Overview of Sustainability Concepts

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International Forum on Sustainable Operations for Uranium Production
Topic Areas

- Review of Sustainability and Sustainability Concepts
- Incorporating Sustainability Concepts for Reclamation Projects
- Case Studies
- Agencies and companies no longer hold all the power

- Both Operation and Remediation requires:
  - Access to resources
  - Access to transportation
  - Access to approvals

- Indigenous peoples and local communities effect these
Key Concepts in Sustainability

- Three pillars: Economics, environmental, and sociopolitical
- Seven questions to sustainability, with engagement at the center
Three Pillars of Sustainability (or “Triple Bottom Line”)

- Economic Sustainability
- Environmental Sustainability
- Sociopolitical Sustainability

*The intersection of these three represents where sustainable development, or sustainable remediation, is optimized.*
Seven Questions to Sustainability
Seven Questions to Sustainability (continued)
is the net contribution to sustainability positive or negative, over the long term?

1. **Engagement.**
   Are engagement processes in place and working effectively?

2. **People.**
   Will people’s well-being be maintained or improved?

3. **Environment.**
   Is the integrity of the environment assured over the long term?

4. **Economy.**
   Is the economic viability of the project or operation assured, and will the economy of the community and beyond be better off as a result?

5. **Traditional and Non-market Activities.**
   Are traditional and nonmarket activities in the community and surrounding area accounted for in a way that is acceptable to the local people?

6. **Institutional Arrangements and Governance.**
   Are rules, incentives, programs and capacities in place to address project or operational consequences?

7. **Synthesis and Continuous Learning.**
   Does a full synthesis show that the net result will be positive or negative in the long term, and will there be periodic reassessments?
What is GRI?

- Network-based organization
- Pioneered development of sustainability reporting framework
- Committed to continuous improvement and worldwide application
- To ensure highest degree of technical quality, credibility, and relevance, framework is developed through:
  - Consensus-seeking process
  - Participants from business, civil society, labor, professional institutions
- Sustainability reports based on framework are used to:
  - Benchmark organizational performance
  - Demonstrate organizational commitment to sustainable development
  - Compare organizational performance over time

Opportunity exists to link GRI reporting to the ENVIRONET
GRI Reporting Framework – Could be Supplements with Principals and Indicators based on IAEA Stakeholder Guidance

- The Framework was developed through a process of systematic, consensus-seeking dialogue with a large network of individuals from over 60 countries
- Today, GRI reports are submitted from more than 90 countries globally
- Principles and indicators – measure and report performance
  - economic
  - environmental
  - social
- Cornerstone: Sustainability Reporting Guidelines
- 3rd Version (G3) published in 2006
  - Public Document
  - Sector Supplements
  - National Annexes
- IAEA: Guidance for Communicating of Remediation Strategies for Radioactively Contaminated Sites to Stakeholders (2011)
- GRI Cornerstone: Sustainability Reporting
  [http://www.globalreporting.org/Home](http://www.globalreporting.org/Home)
International Forum on Sustainable Options for Uranium Production

- IFSOUP is a Global Network of Individuals and Entities Joined in the Common Goal of Achieving Safe, Sustainable Uranium Production.

- Started in 2007 to Adopt Sustainable Practices at New Uranium Recovery Sites to Avoid Legacy Sites

Means to organize:

- Workshops
- Training Courses
- Forums for Discussion
- Sharing of Information
Elements of G3 Framework

- Part 1 – Report Content, Quality, and Boundary
  - Reporting Guidance
  - Reporting Principles

- Part 2 – Standard Disclosures
  - Economic
  - Environmental
  - Social
Part 1 – Report Content, Quality, and Boundary

- Reporting Guidance
  - Content
  - Boundary

- Reporting Principles
  - Materiality
  - Stakeholder Inclusiveness
  - Sustainability Context
  - Completeness

