Ucore Rare Earth Mine Development in Alaska

Using SPE Technology to Develop a New Rare Earth Production Paradigm at Bokan, Alaska

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Mine Design, Operation & Closure Conference , Butte Montana, April 29, 2014

A Collaboration for Success

IntelliMet™

Innovation

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Process Implementation

ucore® RARE METALS

Onsite Operation

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Part One

Bokan Project Summary

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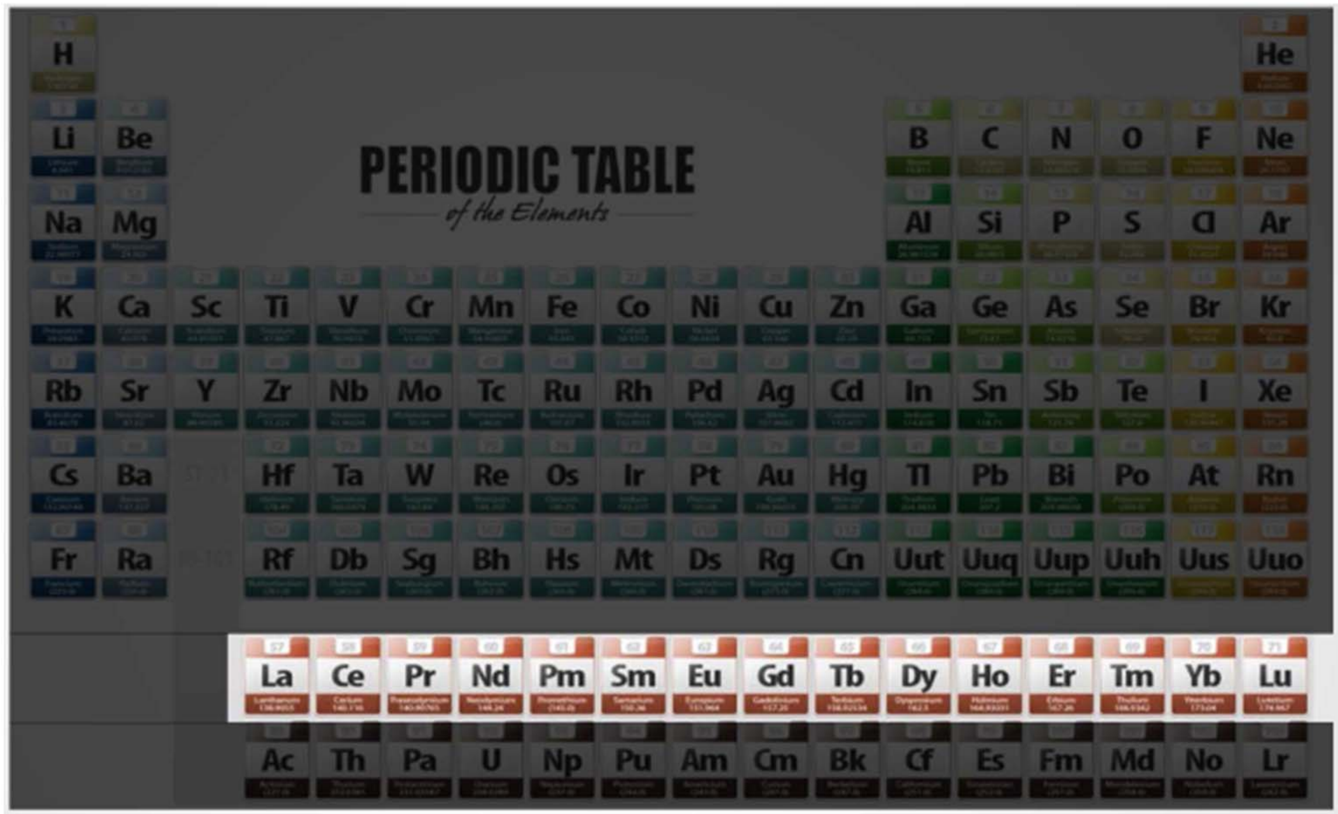
Bokan Mountain: A Leading Rare Earth Development Project

