined areas (either surface mine pits or underground mine workings). Disposal of tailings in mine workings would have the potential to improve the isolation of radionuclides and other toxic materials from the environment, but would also have the potential to impact groundwater. In either case, the affected workings would fall under the control of the NRC (or the VDH, if Agreement Status for milling were obtained), and would require coordination of the mining plans and the mine permit with the substantial requirements for tailings disposal of that agency – **page 26.***
- f. A framework for enforcement to ensure compliance with health, safety, and environmental standards. Key components in a statutory and regulatory framework include:
- Pages 64:**
- *Coordination of inspections and monitoring functions between all agencies having permitting and licensing authority;*
  - *Right of entry upon the site to make unannounced inspections of any activities, monitoring equipment, or any required records;*
  - *Authority to order immediate cessation of activities to prevent or eliminate an imminent danger to the health or safety to employees or the general public; or to prevent significant harm to land, air or water resources;*
  - *Authority to revoke or suspend the permit when a pattern of violation exists or the permittee fails to comply with orders of the division which could adversely affect the health or safety to mine employees or the general public; or to prevent significant harm to land, air or water resources;*
  - *Provisions for appeal of violations through the Administrative Process Act;*
  - *Public access to all inspection, monitoring, and violation records; and*
  - *Public notification and participation for all hearings resulting from enforcement actions taken against the operator.*
  - *Statutory and regulatory authority as well as additional resources would be needed to implement these recommendations.*



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- g. Fee structure, or other funding options, to provide sufficient support for the requisite robust regulatory framework

### **Page 36 - 37:**

- *DMME's present fee schedule does not fully allow for recovery of the cost to process and review permit applications. If the moratorium is lifted, any statutory framework for uranium mining permits should provide authority for DMME to recover all costs of initial permit review, permit modification, and permit renewal through fees attached to the permit application from the mine operator.*
- *Mill license applicants must pay the NRC the full cost of reviewing the application and environmental reports before a license is issued.*
- *The Radioactive Materials Program is self-supported by the licensing fees charged to applicants and annual license fees. Similar fees would need to be put in place for a uranium mill applicant and licensee.*
- *DEQ currently has fees to support its permit programs. For most of DEQ's programs the fees only cover a portion of the costs for the programs. To recoup all the costs of these programs for any potential uranium mine and/or mill, these fees would have to be increased for those permits.*

### **Pages 37 - 41:**

- *If the moratorium is lifted, a strong financial assurance program would be critical to any statutory and regulatory framework created for the mining of uranium in order to protect the public from financial obligations for actions or inactions resulting from the operation. Such a program would need to take into consideration the complete life cycle of the mining from exploration through reclamation and decommissioning of the mine...*
  - *NRC regulations for the milling operation exist under 10 CFR Part 40, Appendix A, Criterion 9 and 10. These regulations require that financial surety arrangements be established by each mill operator prior to the commencement of operations.*
- h. Any other issues that may arise that would assist in establishing a comprehensive, statutory/regulatory framework:
- *If the moratorium is lifted, DEQ would be responsible for permitting any process wastewater and storm water discharges to state waters from a mine or mill. Process wastewater includes both mine dewatering and any discharge associated with processing from a mill. A proposed milling and mining site should have a comprehensive water management program covered under a VPDES permit. All excess water from any potential mine dewatering, tailings management and any storm water that would come in contact with waste rock storage and a mill licensed area would need to be stored and released only if it meets both:*
    - *Any special standard water quality criteria established through the work of an appointed Scientific Advisory Committee that would provide public water supply protection of surface waters downstream from any potential uranium mining and milling operation, and*
    - *Virginia new source technology limits for process wastewater – **page 34.***
  - *If the moratorium is lifted, SWCB should establish a groundwater management area in the area of a proposed uranium mining and milling operation. This would offer protection for public and private wells near a mine from the impacts of mine dewatering. The management and monitoring of groundwater quality and quantity at a proposed uranium mine and mill would need to be specified in the mining permit by DMME and the milling license by either the NRC or Virginia under an agreement with the NRC - **page 35.***

