Uranium Working Group Public Meeting #2

Environmental Impact Analysis
Mine Permitting
Engineering Designs and Best Management Practices
Management of Mine Waste
Environmental Monitoring of Mine Sites
Compliance and Enforcement
Mine Site Reclamation

Chatham, Virginia
June 18, 2012

Virginia Department of Mines Minerals and Energy

DMME and Mining in Virginia

Unique Challenges of Uranium Mining

Why a Uranium Mining Statute is Needed

Draft Uranium Mining Regulatory Framework

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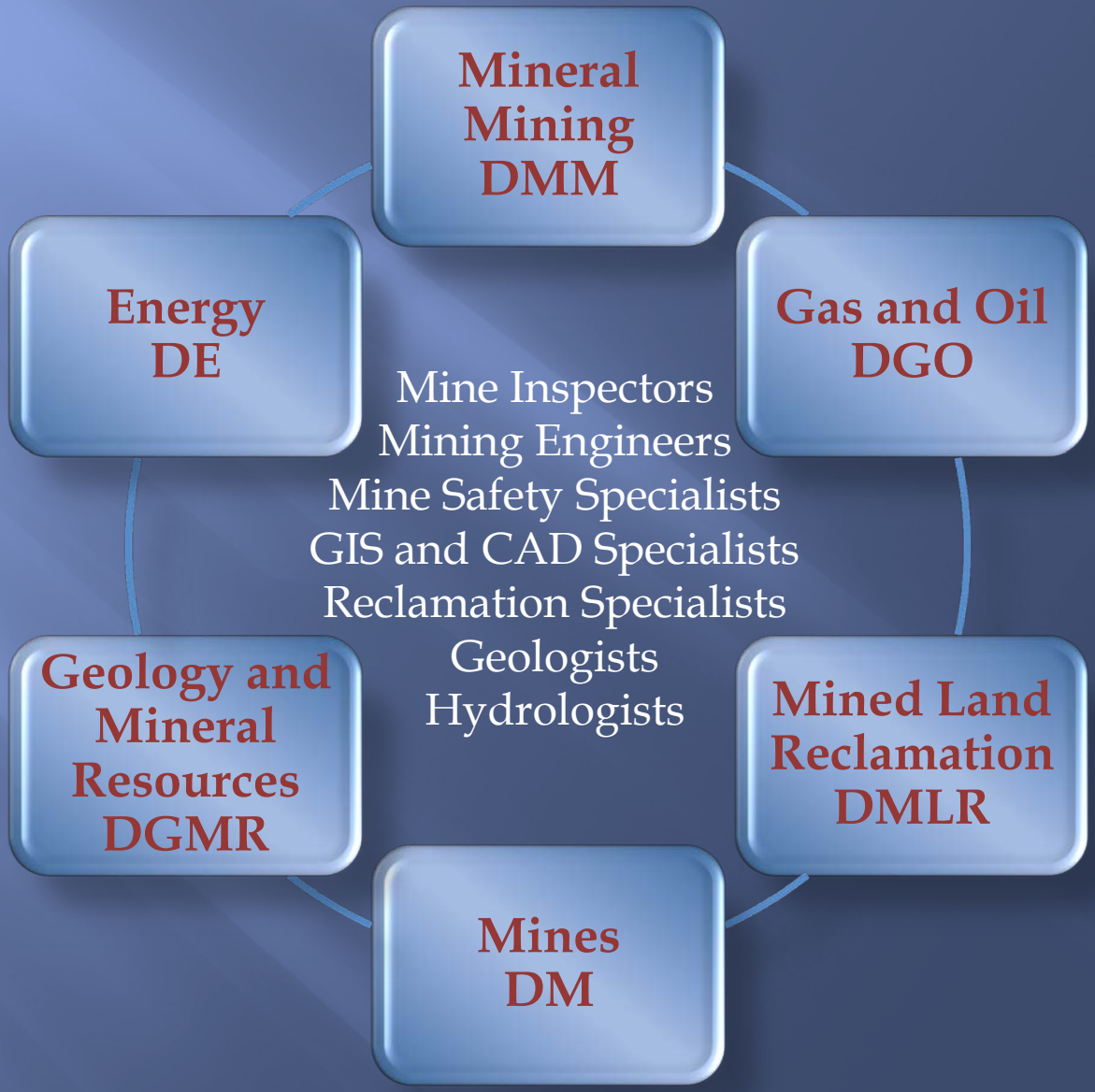
Department of Mines, Minerals & Energy