- Differ for, and can be defined by, each organization

- Take into account the guidance and tests found in the GRI Reporting Principles; and

- Be disclosed.
Part 2 – Standard Disclosures

- The Organization
  - Strategy
  - Profile
  - Report Profile
  - Governance
- Management Approach
- Performance Indicators
  - Economic
  - Environmental
  - Social:
    - Labor Practices
    - Human Rights
    - Society
    - Product Responsibility
Case Study 1
Atlas Site in Moab, Utah

- US NRC licensed cap in place
- Utah, California, others objected
- Moving 16 million tons of tailings
- New site 30 miles away
- $1 billion project
- DOE projects spending $90 million/yr
- Complete by 2019
- Special stimulus funds now
- May drop to $30 million/yr in 2011
- 1 million tons moved so far
- Mining left Moab roads for world-class Mountain biking
Case Study 2
Monticello Tailings Site in Monticello, Utah

- “The average cost remedial action, number of persons per household, number of properties remediated, and the reduction of cancer mortalities through remediation (of the Monticello tailings) resulted in an approximate cost of $11,000,000 per life saved by remediation of mill tailings.”

- DOE Inspector General criticizes DOE's oversight over reclamation of Monticello uranium mill tailings site (Utah)
  Source: Audit Report - Restoration of the Monticello Mill Site at Monticello, Utah, DOE/IG-0665, October 2004 (PDF)

- City helped with reseeding – received $7 Million from “the Feds” (DOE)
  - Used much of those funds to expand City Golf Course from 9 to 18 holes
  - The Hideout was ranked the #2 golf course in Utah and the #23 Municipal Golf Course in the U.S.: http://www.sangres.com/utah/places/sanjuan/monticello.htm
Case Study 3
Restoration of the La Rosita Mine in Duval County, Texas USA

- Discovered and drilled in the mid-1970’s by Union Carbide Corp.;
- Chevron purchased, 1980
- URI acquired in 1985
- Produced 1,073,000 in PA1 1990-1992; Restoration 2005-2008
- Produced 1,569,000 lbs in PA2 1995-1999; Restoration 2001-2005
Uranium Roll Front Deposition

URANIUM ROLL FRONT DEPOSITION = NATURAL ATTENUATION
Natural uranium and its decay products, radium and radon, cause groundwater to become radioactive and to exceed federal and state drinking water limits, making the natural groundwater that is present near the uranium ore suitable only for industrial purposes.
La Rosita Baseline (Pre-Mining) Water Quality

LA ROSITA ISR PRE-MINING U-NATURAL

[Bar chart showing uranium levels in micrograms/L with data points for PA1 Restoration Table, PA2 Restoration Table, 141 BL Well Average, and EPA Primary MCL]
La Rosita Baseline (Pre-Mining) Water Quality

LA ROSITA ISR PRE-MINING $^{226}$Ra

- PA1 Restoration Table
- PA2 Restoration Table
- 141 BL Well Average
- EPA Primary MCL

Uranium Resources
In Situ Uranium Recovery

In-situ recovery ("ISR") is an non-destructive mining process where uranium is extracted from sandstone aquifers by reversing the natural process which deposited the uranium. Existing groundwater fortified with oxygen is used to leach the uranium from sands.

The uranium is then recovered by passing the leach solution over ion exchange resin, much like in a domestic water softener. The loaded resin is then processed. Finally, the groundwater is restored consistent with is previous quality and use.
In Situ Uranium Recovery Process

O₂ INJECTION/CARBONATE COMPLEX
U₄ to U₆

\[ 2\text{UO}_2 + O_2 \rightarrow 2\text{UO}_3 \]
\[ \text{UO}_3 + 2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{UO}_2(\text{CO}_3)_2 + \text{H}_2\text{O} \]
La Rosita Project In Situ Permitted Mining Area

- Permitted mining area is surrounded by a 5 mile (approx. 8 km) boundary zone
La Rosita Project Monitoring Well Rings

- Exempted aquifers must be surrounded by rings of monitoring wells that are used during operation and reclamation.
La Rosita Project Water Quality Change during Mining
La Rosita Project Water Post Mining Groundwater Restoration
La Rosita Project In Situ Uranium Recovery
Groundwater Restoration Process
Post Restoration Groundwater Quality

- Salinity from ion exchange fully mitigated. RO is highly effective in that dissolved salts are reduced below baseline mean.