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- *The VWP permit program administered by DEQ was developed for wetlands and stream protection, and it requires a permit for new surface water withdrawals greater than 300,000 gallons of water per month. If the moratorium is lifted, any mining and/or milling operation in Virginia would have some stream impacts and would require a permit - **page 36.***
2. Assess whether the Virginia framework needs to be more stringent than existing federal regulations to reflect Virginia's population density, rainfall and temperate climate, water table levels, and unique geography.
    - *Groundwater and surface water quality standards criteria for radioactivity are addressed in item 8 of the Governor's Directive.*
    - *Virginia's source technology limits for mining and milling process wastewater and ground water protection dewatering and quality are addressed in item 1.h of the Governor's Directive.*
    - *Private water supply requirements are addressed in item 10 of the Governor's Directive.*
    - *Human Health Surveillance is addressed in items 5 and 6 of the Governor's Directive.*
    - *The maximum allowable annual radon decay product exposure to an underground miner under MSHA regulations is 4.0 working level months (WLM). NIOSH issued a recommendation, based on the results of epidemiologic studies of lung cancer in miners that the exposure limit should be set at 1.0 WLM per year- **page 58.***
  3. Analyze the resources and expertise needed for VDH, DMME, and DEQ to implement and enforce the regulatory programs, as appropriate.
    - *If operations commenced, DMME would anticipate needing 5 FTEs in the areas of mine inspection, mine engineering, hydrogeology and other technical specialists. An initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$1,000,000 per year in personnel, administrative and equipment costs. These costs could eventually be covered through permit and license fees paid by the operator – **page 73.***
    - *VDH DRH has estimated that an additional 2.5 FTEs and \$145,000 annually would be necessary if the mining moratorium is lifted. If Virginia were to become an Agreement State for uranium, an estimated 8 DRH FTEs and \$ 145, 000 would be required. These figures do not include provisions for additional administrative, business management, Human Resources or other positions needed for personnel support – **page 74.***
    - *Other programs within VDH would experience a need for additional staffing and funding if the mining moratorium were to be lifted. These would result whether or not Virginia were to become an Agreement State for regulation of byproduct material and uranium mills. For example, ODW has estimated it would need an additional 0.5 FTE and about \$40,000 of additional annual funding. OEpi has estimated it would need an additional 4 FTEs and \$360,000 annual funding for epidemiologists, health educators, and data managers. If there was a desire to oversample BRFSS data for a local area. OEpi would need approximately 500 surveys per area sampled at an additional cost of about \$25,000 - \$30,000 for each area. OEHS has estimated it would need an additional 6 FTEs and \$1,858,848 annual funding for additional annual sampling and analyses of private water wells – **pages 74.***
    - *If operations commenced, DEQ would anticipate needing 4 FTEs in the areas of environmental permitting, compliance and monitoring. An initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$800,000 per year in personnel, administrative and equipment costs.*

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*These costs could eventually be covered through permit and license fees paid by the operator – **page 74.***