“Rare Earths” are the Lanthanide Elements + Yttrium + Scandium



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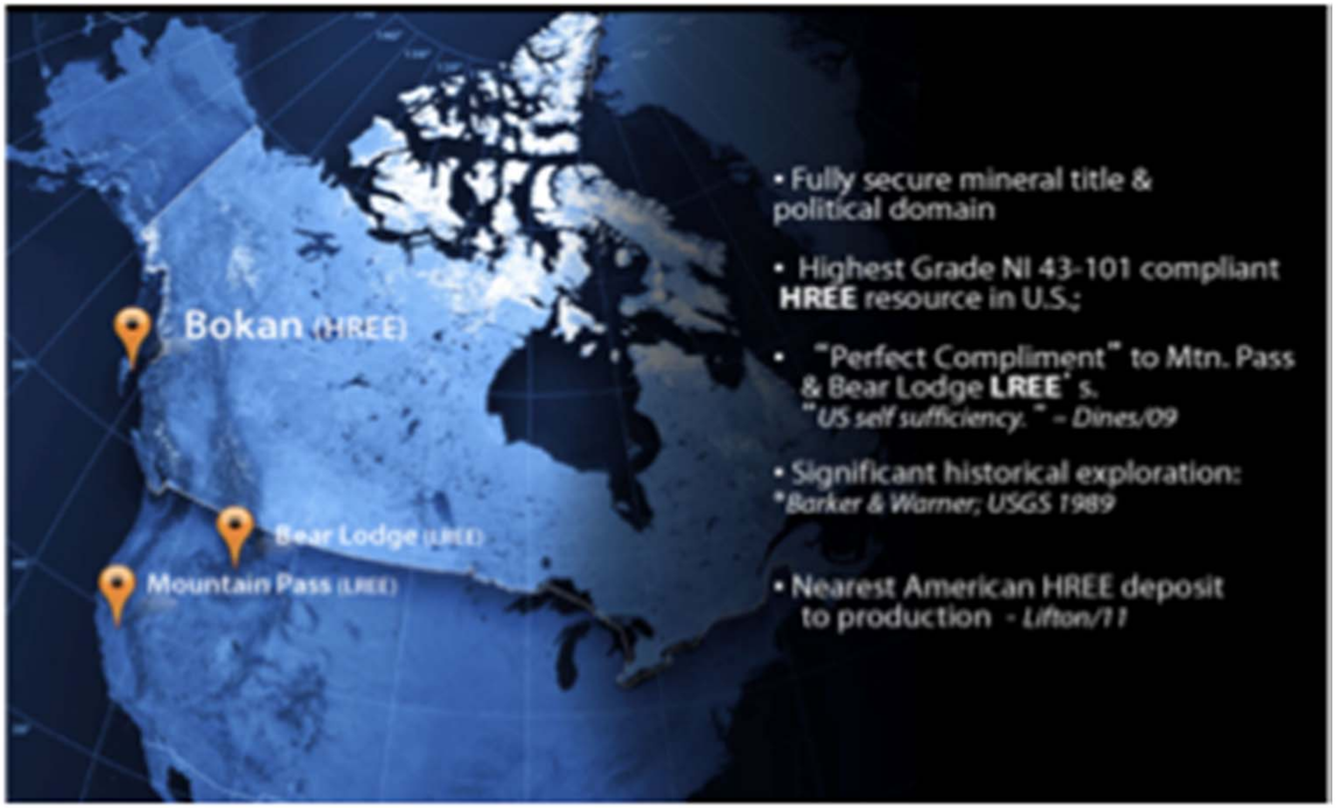
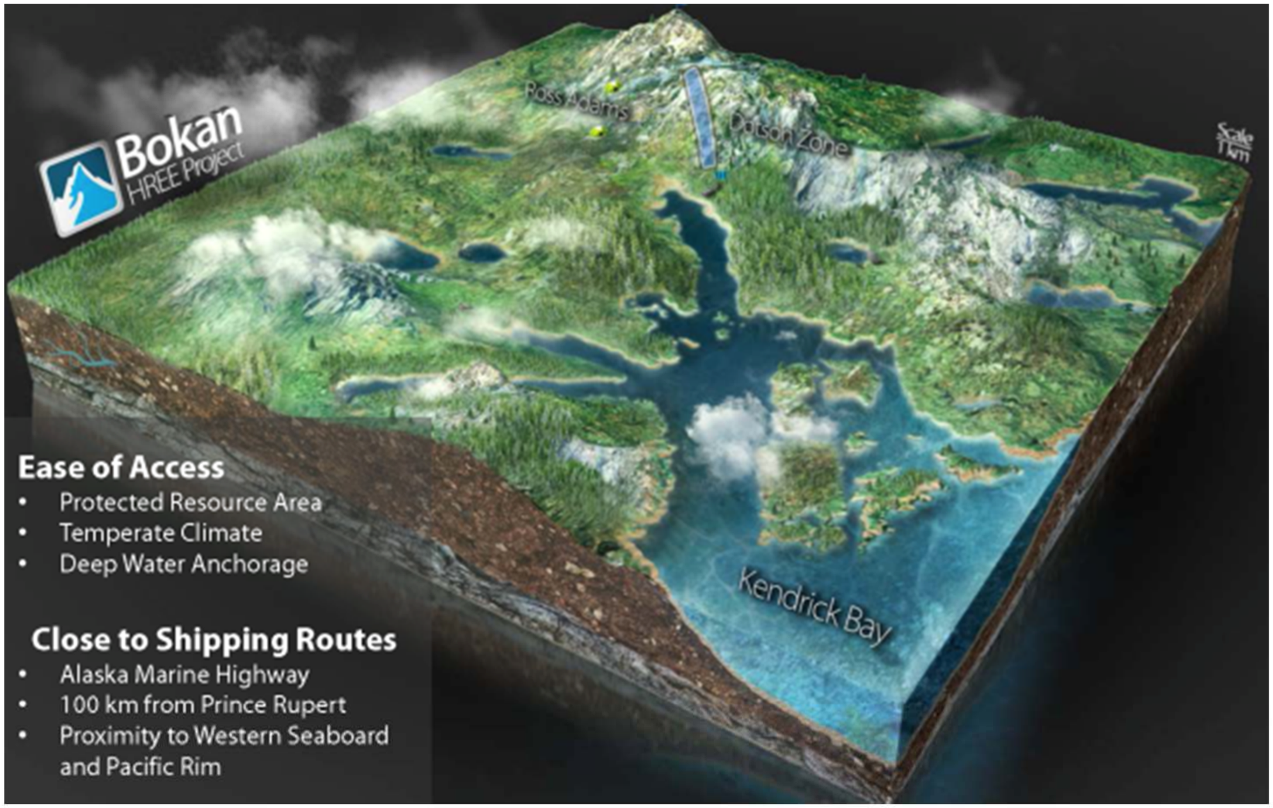
Where is Bokan Mountain?