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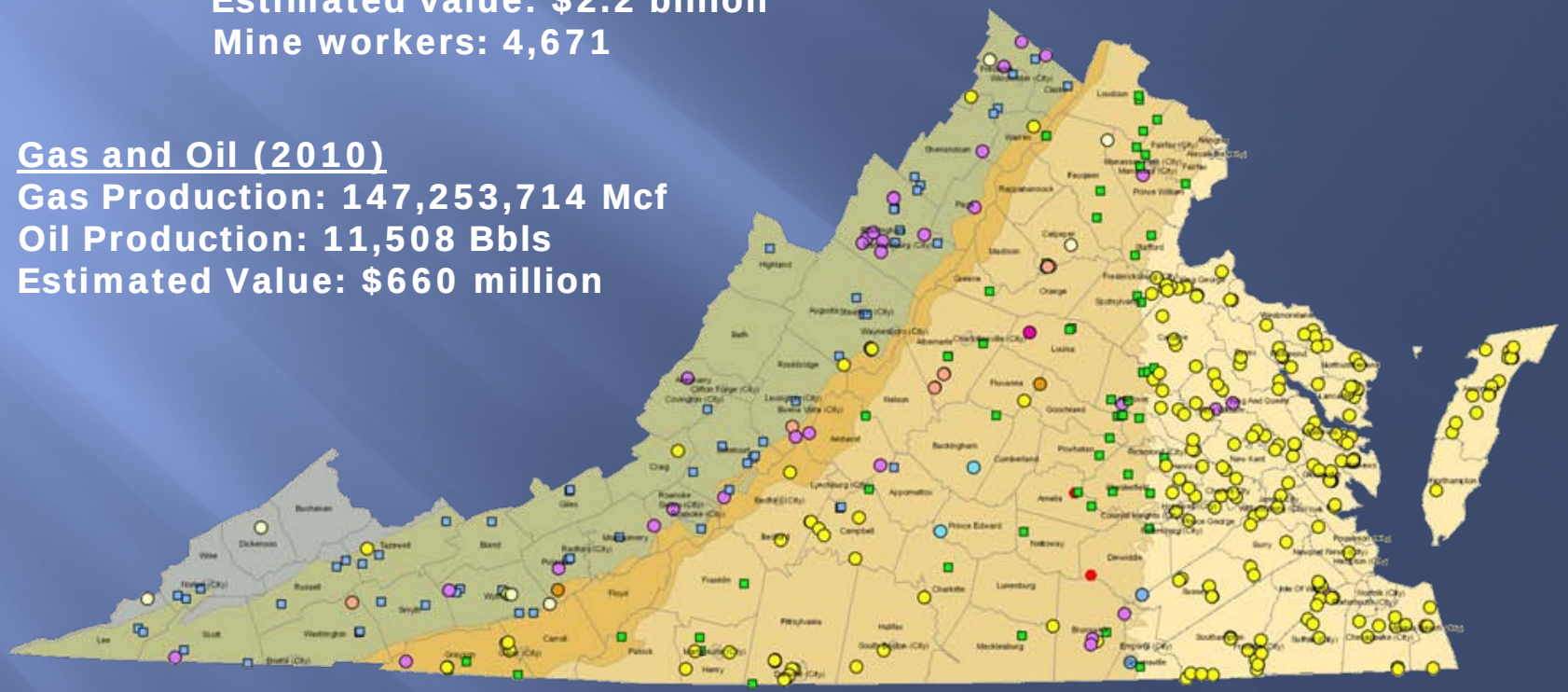
Minerals & Energy Production

Coal (2010)
Production: 22.2 million tons
Estimated value: $2.2 billion
Mine workers: 4,671

Gas and Oil (2010)
Gas Production: 147,253,714 Mcf
Oil Production: 11,508 Bbls
Estimated Value: $660 million



Mineral Mines (2010)
Production: 60.6 million tons
Estimated value: $952 million
Mine workers: 3,030