4. Establish the process by which all three agencies would adopt a unified emergency preparedness and response plan that would define their respective roles and identify the resources needed for implementation.
  - *In Virginia, the foundation for a unified emergency preparedness and response plan is the Commonwealth of Virginia Emergency Operations Plan (COVEOP) and its various Hazard-Specific and Support Annexes. VDEM is the lead coordinating agency for the state's response to large-scale emergencies, radiologic or otherwise. VDH, the state radiation control agency pursuant to Section 32.1-229 of the Code, is responsible, in part, for developing programs to adequately respond to radiation emergencies and coordinating such programs with VDEM. VDH collaborates with VDEM on emergency plans, preparedness, training, exercises and response tactics for large-scale events involving radiological/nuclear material, and responds to licensee-related or other small radiological material incidents that can be managed by VDH staff trained in accident mitigation and emergency response. Similarly, DMME is responsible for the oversight of incident response at a mining facility. If uranium mining were allowed in Virginia, DMME would serve as subject matter experts and utilize its existing emergency response protocols for incidents involving a uranium mine. Additional support, if needed for a large-scale emergency, would be coordinated by VDEM in their role as the Commonwealth's lead coordinating agency for emergency response – **pages 31 - 33.***
5. Establish the parameters of an active epidemiological surveillance program for VDH to monitor the communities surrounding the most likely mining site, neighboring communities, and coordination with border states as necessary, concerning any short and long term health impacts.
  - Specific data not currently addressed in statutes or regulation would be needed in order for VDH to conduct epidemiological surveillance and analyses of uranium mining and recovery impacts on human health. Currently, VDH has sufficient authority to evaluate public health impacts in the Commonwealth. However, VDH may need additional authority to collect data necessary to monitor human health impacts that may be associated with uranium mining and milling. A discussion of potential health effects, potential pathways of public exposure, constituents of concern, pathway and affected organs, population-based human health surveillance and monitoring are contained in **pages 47 - 58.**
6. Determine the measures necessary to proactively protect the public and worker health, including monitoring for both occupational and community-related impact, and how such measures would be implemented and reviewed.
  - If the moratorium is lifted, the reduction of human risks would be accomplished through the characterization of potential contaminant sources, and the ability of engineering designs to contain potential sources that might result in physical and/or environmental damage. A discussion of the human health hazards, surveillance mechanisms and measures needed to monitor and proactively protect public and worker health is contained in **pages 47 - 64.**
7. Plan for the reinstatement of VDH's radon program, funding for which was eliminated as part of a 2009 budget reduction, so sufficient epidemiological studies can be conducted that

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assess community risk or control for background radon (and smoking), as prior studies were ecologically (not epidemiologically) focused.

- *The Environmental Protection Agency (EPA) is the lead agency regulating radon. The EPA is authorized under the 1988 Indoor Radon Abatement Act (IRAA) to establish a long-term goal that indoor air be as free from radon as the ambient air outside buildings. The law authorized funds for radon-related activities at the state and federal levels. Currently, Virginia does not participate in this program - **page 15.***
  - *VDH DRH has estimated that it would need approximately 1.5 full time employees (FTEs) and \$100,000 per year to re-institute a radon program - **page 71.***
8. Determine the standards for groundwater and surface water that might need to be implemented, and determine whether new monitoring programs need to be developed and implemented by DMME, DEQ, Department of Conservation and Recreation (DCR) and VDH.
- *If the moratorium is lifted and prior to any application for a uranium mining permit, DEQ would need to conduct a thorough regulatory review of its water quality standards to ensure they would be adequate to address potential impacts associated with uranium mining and/or milling activities. Virginia should establish a Scientific Advisory Committee to review and make recommendations on the groundwater and surface water quality standards criteria for radioactivity. In addition, if the Scientific Advisory Committee is established, the committee should recommend a special standard that would establish public water supply criteria for surface waters downstream of any uranium mining and milling operation – **pages 17 - 18.***
  - *The use of groundwater modeling is an accepted best practice. If the moratorium is lifted and uranium mining and/or milling is proposed, an effective model would consider such impacts as mine dewatering, groundwater quality and quantity. Groundwater monitoring requirements would need to be consistent with respect to the mine and/or mill and should be coordinated by DMME, DEQ and VDH. If a program is put in place, groundwater monitoring should be developed on the basis of predictive modeling done as part of the EIA review. Monitoring should extend beyond the predictive areas of disturbance, and should be coordinated with DEQ and VDH. A monitoring plan should be adopted that includes information on the criteria to be monitored, the frequency of monitoring, the methods of monitoring, and the protocols for the collection and transmittal of data – **page 44.***
  - *If the moratorium is lifted, implementation of the SDWA and the Radionuclide Rule of the Virginia Waterworks Regulations would allow VDH's ODW to provide adequate protection to the general public with regard to radionuclides within public drinking water supplies - **page 43 - 44.***
  - *These requirements would also need to be coordinated with DEQ through the establishment of a groundwater management area that encompasses the proposed mine and/or mill site. Establishing such an area would establish the mine and/or mill operator's liability if private water supplies within the groundwater management area were impacted with respect to quantity or quality as the result of the operator's activities. Further, operators could be required to submit mitigation or corrective action plans to establish how impacted private water supplies would be replaced – **page 44.***
  - *VDH programs are addressed below in item 10 of the Governor's Directive.*
9. Determine if additional resources are necessary to support new water monitoring programs and enforcement once the regulations are implemented.

