The National Mining Association's Generic Environmental Report for In Situ Uranium Recovery Facilities

Prepared for the National Mining Association/Nuclear Regulatory Commission Annual Conference

Denver, 2008

Prepared by:
Anthony J. Thompson, Esq. (Presenter)
Christopher S. Pugsley, Esq. (Presenter)
Thompson & Simmons, PLLC

Introduction

- **The Uranium Recovery Industry Has Estimated That as Many as 26 License/License Amendment Applications Will Be Submitted by the End of 2009 for:**
  - **New Uranium Recovery Projects (Conventional/In Situ Recovery (ISR);**
  - **Construction/Operation of New Facilities at Licensed Sites;**
  - **Project Restarts & Expansions**

Introduction

- **A Majority of These Newly Proposed & Submitted License/License Amendment Applications Will Involve ISR Facilities:**
  - **Crowe Butte (Nebraska, Submitted);**
  - **Energy Metals/Uranium One (Wyoming, Submitted);**
  - **Ur-Energy (Wyoming, Submitted);**
  - **Uranerz (Wyoming, Submitted)**
  - **COGEMA (Restart Christensen Ranch/Wyoming, Submitted);**
  - **Uranium Energy (Texas, Submitted)**

New Projects (List Not Exhaustive)

- **Pending ISR Projects:**
  - Powertech Uranium (Dewey Burdock, South Dakota;)
  - Powertech Uranium (Centennial, Colorado);
  - Energy Metals/Uranium One (Antelope, Wyoming);
  - Uranium Resources, Inc. (Ambrosia Lake/New Mexico/Resin Stripping);
- **Proposed ISR Projects:**
  - Powertech (Dewey Terrace, Aladdin/Wyoming);
  - Energy Metals/Uranium One (Ludeman, Allemand-Ross/Wyoming)
  - Strathmore Minerals (Reno Creek/Wyoming)
  - Ur-Energy (Lost Creek/Wyoming (Expansion))
  - Kennecott Uranium Company (Sweetwater/Wyoming/Resin Stripping/Elution)

Expeditious Review of Applications

- **NRC Has Anticipated and Attempted to Prepare for the Resurgence of Primary Uranium Production in the United States By**:
  - **Hiring Additional Technical Staff;**
  - **Instituting New Procedures for License Applications (i.e., Notice of Intent (NOI) Letters);**
  - **Instituting New Administrative Hearing Procedures (New 10 CFR Part 2 Procedures);**
  - **Preparing Rulemaking for ISR Facilities Clarifying & Modifying 10 CFR Part 40, Appendix A Criteria Regarding Groundwater Restoration;**
  - ***Preparing New Generic Environmental Impact Statement for ISR Facilities (ISR GEIS)***

ISR GEIS Proposal

- **NRC Staff Has Proposed to Expedite Review of ISR License/License Amendment Applications by:**
  - **Creating a Draft Generic EIS (DGEIS) Specifically Tailored to ISR Projects;**
  - **Engaging Industry, Agencies, Members of the Public, and Public Organizations in the Scoping and Notice-and-Comment Process;**
  - **Preparing and Publishing a Final GEIS (FGEIS) From Which Site-Specific Environmental Assessments (EAs) or Supplemental EISs May Be "Tiered"**

NRC Proposed Timetable for ISR GEIS

- **Scoping Comment Period Terminated on November 30, 2007**
- **DGEIS to be Issued for Public Comment April/May 2008;**
- **Time Allotted for Public Comment and Other Interested Stakeholder Input (e.g., Public Meetings);**
- **FGEIS to be Issued January/February, 2009**

ISR GEIS Proposal: Industry Response

- **In Response to NRC's Request for Scoping Comments, NMA Has Prepared and Submitted:**
  - **Scoping Comments Addressing Issues of Concern to Industry, NRC/Agreement States, and Interested Stakeholders;**
  - **Detailed Generic Environmental Report (GER);**
  - **Appendices**
- **NMA's Ultimate Goal: To Assist in the Development of a Final ISR GEIS Which Will Provide NRC, Agreement States, Industry Members, and Members of the Public with A SINGLE RESOURCE Wherein Detailed Information Regarding Generic ISR Agency/Industry Regulatory Experience & Results Can Be Found to Allow More Focus on Site-Specific Issues in Agency Regulatory Reviews**