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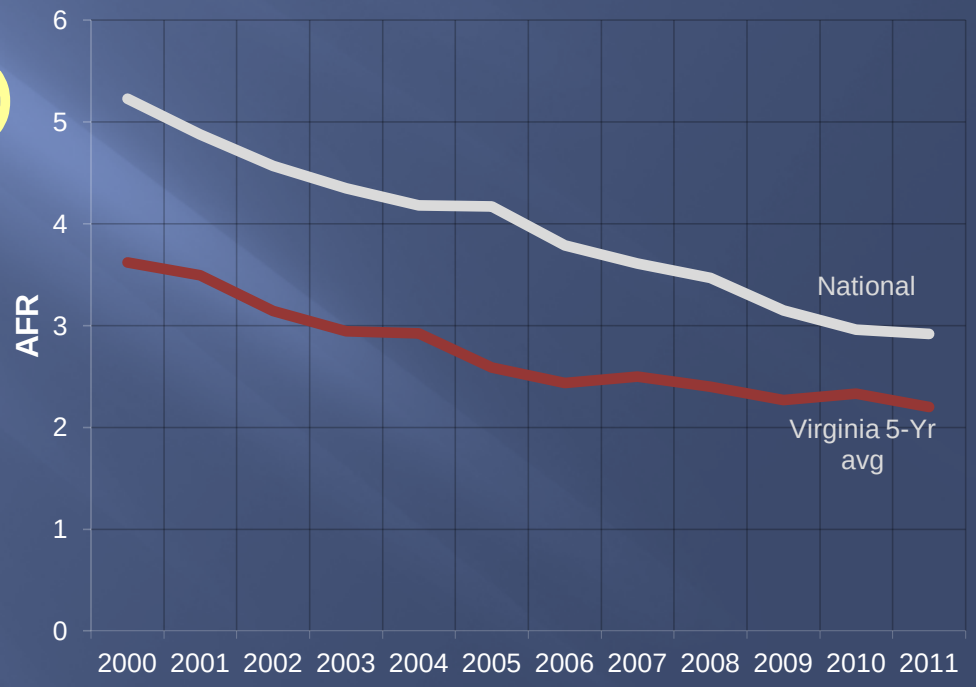
Mineral Mines in Virginia

DMM safety programs have helped keep Virginia's Accident Frequency Rate (AFR) below the national incident rate



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Mineral Mines in Virginia

Reclaimed mines have received national recognition

Virginia Vermiculite LLC, Louisa County
2012 IMCC National Reclamation Award

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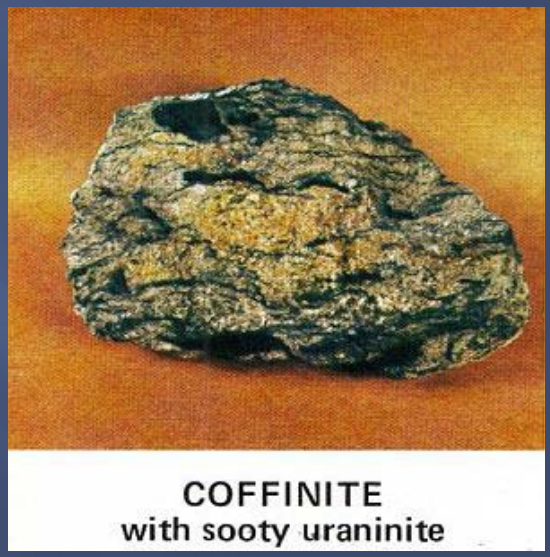
Ore minerals in Virginia

Uraninite

$UO_2 - U_3O_8$ (85% U)



Pitchblende

Coffinite

$(U,Th)(SiO_4)_{1-x}(OH)_{4x}$ (73% U)

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Mining of uranium presents unique challenges

Potential exposure to elevated radionuclides

Radon hazards (underground mine workers, mine ventilation outlets, emissions from waste rock and stockpiles)

Uranium chemical toxicity

Radionuclide (e.g. radium) transport in mine waters

Managing mine waste rock and ore stockpiles

Potential for release of airborne particulates

Long-term environmental monitoring

Surety and long-term liability

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A new statutory framework for uranium would be necessary

§45.1-283 of the Code of Virginia prohibits the acceptance of permit applications until a program for permitting uranium mining is established by statute.

Existing mineral mining statutes and regulations do not address the unique characteristics of uranium.

Uranium mining would require a comprehensive regulatory program that incorporates specific technical standards, best management practices, and key public input and transparency throughout the life cycle of mining.