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- *If operations commenced, DMME would anticipate needing 5 FTEs in the areas of mine inspection, mine engineering, hydrogeology and other technical specialists. An initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$1,000,000 per year in personnel, administrative and equipment costs. These costs could eventually be covered through permit and license fees paid by the operator.*
- *ODW has estimated it would need an additional 0.5 FTE and about \$40,000 of additional annual funding. OEHS has estimated it would need an additional 6 FTEs and \$1,858,848 annual funding for additional annual sampling and analyses of private water.*
- *If operations commenced, DEQ would anticipate needing 4 FTEs in the areas of environmental permitting, compliance and monitoring. An initial funds source would need to be determined. It is estimated that these positions combined would cost approximately \$800,000 per year in personnel, administrative and equipment costs. These costs could eventually be covered through permit and license fees paid by the operator.*

### **Pages 73 - 74.**

10. Determine what additional statutory regulatory authority might be needed to ensure water quality in private wells.
  - *If the moratorium is lifted, VDH should establish water quality standards for private water supplies within the area defined to be at risk through groundwater modeling developed during the baseline sampling period. This should be coordinated with any action by DEQ to establish a Scientific Advisory Committee to review and make recommendations on the groundwater criteria. Statutory and regulatory authority and additional resources would be needed to implement these recommendations - **page 46.***
  - *Additionally, if the moratorium is lifted, VDH should require that any private water supply, within the area defined to be at risk through groundwater modeling developed during the baseline sampling period, that is found to be unsuitable for use, either through contamination or lack of production, to be properly and permanently abandoned, in order to eliminate potential pathways for groundwater contamination. Statutory and regulatory authority and additional resources would be needed to implement these recommendations - **page 46.***
  - *VDH would also need to perform a case-by-case evaluation of the risks to specific cisterns resulting from a significant accidental release, with potential mitigation by the facility operator - **page 46.***
  - *If the moratorium is lifted, VDH should establish water quality standards for swimmable surface water. Such standards would need to protect public health with an adequate margin of safety. This process should be coordinated with DEQs proposal to establish a Scientific Advisory Committee to review and make recommendations on the groundwater and surface water criteria for radioactivity. VDH would need the authority to establish water monitoring requirements for all water quality standards at summer camps and campgrounds. If the moratorium, VDH should update its list of diseases pursuant to Section 32.1-35 to include diseases related to exposure to radionuclides as diseases that require reporting – **page 46 - 47.***
  - *In addition, Section 35.1-10 of the Code would need to be amended to explicitly authorize the Commissioner to prevent access to waters at summer camps and campgrounds and beaches when levels exceed the developed water quality standards for swimmable surface water – **page 46 - 47.***

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11. Determine in conference with the U.S. Nuclear Regulatory Commission (NRC) the standards necessary for the regulation of uranium milling operations pursuant to an amended agreement with the NRC and whether the Governor should send a letter of intent to the NRC seeking amendment.
  - *If Virginia amended its Agreement and took over regulation of uranium milling activity, all radioactive material license applications for uranium milling would be submitted to DRH, which would administer all aspects of the licensing and regulation of uranium milling, siting, design, construction, operation and reclamation uranium milling in the Commonwealth. DRH would consult with the DMME and DEQ for specific expertise regarding selected aspects of license applications. DRH would adopt and implement NRC regulations either by reference or through specific rulemaking – page 71.*
  - *If the NRC maintains authority over uranium milling, Virginia agencies (i.e., VDH, DMME, DEQ) would be included in the EIS and application review process. The NRC would communicate routinely on notifications, inspection reviews, license reviews, amendments and renewals, and adverse incidents. VDH, DMME and DEQ would continue to maintain a role in emergency response with the NRC and VDEM - page 72.*
  
