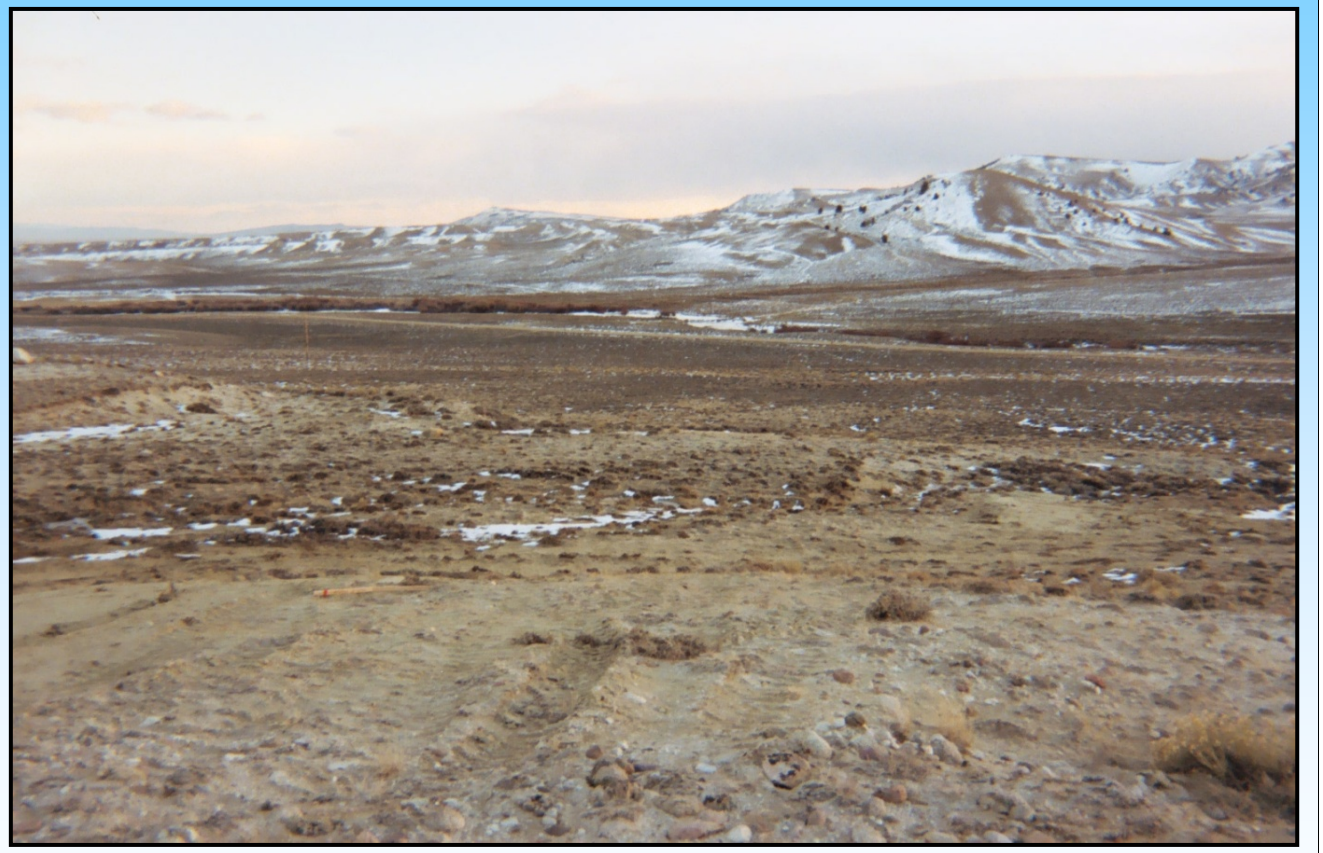
Optimization of ISR Injection and Extraction Systems

Presented by:

Shawn Leppert

Leppert Associates



NRC/NMA Uranium Recovery Workshop

July 1-2, 2009
Denver, Colorado

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A Uranium Mine Prospect

Opportunity **– Uranium Ore has been Delineated within "Shallow" Subsurface**

- **Data indicate that uranium is potentially present in mineable quantities.**
- **The ore is present within water-bearing geologic units 100+ feet bgs.**
- **Ore body is accessible through the application of In-Situ Recovery mining techniques (ISR).**