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Virginia Uranium Studies

- The UWG has reviewed recent studies and past reports including:
- Common themes and recommendations are being carefully evaluated

- National Academies
- Chmura
- Research Triangle Institute
- Virginia Beach
- Fairfax Water
- 1984 UTF
- Others

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Recent Studies - Common Themes

- Mine plans should be evaluated as part of a complete life cycle analysis.
- Permitting and licensing of the mine and mill should be coordinated, to the extent possible.
- Health and environmental concerns should be evaluated holistically.
- Opportunities for meaningful public involvement in the regulatory process should be provided.

Sources: NAS (2011)

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Recent Studies - Common Themes

- There should be transparency throughout the permitting, mining and reclamation phases.
- An environmental impact analysis prior to the commencement of mining activities is an internationally accepted best management practice.
- Engineering design standards must consider the possibility of extreme weather and climate events.

Sources: NAS (2011), Chmura (2011)

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Recent Studies - Common Themes

- A comprehensive and effective community-engaged environmental monitoring program is necessary to assure compliance and foster transparency.
- Virginia's positive water balance conditions and implications for runoff from mine waste, tailings, ore stockpiles must be considered.
- Future impacts of mine dewatering on groundwater resources must be considered.

Sources: Chmura (2011), RTI (2011)

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Recent Studies - Common Themes

- Groundwater resources should be protected in accordance with Virginia's anti-degradation policy for groundwater.
- Thorough site characterization supplemented by predictive modeling would be necessary to evaluate the potential risks of environmental impacts.
- Waste rock and ore stockpiles must be managed effectively to prevent the release of radiological and non-radiological contaminants.

Sources: UTF (1984), RTI (2011), IAEA (2002)

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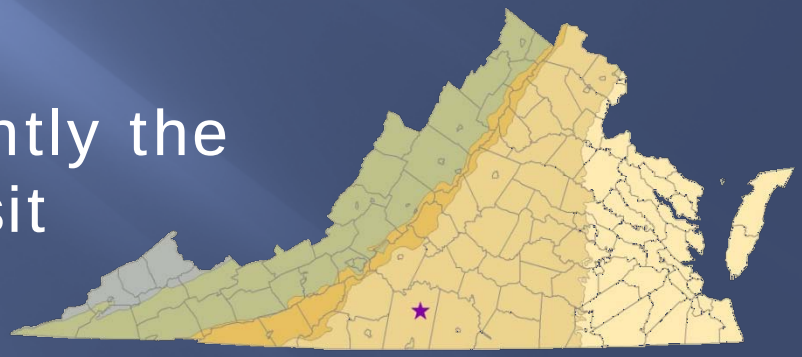
Conceptual Regulatory Framework for Uranium Mining

Framework for Statewide application considering all likely mining methods (surface, underground, in-situ recovery), with or without an associated mill.

The Coles Hill site is presently the only known uranium deposit of commercial interest.



A site-specific analysis ensures that all conditions that may be unique to this site are included in the statewide framework.

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Conceptual Regulatory Framework for Uranium Mining