12. Meet with governmental entities that currently regulate active uranium mining and/or milling operations and review their regulatory programs. Review pertinent information research and studies, the World Nuclear Association, International Atomic Energy, and International Radiation Protection Association, and any other expert source having information of value.
  - *UWG reviewed numerous reports to identify potential issues and risks that may be associated with uranium mining and milling.*
  - *The Wright Environmental Services (WES) Reports were reviewed and discussed in great detail by the UWG, provided the background information and the knowledge to develop the recommendations in this report. The WES Final Report includes a table with approximately 140 specific recommendations or “PFCs” that Virginia should consider when developing regulations.*
  - *The UWG held several public meetings to provide information, to answer questions from the public and to take public comment.*
  - *VDH recognized that the moratorium would be of interest to stakeholders across the Commonwealth. Accordingly, VDH conducted four public meetings (Chatham, Warrenton, Virginia Beach and a final wrap-up session in Chatham) and three facilitated discussions to promote participation from a diverse group of stakeholders and to ensure regional concerns were captured.*
  - *Members of the UWG met weekly in person or via conference call from January 19 to November 30. These meetings were supported by agency staff who researched, reviewed and drafted reports.*

### **Pages 3-8**

13. Define parameters for a full environmental impact analysis with input from the public for any proposed uranium mining and milling site.
  - *If the moratorium is lifted and the NRC Agreement is not amended, the NRC would have primacy over the NEPA process for both the mine and mill and would apply its existing regulations. The various state agencies described in this report would become cooperating agencies with the NRC, be allowed to review the applicant’s environmental report and provide comments to the NRC. Any statutory framework that results from lifting the moratorium should include the ability to adopt any appropriate NRC NEPA*

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*decision documents (e.g., EIS), provided that the analyses and documents meet the Commonwealth's program requirements. If, NRC Agreement is amended, the state EIS process would be fully regulated by the Commonwealth following the federal NEPA model - **page 23.***

- *Regardless of the decision to amend the Agreement, any regulatory framework for uranium mining in Virginia should anticipate the possibility of future mining that is not associated with a uranium mill licensing application. The EIA process would need to be included as a requirement of all standalone uranium mine permit applications, as well as significant amendments to existing uranium mine permits, and should closely follow the NRC NEPA model with DMME as the lead regulatory authority - **page 23.***
  - *Any statutory framework for uranium mining should include multiple opportunities for public input throughout the complete lifecycle of the operation. Specific opportunities should be defined in the environmental assessment process, the mine permitting process, ongoing environmental monitoring, significant permit modifications or renewals, enforcement actions, and bond release of areas disturbed by mining - **pages 25.***
  - ***Pages 21 – 25** provide further discussion on opportunities for public input with regard to mine permitting and the EIS.*
14. Establish a coordinated plan for conducting meaningful public outreach and input at all stages of the process in order to keep the public informed during permitting, construction, operation of the mine and mill, reclamation of the mine, and closure/decommissioning of the mine and mill.
- *Any statutory framework for uranium mining should include multiple opportunities for public input throughout the complete lifecycle of the operation. Specific opportunities should be defined in the environmental assessment process, the mine permitting process, ongoing environmental monitoring, significant permit modifications or renewals, enforcement actions, and bond release of areas disturbed by mining - **pages 25.***
  - *Any program established upon the moratorium being lifted should maintain transparency, provide for public participation, and assure the public of full compliance of the uranium mining operation by making all monitoring and inspection reports, investigation reports, violations and enforcement actions readily available to the public. Public participation should also be available for actions taken by DMME in any hearings pertaining to imminent danger cessation orders, pattern of violation show cause orders, or formal hearing involving issuance of notices of violation, which come under the Administrative Process Act– **page 67.***
  - *Any uranium mining and/or milling operation could be required to develop a Community Involvement Plan laying out an ongoing process for public involvement – **page 72.***
15. Evaluate engineering designs and best management practices to prevent the release of radionuclides into ground and/or surface waters. Also, perform an onsite analysis with appropriate experts to ensure all necessary issues that may be unique to the Coles Hill site have been considered.
- *If the moratorium is lifted, statutory authority should be provided to require a complete operations plan as part of the mine permitting process. This plan would describe the method of mining to be employed (surface, underground, in situ leach (ISL), etc.), the equipment to be used, the required facilities and structures, and the location of those facilities and structures. It would also describe all water supply and dewatering systems, any ventilation or airborne pollutant control systems, and any*