We Can Walk from the Mine to the Dock



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The Bokan Team to Develop Mine/SPE Processing of Rare Earths

Technical:

- Ken Collison – M. Eng
- Jarda Dostal – PhD
- Richard Hammen - PhD
- Anthony Mariano – PhD
- James Barker – P. Geo
- Mike Power – P. Geo
- James Robinson – P. Geo

Financial & IR:

- James McKenzie - B. Comm.
- Peter Manuel - CA
- Brendon Ferguson - CA
- Mark MacDonald - B. Comm.
- Byron Fillmore - B. Comm.

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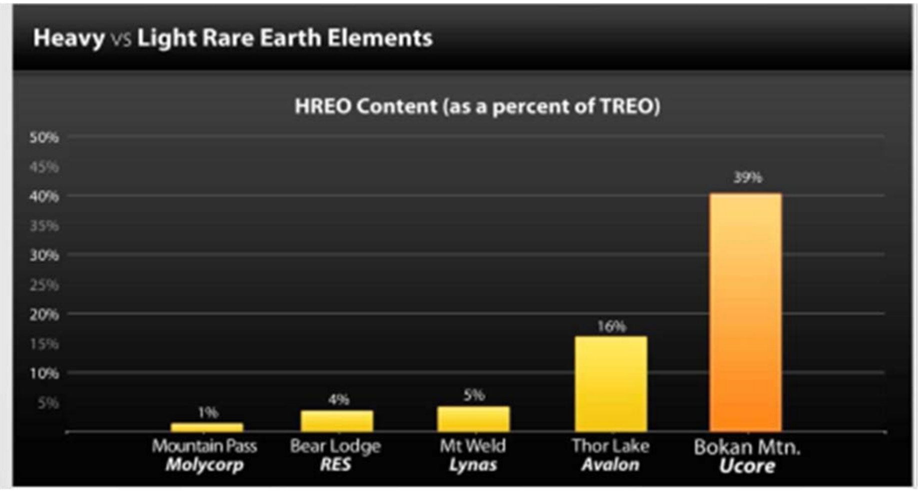
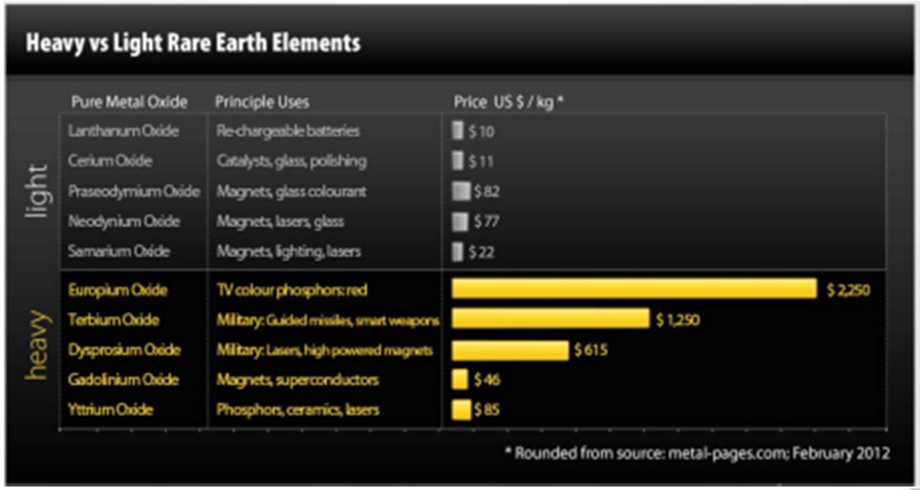
The Bokan Deposit has Unusually High HREE Percentage





Heavy vs Light Rare Earth Elements

	Pure Metal Oxide	Principle Uses	Price US $ / kg *
light	Lanthanum Oxide	Re-chargeable batteries	$ 10
	Cerium Oxide	Catalysts, glass, polishing	$ 11
	Praseodymium Oxide	Magnets, glass colourant	$ 82
	Neodymium Oxide	Magnets, lasers, glass	$ 77
	Samarium Oxide	Magnets, lighting, lasers	$ 22
heavy	Europium Oxide	TV colour phosphors: red	$ 2,250
	Terbium Oxide	Military: Guided missiles, smart weapons	$ 1,250
	Dysprosium Oxide	Military: Lasers, high powered magnets	$ 615
	Gadolinium Oxide	Magnets, superconductors	$ 46
	Yttrium Oxide	Phosphors, ceramics, lasers	$ 85

* Rounded from source: metal-pages.com; February 2012

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Overall Process Summary

Ore Sorting

- Sorting rejects approx. 52% of mill feed as waste and recovers 95% of rare earths
- 1,500 tpd mine but 750 tpd grinding circuit
- RESULT IS ALL TAILINGS WILL GO UNDERGROUND AS BACKFILL

Nitric Acid Leach

- Recycle 80% and process is at 90°C. vs 225°C
- Environmentally Friendly Technology

Solid Phase Extraction (SPE)

- Potential to build a custom separation plant using this technology in Southeast Alaska
- Small Footprint Nanotechnology
- Low Capex
- American Engineered
- Low Cost per Output Unit