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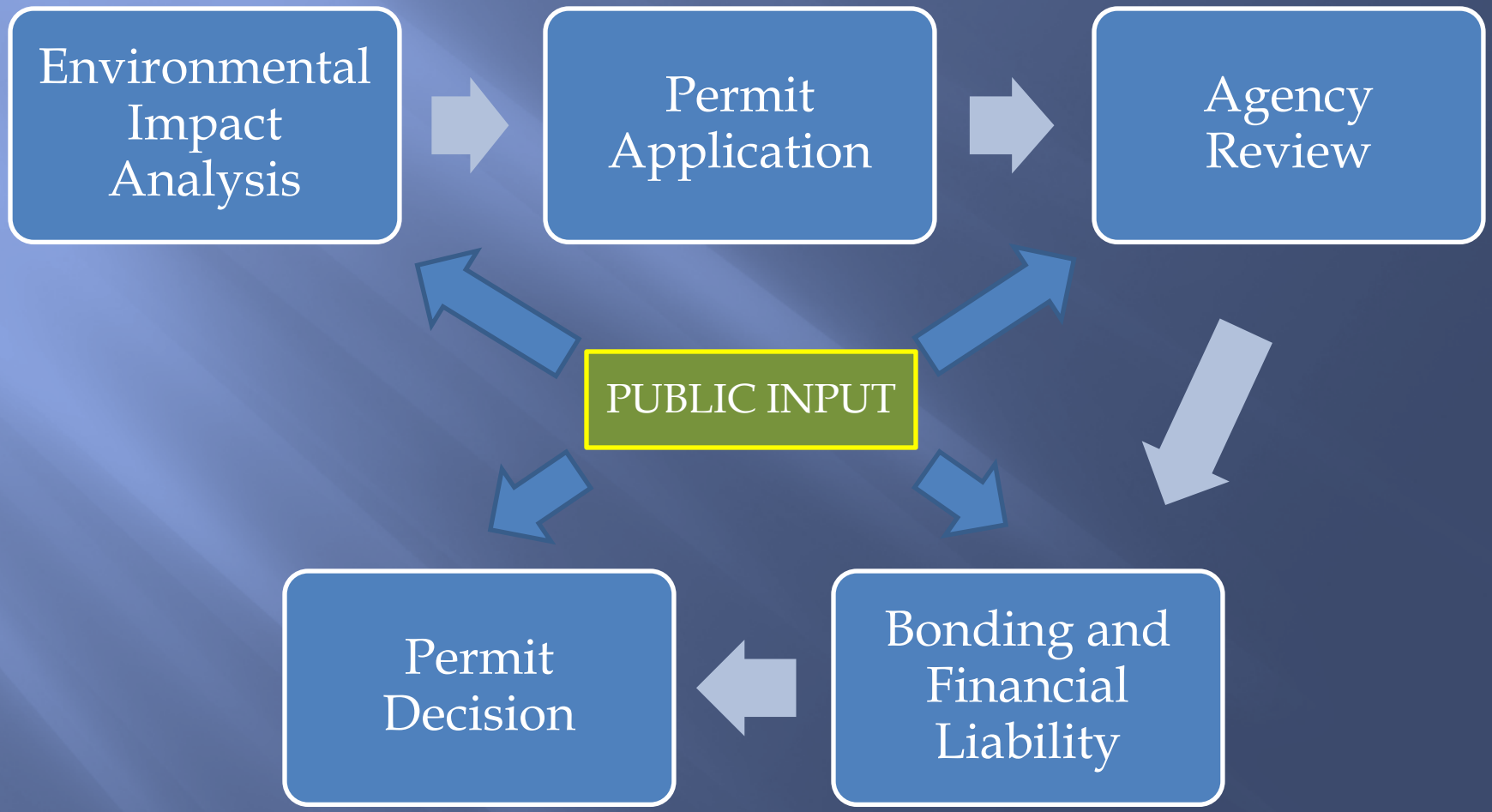
Permitting Process



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Environmental Impact Analysis (EIA)

Conceptual Framework:

- Baseline data submitted by the applicant should encompass a full assessment of environmental conditions that may be affected by uranium mining operations. A minimum of one year of data collection and monitoring would be expected.
- Combined impacts of mining and milling should be considered, if applicable.
- Provisions for public review and comment should be included at multiple stages of the EIA review process (which might include initial scoping, draft review, final review prior to a decision on the permit application).

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Environmental Impact Analysis (EIA)

EIA Components:

- Key environmental parameters;
- Proposed actions - mine and mill facilities and activities;
- Environmental effects of site preparation, facilities construction and commencement of mining activities;
- Environmental effects of mine and mill operations;

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Environmental Impact Analysis (EIA)

EIA Components:

- Environmental monitoring methods, schedules, and results from predictive modeling of air and hydrology;
- Short and long-term impacts of site reclamation;
- Alternatives to the proposed action;
- A risk/benefit analysis.

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Environmental Impact Analysis (EIA)

Specific environmental parameters:

- Site description, adjacent land use, population distribution;
- Regional archeological, historic, scenic, cultural resources;
- Background radiation surveys;
- Geology and soils;
- Host rock, waste rock, overburden, and ore characterization (geochemical, radiological, hydrogeologic, mineralogic);

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Environmental Impact Analysis (EIA)

Specific environmental parameters:

- Groundwater (quality, water table, gradient, aquifers);
- Surface water (quality, channel dimensions, flow records);
- Ecology (biota surveys, endangered species);
- Site specific meteorological data (PMP, PMF, wind, precipitation, evaporation, extreme events);
- Air quality data;
- Seismology.

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Operations Plan

Additional requirements unique to uranium mining include:

- Determination of Probable Hydrologic Consequences;
- Management of waste rock and ore stockpiles;
- Specific best management practices for all water-related issues, ventilation and airborne particulates;
- Site monitoring plans that incorporate As Low As Reasonably Achievable (ALARA) concept;
- Radiological protection plan for workers;
- Structured change management plan.