## 2012 Uranium Working Group Report

*other information, which would assist in evaluating the safety and environmental protections provided by the applicant. The operations plan would need to:*

- *Address the probable hydrologic consequences of the proposed mining activities on both the quantity and quality of surface water and groundwater, including storm events and mine dewatering.*
  - *Include information to obtain and comply with required DEQ permits for water discharge (VPDES), a groundwater withdrawal permit under the Groundwater Management Act (GWMA), and air quality.*
  - *Provide a groundwater protection plan to control and monitor the effects of mining operations on groundwater. The operations plan should also identify alternative sources of water which would be available for replacement or mitigation of impacts on existing sources - **pages 25 - 26.***
  - *DMME conducted an information gathering visit to the VUI office in Chatham and the Coles Hill site on May 16-17; examined and sampled Marline and VUI core; visited rock outcrops, meteorological stations, surface water sample locations on Whitethorn, Mill, and Georges Creek, examined confluence at Bannister River; visited possible mill and tailings site locations; discussed geology, mine and mill plans. Rock core samples from the Coles Hill site were submitted for geochemical analysis to Activation Laboratories Ltd, located in Ancaster, Ontario... – **page 9.***
16. Ensure implementation of an "As Low As Reasonably Achievable" (ALARA) standard for the design and management of the mine, mill, and tailings containment into the statutory/regulatory framework.
- *Designs should include the "As Low As Reasonably Achievable" (ALARA) concept to minimize radiological exposure to mine workers and the environment. They should also include surface water and groundwater protection plans and periodic monitoring requirements for both surface water and groundwater. The sites should be designed by a licensed professional engineer. Periodic inspection and certification of construction in accordance with the design by a licensed professional engineer should be required - **page 26.***
  - *Surveys for uranium ore dust are conducted in ore handling areas of a mill to demonstrate compliance with the occupational dose limits, meet the "airborne radioactivity area" posting requirements, determine what precautions are needed to meet the limits, and to determine whether airborne concentrations of radiation materials are being kept ALARA – **page 59.***
  - *A mill license must include provisions that are consistent with keeping radiation doses "As Low As Reasonably Achievable" (ALARA) – **page 60.***
17. Evaluate the World Bank Guidance on financial Surety and develop a financial assurance program for uranium mining and milling to ensure appropriate closure and decommissioning, and determine the amount of surety or other assurance instruments (i.e., insurance emergency fund) necessary to guarantee that all needed monitoring, maintenance, emergency response and future design improvements can be made.
- *If the moratorium is lifted, a strong financial assurance program would be critical to any statutory and regulatory framework created for the mining of uranium in order to protect the public from financial obligations for actions or inactions resulting from the operation. Such a program would need to take into consideration the complete life cycle of the mining from exploration through reclamation and decommissioning of the mine. Key components of a financial assurance statute would require 1) a performance or reclamation bond based on third party performance of required reclamation work; 2) liability insurance sufficient to provide coverage for personal and economic injury*



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*as well as property and natural resource damage protection; 3) a uranium response fund which would be readily accessible to the Commonwealth to respond to the release or threatened release of any pollutant or contaminant into the environment from the mining operation; and 4) a long-term environmental monitoring fund or trust which would assure financial resources for monitoring surface water and groundwater and air quality during and after reclamation and decommissioning of the mine. Each of these components should be funded by the operator and established prior to the commencement of operations - **page 37.***