- Calcium and carbonates due to pH drop are effectively mitigated. RO is effective with affected parameters restored to baseline mean.

- Uranium, trace elements due to oxidation are greatly reduced but not eliminated. RO is partially effective and residual concentrations may remain. Parameters typically affect use quality of the water similarly before mining and after restoration.
Issues Related to the Restoration Groundwater Quality

- For what uses was groundwater suitable at baseline levels?
- What was the actual existing use of groundwater in the area prior to and during mining?
- What is the potential future use of baseline quality groundwater and of proposed restoration quality water?
- How much effort was made by the permittee to restore the groundwater to baseline?
- What technology is available to restore groundwater for particular parameters?
- What is the ability of existing technology to restore groundwater to baseline quality in the area under consideration?
- What would be the cost of further restoration efforts?
- What would be the consumption of groundwater resources during further restoration?
- What are the harmful effects of levels of particular parameters?
Restoration Progress Illustration

LA ROSITA ISR
1,000,000,000 gal. or 6.8 PV treated and circulated
In Situ Uranium Deposit – Restoration Sustainability

URANIUM ROLL FRONT DEPOSITION = NATURAL ATTENUATION
State Rules Require Restoration Achievement to be Demonstrated by One of Two Methods

- (A) When all sample measurements from groundwater samples from all baseline wells for a restoration parameter are equal to or below the restoration table value…; or

- (B) A statistical analysis of information from groundwater samples from baseline wells proposed by the owner or operator and approved by the executive director that demonstrates that the groundwater quality is representative of the restoration table values.
Upper Tolerance Limits Method

- Rosita data set was used to calculate Upper Tolerance Limits (UTL95-95) for most constituents. For large data sets following normal distributions, this factor can be roughly estimated as the mean plus two standard deviations.

- Used ProUCL 4.00.04, an EPA-sponsored statistical program. ProUCL first determines if the data for a given constituent follows a normal, gamma, or logarithmic distribution. If the data follow one of these statistical distributions, a relevant UTL is calculated. If the data follow no discernible distribution a non-parametric UTL is calculated. In the case of data with non-detects, the Kaplan-Meier non-parametric method is used. Non-detect data are entered as the MDL with a qualifier code indicating non-detect status.

### LANL Mean vs. 95% UTL Analysis

<table>
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<tr>
<th>Parameter</th>
<th>Units</th>
<th>PA Restoration Table</th>
<th>Value</th>
<th>Distribution Type</th>
<th>Stability Average</th>
<th>CODE</th>
<th>PA Restoration Table</th>
<th>Value</th>
<th>Distribution Type</th>
<th>Stability Average</th>
<th>CODE</th>
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<td>617.1</td>
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**Below RT:** Below the Remediation Target (RT)
**Below MCL:** Below the Maximum Contaminant Level (MCL)
**No Standard:** No standard
**Above RT & MCL:** Above both the Remediation Target (RT) and Maximum Contaminant Level (MCL)
**Below 95% UTL:** Below 95% Upper Tolerance Limit (UTL)
Uranium Transferred to 3-D Graphic
Radium Transferred to 3-D Graphic
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Summary

- Sustainability indicators are measurable and need to be communicated
- Transparency is key to communication and trust building
- GRI Framework provides a method to assess sustainability of remediation approaches; and to measure and report remediation plans and results
- Framework is designed for all sizes and types of organizations
- Reporting provides a method for measuring continual improvement