Part Two

The Solid Phase Extraction Difference

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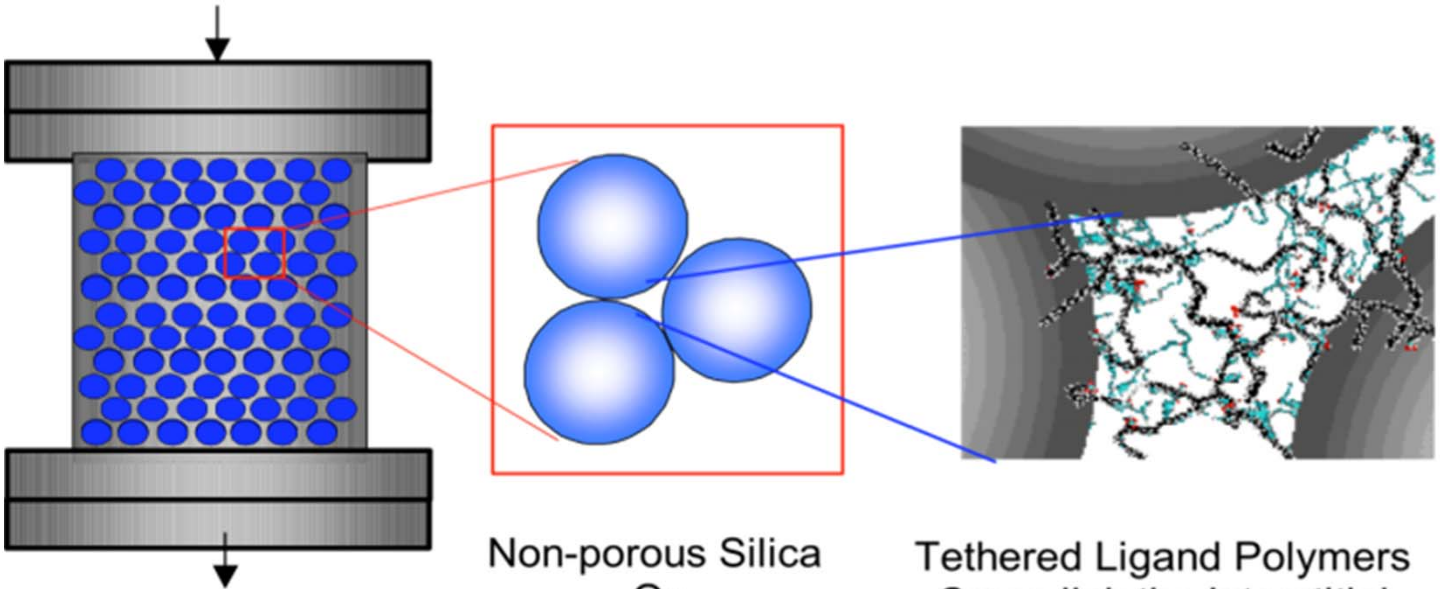
What do we mean by the term “Solid Phase Extraction”?

Solid Phase Extraction (SPE) was developed as a logical improvement on Ion Exchange resin technology to address the question:

Could Ion Exchange with Interstitial SPE Columns be better, faster, cheaper?

Solid Phase Extraction of Rare Earths is an Ion Exchange process using metal-selective binding agents tethered inside nano-composite materials that allow for the rapid separation and processing of Rare Earths

Why Our Ion Exchange "Resin" is Different



Chromatography or Synthesis Column

Non-porous Silica Or Polymer Beads

Tethered Ligand Polymers Cross-link the Interstitial Volumes

Interstitial Ion Exchange/Chelating Columns bring 3 Factors Together:

1. **Rapid Processing:** The fast exchange kinetics allows one to attain chemical equilibrium with seconds of residence time. This means that high separation factors can be attained in each process step.