- *NRC regulations for the milling operation exist under 10 CFR Part 40, Appendix A, Criterion 9 and 10. These regulations require that financial surety arrangements be established by each mill operator prior to the commencement of operations - **page 40.***

18. Extensively consider and seek public input regarding:

- a. Impacts on local and statewide economic development and measures that may be taken to prevent negative impacts, and capture potential opportunities for positive impact, and*
  - b. The protection of existing businesses, industries, individuals and property that may be impacted by a potential uranium mine/mill site and a process for the assessment of impact and appropriate response.*
- *Any statutory framework for uranium mining should include multiple opportunities for public input throughout the complete lifecycle of the operation. Specific opportunities should be defined in the environmental assessment process, the mine permitting process, ongoing environmental monitoring, significant permit modifications or renewals, enforcement actions, and bond release of areas disturbed by mining - **pages 25.***

***Additional information on Item 18*** will be forthcoming upon the completion of the ORI Results, Inc. Economic Impact Study.

## Attachment 2 Delegate Ware Letter Dated January 18, 2012



R. LEE WARE, JR.  
POST OFFICE BOX 889  
POWHATAN, VIRGINIA 23139  
  
SIXTY-FIFTH DISTRICT

COMMONWEALTH OF VIRGINIA  
HOUSE OF DELEGATES  
RICHMOND

January 18, 2012

COMMITTEE ASSIGNMENTS:  
COMMERCE AND LABOR (VICE CHAIRMAN)  
FINANCE  
AGRICULTURE, CHESAPEAKE AND  
NATURAL RESOURCES  
RULES

His Excellency, Robert F. McDonnell  
Governor of Virginia  
1111 East Broad Street  
Richmond, Virginia 23219

Dear Governor McDonnell:

As well you know, the presence of a large and potentially valuable deposit of uranium ore at Coles Hill in Pittsylvania County has raised supremely important policy questions for decision by the General Assembly and Governor.

To assist in the consideration of this matter, the Virginia Coal and Energy Commission, through its Uranium Mining Subcommittee, has secured two authoritative studies. The National Academy of Sciences (NAS) examined environmental, health and safety matters, while Chmura and Associates evaluated the socio-economic consequences, particular to Pittsylvania County and the surrounding area. Taken together, these studies identified the economic benefits of uranium ore extraction and sale, the attendant risks to public and environmental health and safety, and the "best practices" that are used to mitigate those risks by uranium-extraction companies around the world.

Although the permitting of a uranium mining and milling facility at Coles Hill would be subject to lengthy state and federal regulatory processes, some interested parties have suggested that the Commonwealth should take another year to study these recently completed reports before taking any action with respect to uranium mining. Other interested parties maintain that such a delay is unwarranted because uranium is mined safely around the world, including in similar climates and elsewhere, and the NAS report provides an eminently reliable analysis by which the Commonwealth could, if deemed of sufficient public importance, develop mining regulations based on international best practices.

While some of us may incline more toward one or the other of these two competing viewpoints, we believe there is a third viable option, namely, a responsible approach that is consistent with Virginia's reputation for deliberate governance. This approach would enable members of the General Assembly to know what a Virginia uranium mining regulatory program would look like, that is, what best practices and other safeguards it would incorporate and mandate, before legislators are called upon to vote on whether to remove or retain the current moratorium on uranium mining in the Commonwealth.

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January 18, 2012  
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The executive agencies responsible for developing and implementing a uranium mining regulatory program—primarily the Department of Mines, Minerals, and Energy, in consultation with the Departments of Environmental Quality and Health—already possess the authority to prepare draft uranium mining regulations that would inform the General Assembly as to what such a Virginia regulatory program would appropriately include. By deferring legislative consideration of the moratorium issue until the 2013 General Assembly session, those agencies would have the opportunity to engage the necessary technical assistance, to provide opportunities for public review and comment consistent with the Administrative Process Act, and also to develop a proposed regulatory structure and process that incorporates the safeguards and international best practices identified by the National Academy of Sciences and other reputable institutions. Accordingly, the policy question of whether to lift the moratorium would be assigned to the General Assembly Session of 2013.