Industry GER: Preparers & Contributors

- **NMA Issued an Invitation for Bids (IFB) to Companies to Prepare the GER & the Project Was Completed By:**
  - National Mining Association
  - Tetra Tech, Inc.;
  - SENES Consultants, Ltd.;
  - Petrotek Engineering Corporation;
  - Straughan Environmental Services, Inc.;
  - Thompson & Simmons, PLLC

Industry GER: Preparers & Contributors

- **NMA Member Companies Were Intimately Involved in the Preparation of the GER:**
  - Crowe Butte Resources, Inc., a Cameco Company
  - Denison Mines (USA) Corporation;
  - Energy Metals Corporation, Uranium One Americas;
  - Kennecott Uranium Company, a Rio Tinto Company;
  - Mesteña Uranium, LLC;
  - National Mining Association;
  - Power Resources, Inc., a Cameco Company;
  - Powertech Uranium Corporation;
  - Strathmore Minerals Corp.;
  - Ur-Energy;
  - Uranium Energy Corporation;
  - Uranium Resources, Inc.

Basic Form of the GER

- **NMA's GER Takes the Form of a Hybrid Environmental Report and Environmental Impact Statement (EIS) Based on NRC Guidance (NUREG-1748):**
  - Scoping Comments;
  - Preamble (Detailed Uranium Recovery Regulatory Regime Historical Development);
  - The Proposed Action;
  - Alternatives;
  - Description of the Affected Environment;
  - Potential Impacts of Proposed Action & Alternatives;
  - Mitigation Measures

Scoping Comments: Highlights

- **ISR Site Development is Frequently Misunderstood:**
  - **Iterative, Phased Site Development:**
    - **Preliminary Site Characterization:**
      - **Surface & Subsurface Geological/Geochemical Conditions**
    - **Detailed Site Characterization:**
      - **Baseline Surface & Subsurface Conditions**
      - **Development of Upper Control Limits (UCLs);**
      - **Pump Tests;**
      - **Well-Field Installation**
    - **Operations;**
    - **Site Reclamation & Groundwater Restoration**
  - **This Development Process Results in Sequential Well-Field Development, Operation, and Restoration;**

Scoping Comments: Highlights

- **The Proposed ISR GEIS *DOES NOT* Obviate the Need for Site-Specific Assessments:**
  - **NRC Regulations (10 CFR Part 51) Expressly Require Site-Specific Assessment Even With the Benefit of a GEIS;**
  - **Site-Specific EAs or Supplemental EISs Are Available for Use**

Scoping Comments: Highlights

- **Proposed "Tiering" of Site-Specific EAs from the ISR GEIS is a Common Practice:**
  - **Council on Environmental Quality (CEQ) Contemplate "Tiering" (40 CFR § 1508.28, (Defines *Tiering*);**
  - **NRC Regulations Also Recognize "Tiering" (10 CFR § 51.10(a) & NUREG-1748, Section 1.6.2);**
- **Licensing/Permitting of ISR Projects Involves a Stringent, Three-Layer Program Enforced by Two Federal Agencies (or State-Delegated Equivalents):**
  - **NRC/Agreement State License (Authorizes the Recovery Possession and Disposition of Source Material Uranium);**
  - **EPA/Delegated State Underground Injection Control Permit (Authorizes the Injection of Lixiviant (Oxygen Etc.) Into Underground Ore Body);**
  - **EPA Aquifer Exemption (Certifies That Water in Permit Area Cannot Now Nor Ever in the Future Serve as a Public Drinking Water Source)**

Preamble: Highlights

- **NRC/Agreement State Authority Over Source Material Recovery Originates From Federal Statute:**
  - Atomic Energy Act of 1954 (AEA);
  - AEA Amendments in Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA);
  - 2000 Commission Decision on ISR Projects
- **Uranium Recovery Regulatory Program Has Evolved Over a Thirty-Plus Year Period:**
  - 10 CFR Part 40 & Appendix A Criteria (Uranium Milling Facilities);
  - 10 CFR Part 20 (Radiation Protection);
  - 10 CFR Part 51 (NEPA)