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Challenge **- Can the Uranium Ore be Mined Cost Effectively?**

- **Efficiently create the chemical disequilibrium required to mobilize the ore** → **Lixiviant effectiveness and lixiviant delivery/recovery system design**
- **Minimize the number of delivery/recovery wells required to accomplish the task** → **Lixiviant delivery/recovery system design**
- **Maximize the volume of uranium ore mined** → **Lixiviant delivery/recovery system design**
- **Minimize subsurface impacts** → **Lixiviant delivery/recovery system design**

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Advantageous Factors

- **Site subsurface data is available - the characterization conducted to define the ore body provides substantial data which are require to characterize subsurface hydraulics.**
- **Subsurface fluid hydraulics are predictable – these can be complex problems; appropriate, sophisticated simulators are available.**

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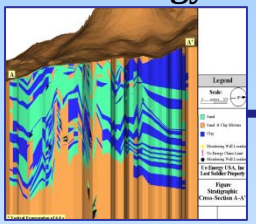
Quantitative Hydrogeologic Decision Framework (Geologic/Hydrologic,/Geochemical Model)

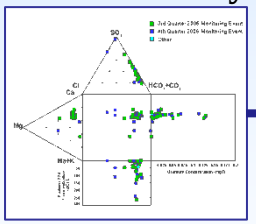
Data → **Evaluation** → **Decision**

Geology

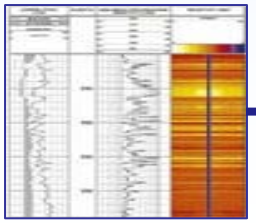


Hydrology

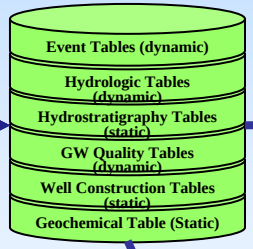
Geochemistry



Geophysical

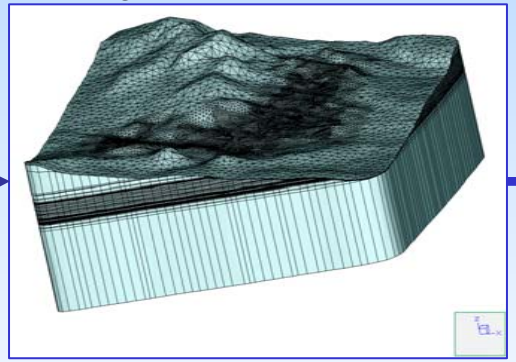


Electronic Database

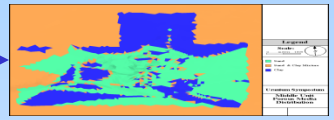


Reports/Permits

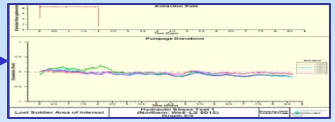
Quantitative Model



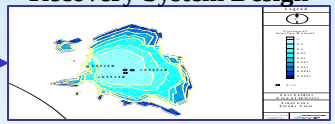
Pilot Tests & Additional Characterization



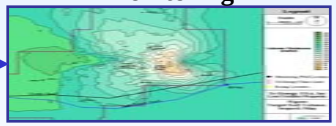
Hydraulic Property Estimation



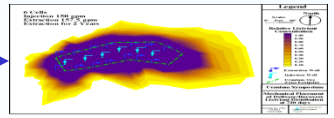
Lixiviant Delivery & Recovery System Design



System Performance Monitoring



Reclamation



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Conclusions

Demonstrated how the Quantitative Model can be used to Assist in Optimizing the Design of a Hydraulic Lixiviant Delivery and Recovery System

- Comparison of three design alternatives using three quantitative design criteria
- Optimize the design to maximize its efficiency
- Design a system the will control the lixiviant so as to require only minor restoration efforts

One can Infer How the Decision Framework can Assist in the other Challenges

- Develop a thorough understanding of the subsurface setting
- Place an effective subsurface monitoring network

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End

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Site Specific Information has been Modified to Protect Its Propriety Nature

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