While we do not prejudge the agencies' substantive work, we do suggest that the draft regulations and any ensuing adjustment to the statutory moratorium relate specifically to the uranium deposit at Coles Hill, which has already been the subject of extensive exploratory drilling and is the only known economically viable uranium deposit in the Commonwealth, according to the NAS. If the day comes when comparable exploration and study yields evidence of another economically viable uranium deposit, then the General Assembly and Governor in office at that time could consider what, if any, legislative relief from the moratorium is warranted.

Finally, we respectfully call to your attention the fact that the proponents of uranium mining have proposed enactment of a severance tax or like provision, so that some of the revenues from uranium ore extraction and sale would be shared with the surrounding community. This aspect of the matter should, we believe, also be addressed before the 2013 Session.

We believe that this recommended course of action neither rushes to judgment nor delays the inevitably controversial subject merely for the sake of delay. It provides for an orderly two-step process in which the responsible technical individuals and agencies could execute their vital work, aided appropriately by public comment, and then—and only then—could the General Assembly make a well-informed decision, next year, on the important policy issues that are raised by the presence of a valuable uranium deposit in Virginia.

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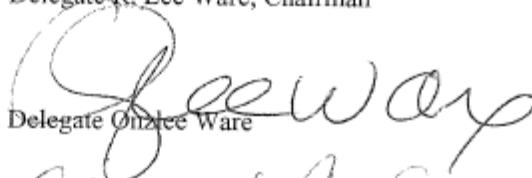
Accordingly, we respectfully request that you employ the authority of your office to initiate the aforementioned processes.

Thank you for your consideration.

Sincerely,



Delegate R. Lee Ware, Chairman



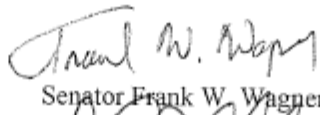
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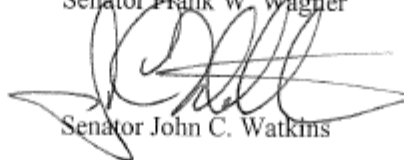
Senator Charles W. Carrico



Senator Phillip P. Puckett



Senator Frank W. Wagner



Senator John C. Watkins



Delegate Terry Kilgore, ex officio

***Appendix B***

***WES PFCs***

**Please click link below:**



Exhibit\_B\_Final\_Report\_PFCs\_VDEQ\_VDH

***Appendix C***  
***UWG Bibliography***

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**Exhibit A Governor Robert F. McDonnell's Letter of January 19, 2012**

**Exhibit B Compilation of Points for Consideration**

**Exhibit C DEQ/DMME Uranium Study: Initial Report**

**Exhibit D DEQ/DMME Uranium Study: Surface water and Groundwater  
Monitoring Plans and Standards Adequacy Assessment**

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**Exhibit E DEQ/DMME Uranium Study: Air Quality Monitoring Plan**

**Exhibit F DEQ/DMME Uranium Study: Safe Disposal of Mine and Mill Wastes**

**Exhibit G DEQ/DMME Uranium Study: Engineering Design Best Management Practices**

**Exhibit H DEQ/DMME Uranium Study: Full Components of Environmental Impact Analyses**

**Exhibit I DEQ/DMME Uranium Study: Assessment of Financial Assurance Mechanisms**

**Exhibit J VDH Uranium Study: Initial Report**

**Exhibit K VDH Uranium Study: Interim Report # 1**

**Exhibit L VDH Uranium Study: Interim Report # 2**

**Exhibit M Facilitator's Report: Final Report of Public Meetings Regarding Impacts to Private Water Wells , Public Water Supplies and Recreational Waters by Uranium Mining and Milling**