Preamble: Highlights

- **ISR Projects Are Regulated By NRC Using License Conditions Based on 10 CFR Part 40 Regulations, Appendix A Criteria, and Applicable Guidance Including:**
  - **NUREG-1569 (ISR Standard Review Plan);**
  - **NUREG-1748 (Environmental Report Guidance);**
  - **Regulatory Guides 4.14 (Radiological Monitoring) & 8.31 (Occupational Protection);**
- **Past and Future Items Have Shaped or Will Shape Future ISR Regulation:**
  - **Hydro Resources, Inc. Litigation;**
  - **ISR Rulemaking;**
  - **Concurrent Jurisdiction Decision (SRM-SECY-99-027);**
  - **Alternate Feed Policy**

The Proposed Action: Highlights

- **ISR Companies are Required to Submit Applications to NRC Under the AEA. NRC May:**
  - **Approve;**
  - **Approve with Conditions; or**
  - **Deny**
- **The GER's Purpose is to Provide a Programmatic Compilation and Analyses of All ISR Issues Based on Over Thirty Years of Research, Development, Operations, and Reclamation/Restoration;**
- **NMA Recommends the Use of Standard "Tiering" Checklists as a Tool to Assist in the Evaluation of Applications:**
  - **Bureau of Land Management (BLM) Currently Uses Such Checklists;**
  - **GER Provides Sample BLM Checklist Cross-Referenced with NRC Guidance**

Alternatives: Highlights

- **Alternatives Were Formulated Based on Previous EIS Experience and Other Uranium Recovery Methods:**
  - **The Proposed Action;**
  - **No-Action;**
  - **Conventional Uranium Recovery (Underground & Surface Mining/Conventional Milling & Heap Leaching);**
  - **Byproduct/Sidestream Recovery**

Alternatives: Highlights

- **GER Provides a Generic Overview of the Entire ISR Process Lifecycle from Exploration/Site Characterization to Operations to Groundwater Restoration & Surface Reclamation:**
  - **Overview;**
  - **Site and Facility Infrastructure;**
  - **Instrumentation & Control;**
  - **Uranium Recovery from ISR-Amenable Underground Ore Bodies;**
  - **Waste Management**

Description of Model ISR Region: Highlights

- **The GER Lays the Foundation for Its Analysis Based on the Use of a Model Region:**
  - **Similar to the Approach Used in NUREG-0706 (1980 GEIS);**
  - **Focuses on Well-Understood Characteristics of Traditional Regions Where ISR Amenable Deposits are Located:**
    - **South Texas;**
    - **Great Divide/Powder River Basin;**
    - **New Mexico/"Four Corners" Area;**

Description of Model ISR Region: Highlights

- **The GER Utilized NRC EIS/Environmental Report Guidance to Develop the Model Region Description:**
  - **Land Use;**
  - **Transportation;**
  - **Geology & Soils;**
  - **Water Resources & Hydrology;**
  - **Ecology;**
  - **Meteorology & Climatology, Air Quality & Noise;**
  - **Historic & Cultural Resources;**
  - **Visual & Scenic Resources;**
  - **Socioeconomics;**
  - **Environmental Justice**

Description of Model ISR Region: Highlights

- **Important Notes from the Model Region Description:**
  - **Analyses of Model Region Characteristics Demonstrate that Surface Conditions are Substantially Similar:**
    - **Surface Lands Typically Consist of Rangeland (50-60 Percent);**
    - **Well-Fields Utilize Similar Equipment on the Surface;**
    - **Central Processing Plants Utilize Similar Technology;**
    - **Waste Management Procedures are Standardized**

Description of Model ISR Region: Highlights

- **Important Notes from Model Region Description:**
  - **Analyses of Model Region Characteristics Demonstrate that Subsurface Hydrologic and Geochemical Conditions are Substantially Similar:**
    - **Regional Redox Front & Geochemical "Trap;"**
    - **Generally, Some Confining Layers Above and Below the More Porous Sands Through Which Uranium-Bearing Groundwater Flows;**
    - **Natural Reducing Processes in Recovery Zone Created and Still Create Roll-Front Uranium Deposits;**
    - **Recovery Zone Water Cannot Ever Be Used as Public Drinking Water Source But Can Be Restored to Prior Class of Use;**

    NOTE: ***IF SUBSURFACE CONDITIONS AT MODEL SITES WERE NOT SUBSTANTIALLY SIMILAR, THEN THEY MAY NOT CONTAIN SIMILAR URANIUM DEPOSITS AMENABLE TO THE ISR PROCESS***