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Engineering Designs and Best Management Practices

Conceptual Framework:

- A mechanism for integrated and interdisciplinary collaboration for mine planning and permit review, including environmental, engineering, health, safety, monitoring, and legal elements;
- Best Management Practices by the International Atomic Energy Agency, World Nuclear Association, International Radiation Protection Association and other recognized organizations;
- Regular and structured risk analyses, hazard analyses, and operations analyses.

Sources: NAS (2011)

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Engineering Designs and Best Management Practices

Conceptual Framework:

- Engineering designs that consider risks of worst case scenarios;
- Requirements that all materials storage and surface water facilities to be designed by licensed professionals of the appropriate discipline;
- Requirements that the design of all significant structures include stability analysis and seismic protection analysis.

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Management of Mine 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 necessitates management to protect health or the environment.

Sources: IAEA (2002); NAS (2011)

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Management of Mine Waste

Management Design Criteria:

- Characterizations of overburden, ore, and non-ore host rock in the EIA to provide the basis for mine waste rock management;
- Criteria for site selection and design of mine waste storage areas to be included in the EIA;
- Waste rock storage areas to be designed to conform with the state anti-degradation policy for groundwater.

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Management of Mine Waste

Management Design Criteria:

- Design of waste rock storage areas to be certified by a qualified registered Professional Engineer;
- Standards for waste rock sorting and transport, stabilization, cover, surface and internal drainage controls, and controls for dust and radon;
- The utilization of ALARA to minimize radiological exposure to protect worker and public health and the environment.

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Agency Review

Conceptual Framework:

- Online posting of permit applications, amendments, and renewals for public review and comment to foster transparency;
- The flexibility for a joint permitting process with other state agencies;
- Best available technologies for technical reviews (internal and external sources).

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Permit Decision

Conceptual Framework:

- Opportunity for public hearing prior to the permit decision;
- A mechanism for appeal of the permit decision by the applicant or any qualified person who may be affected by the decision.

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Environmental Monitoring

Conceptual Framework:

- Authority for a comprehensive and ongoing monitoring program;
- The flexibility to adapt as appropriate to reflect ALARA concept;
- Potential options include:
  - Multi-stakeholder approach
    - Parallel monitoring among operator, community and state/local authorities
  - Independent community advisory groups.

Sources: NAS (2011), Chmura (2011)

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Environmental Monitoring

Conceptual Framework:

- Authority to require data to be made readily available to the public;
- A funding mechanism for post-closure monitoring.

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Compliance and Enforcement

Conceptual Framework:

- Authority to order immediate cessation of mining activities to avoid or eliminate an imminent danger to the health or public safety, or to prevent significant harm to land, air, or water resources;
- Authority to revoke or suspend the permit when a pattern of violations exists;
- Mandatory civil penalties against the operator and/or responsible individuals for the violation(s) of law, regulations, or permit conditions.

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Compliance and Enforcement

Conceptual Framework:

- Provisions for appeal of violations through the Administrative Process Act;
- Right of access for announced and unannounced inspections;
- Authority to independently access insurance, bonds, or other funds for the prompt remediation of violations;
- Public notification and hearing prior to the release of performance bonds.

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Reclamation Plan

Conceptual Framework:

- Detailed description of timing and sequence of mining, contemporaneous and final reclamation for the life of the mine;
- A detailed plan for the post mining land use, including consideration of alternative uses;
- Detailed estimates for the cost of reclamation to assure adequate bonding.

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Reclamation Plan

Conceptual Framework:

- Consideration of local and state land use plans and program;
- Detailed descriptions of the measures to be taken to comply with all relevant state and federal air and water quality requirements;
- A detailed description of alternative sources of water for replacement of current sources.

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Reclamation Bonding

Conceptual Framework:

- Detailed submissions discussed in reclamation plans would assist in determining amount of bonding necessary;
- Sufficient bonding would cover the costs of reclamation and would be readily accessible;
- Bonding requirements will be discussed in much greater detail at the November meeting.

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Resource Requirements

- For initial permit review, DMME will utilize existing resources including:
  - Hydrologists, Geologists, Ecologists, Engineers
- DMME will utilize expertise from DEQ, VDH and outside consultants.
- If a program is enacted, DMME anticipates the need for additional staff with specific expertise in these areas:
  - Mine Inspection
  - Mining Engineering (mining best management practices)
  - Hydrogeology (groundwater modeling)
  - Technical Specialists (ecological risk assessment, modeling)

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