Potential Environmental Impact Assessment: Highlights

- **The GER Assesses All Potential Environmental Impacts Under Model Region Description Headers;**

- **NRC's Evaluation of ISR Projects Evolved Over Time:**

  - **Prior to the Mid-1980s, NRC Conducted Site-Specific EISs for ISR Projects;**
  - **In the Mid-1980s, Environmental Reviews Shifted to Site-Specific EAs Likely Due to Minimal Potential Impacts;**
  - **Post-2000, NRC Staff Interprets 10 CFR Part 51 to Mandate Site-Specific EISs for ISR Projects**

Potential Environmental Impact Assessment: Highlights

- **Land Use Impacts:**
  - **Liquid Waste Disposal Impacts:**
    - **Mud Pits;**
    - **Process Pad;**
    - **Deep-Well Injection;**
    - **Evaporation & Retention Ponds;**
    - **Surface Discharge & Land Application**
  - **Solid Waste Disposal Impacts:**
    - **On-Site Non-AEA Solid Waste Burial;**
    - **Off-Site of Non-AEA Solid Wastes & 11e.(2) Byproduct Material Disposal**

Potential Environmental Impact Assessment: Highlights

- **Transportation Impacts:**
  - **Temporary Roadway Impacts;**
  - **Vehicle Accidents;**
  - **NRC Has Conducted Multiple Transportation-Related Assessments:**
    - **1980 GEIS;**
    - **NUREG-0535;**
    - **NUREG-0170;**
    - **NUREG-1508**

Potential Environmental Impact Assessment: Highlights

- **Geology & Soil Impacts:**
  - **Construction Activities:**
    - Well-Fields and Associated Piping;
    - Uranium Processing Facilities
  - **Operations:**
    - Active Well-Field Operations
    - Uranium Processing

Potential Environmental Impact Assessment: Highlights

- **Water Resource Impacts**:
  - **Surface and Groundwater**:
    - **Surface Discharges;**
    - **Groundwater Consumption;**
    - **Groundwater Quality:**
      - **Excursions;**
      - **Accidents (e.g., Surface Spills/Leaks);**
      - **Restoration**

Potential Environmental Impact Assessment: Highlights

- **Public & Occupational Health Impacts:**
  - **Non-Radiological Impacts:**
    - Construction;
    - Operations
  - **Radiological Impacts:**
    - Construction;
    - Operations:
      - Yellowcake Drying & Packaging Facilities

Mitigation Measures: Highlights

- **The GER Emphasized the Critical Nature of Mitigation Measures for ISR Projects With a Focus on:**
  - **Groundwater Mitigation;**
  - **Airborne Emissions Mitigation;**
  - **Radiological Dose Mitigation**

Mitigation Measures: Highlights

- **The GER Places Particular Emphasis on Groundwater Mitigation:**
  - **Natural Geologic, Hydrologic, and Geochemical Conditions:**
    - **Regional Aquifer Conditions: Redox Front;**
    - **Overlying & Underlying Confinement;**
    - **Regional/Local Groundwater Travel Times;**
    - **Natural Attenuation**

Mitigation Measures: Highlights

- **Additional Groundwater Mitigation:**
  - **Measures Inherent in the ISR Process Now Routinely Reflected in Mandatory NRC-Imposed License Conditions:**
    - Develop Detailed Baseline Water Quality Parameters on a Well-by-Well and Well-Field-by-Well-Field Basis
    - Develop UCLs Based on Most Mobile Constituents to Provide "Early Warning" of Excursions;
    - Well Construction & Mechanical Integrity Testing (MIT);
    - Pump Tests to Determine Confinement;
    - Well-Field Balance and Process "Bleed" to Control Radial Groundwater Flow Into and Within Recovery Zone;
    - Monitor Wells Around the Recovery Zone to Monitor Excursions

Mitigation Measures: Highlights

- **Additional Groundwater Mitigation:**
  - **NRC & EPA Regulatory Requirements:**
    - **NRC-Mandated Groundwater Restoration Can Utilize:**
      - Active Groundwater Sweep;
      - Reverse Osmosis and Re-Injection of Ion-Filtrated Water;
      - Brine Concentration to Minimize Resulting Wastes;
      - Bioremediation
    - **NRC Financial Assurance & Restoration Action Plans:**
      - Mandated by the Commission in HRI Litigation
    - **EPA Area of Review & Post-Restoration Excursion Remediation:**
      - Area of Review: 40 CFR § 146.6
      - Post-Restoration Excursion Remediation: 40 CFR § 146.7

Mitigation Measures: Highlights

- **Important Notes from Assessment of Potential Groundwater Impacts:**
  - **Natural Conditions Dictate the Formation of Roll-Front Uranium Deposits and Assist in Future Restoration of Recovery Zone Aquifer;**
  - **Protection of Groundwater Resources Subject to Multi-Layered ISR Control Techniques Reflected in Mandatory NRC License Conditions;**
  - **Excursions Must Be Immediately Addressed and Redressed Under Current Regulatory Program or Operations Must Cease;**
  - **Financial Assurance is Strictly Imposed to Ensure that Groundwater is Restored in Compliance With Regulatory Requirements**

Mitigation Measures: Highlights

- **The GER Also Emphasizes Mitigation Measures Regarding:**
  - **Potential Airborne Emission Impacts:**
    - **Drilling & Construction Emissions**
    - **Process Emissions & Spills**
  - **Potential Radiological Dose Impacts:**
    - **NRC Regulatory Dose Limits;**
    - **On-Site Surface Reclamation;**
    - **Decontamination and/or Off-Site Disposition;**
    - **Survey Methods**

Mitigation Measures: Highlights

- **Potential Airborne Emissions Impacts**:
  - **Drilling & Construction Emissions**:
    - **Best Management Practices for Dust Suppression;**
    - **Properly Maintained Equipment**
  - **Process Emissions & Spills**:
    - **Exhaust Gases;**
    - **Yellowcake Particulate Emissions:**
      - **Dryer Mechanisms Designed With Fugitive Dust Control Aspects (Vacuum & Atmospheric Dryers)**
    - **Process Leaks or Spills:**
      - **Radiological;**
      - **Non-Radiological**

Mitigation Measures: Highlights

- **Potential Radiological Dose Impacts:**
  - **NRC Regulatory Dose Limits:**
    - 10 CFR Part 20 Public & Occupational Dose Limits (Total Effective Dose Equivalent (TEDE))
  - **Operational Waste Management:**
    - 11e.(2) Byproduct Material Disposed of:
      - Deep-Well Injection
      - Off-Site Disposal at Licensed 11e.(2) Disposal Facility
  - **Decontamination and/or Off-Site Disposition:**
    - Dismantling and Removal of On-Site Structures in Compliance with 10 CFR § 40.42 Requirements and Applicable Guidance
    - Materials Decontaminated for "Free Release" May Be Removed and Sold or Disposed
  - **Survey Methods:**
    - Site Survey Methods Must Be In Compliance With NUREG-1575 and Applicable Appendix A Benchmark Dose

Mitigation Measures: Highlights

- **Important Notes From Assessment of Airborne Emission and Radiological Impacts:**
  - **Active ISR Operations Are Not Considered to Pose Significant Radiological Dose Risks to Members of the Public or Workers:**
    - **Conventional Mill Studies Show Dose to Workers Are On the Same Order of Magnitude as Annual Average United States Background Dose;**
    - **Conventional Mill Studies Show No Impact to Nearby Populations and ISR Facility Dose Contribution is Orders of Magnitude Less**
  - **NRC Regulations Impose Stringent Radiological Dose Limits & ALARA Requirements;**
  - **Financial Assurance is Strictly Imposed to Mandate Complete Site Surface Reclamation to Ensure Potential Dose is Within Regulatory Limits**

Summary of NMA GER

- **NMA Created Its GER to:**
  - **Provide NRC, Its Agreement States, Members of the Uranium Recovery Industry, and Interested Stakeholders With a Resource Assisting in the Development of the ISR GEIS;**
  - **Assist NRC & Agreement States a Means By Which Cumbersome Reviews of Generic Issues by Providing Historical Data and Analyses;**
  - **Provide NRC & Agreement States With A Resource to Focus Regulatory Reviews on Site-Specific Issues**

Conclusions

- **The Preparation of the ISR GEIS is an Important Step Towards an Efficient Licensing Process;**
- **Industry Has Considerable Experience & Expertise That Has Been Presented in Its Scoping Comments & GER;**
- **NRC Should Consider the Information in the GER & in the Draft ISR GEIS When Evaluating Applications That Have Already Been Submitted**