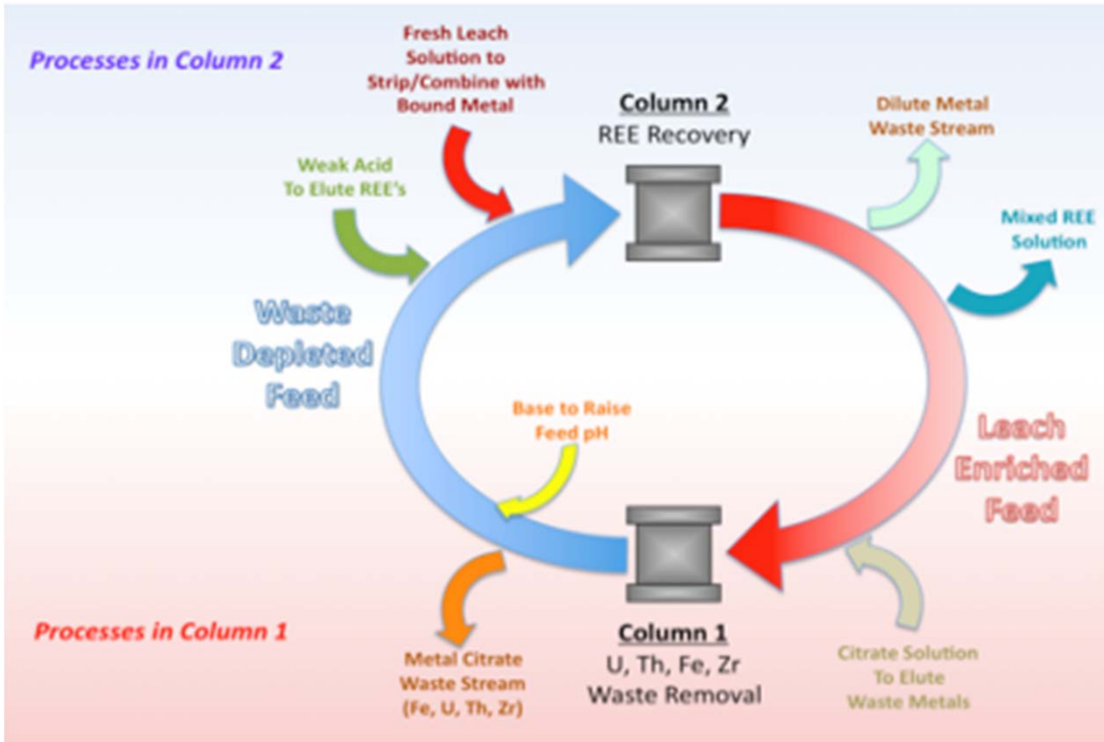
2. **Customizability:** We can synthesize, tweak, and optimize ligand chemistry to make columns that have greater selectivity factors for individual elements.

3. **Established Engineering:** The engineering of ion exchange columns and systems is a mature business and processes with Metals US SPE columns are in fact scaled down ion exchange plants.

Part Three

SPE in Action: *The Bokan Class Separation Process*

Separation of REE Elements from Bokan PLS using SPE



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Class Separation Summary

1. **Waste Removal:** Metal Waste is Removed in Column 1 as a Citrate Solution, and then removed by carbonate precipitation.
2. **Rare Earth Product:** Rare Earths are recovered in an Acetic Acid Solution that can be converted to an oxalate product via oxalic acid precipitation.
3. **High Purity Product:** Rare Earth solution/product is virtually free of all noxious metals (Fe, Al, U, Th), with only significant impurity being calcium.
4. **Industry Leading Results:** Bokan is the only recent Rare Earth Development project to report >99% Removal of Fe, Th, and U in a Class Purification Process.

Component	Bulk Solution Precipitate	Purified Solution Precipitate
Iron, % Fe2O3	14.87	0.02
Thorium, % Th	0.4150	0.0027
Uranium, % U	0.1720	0.0018
% TREE+Y	18.23	27.17
% *Other	15.11	6.415
Loss on Ignition, % LOI	45.51	58.98

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The Purification Advantage

1. **Waste Returned to Backfill:** Metal waste concentrated as oxide to be remixed in barren ore backfill.

2. **Low Discharge Improves Permitability/Mine Launch/Remediation Prospects:** Reducing discharge amerliorates long standing concerns about Rare Earth Mining being a “dirty” process

3. **Avoid Downstream Process Fouling:** REE element purification using solvent extraction is often inhibited/fouled by presence of non-REE contaminants, slowing implementation and disrupting production

4. **High Purity is Essential for Product Value:** Impurities can reduce product value or even prevent salability. Moving product has been a major difficulty lately for MolyCorp/Lynas.

What can be done with excess acid from class purification circuit?

1. **Neutralization/Disposal:** It can be neutralized with a base and the resulting salt can be disposed of.

2. **Neutralization/Regeneration:** It can be neutralized with a base and the resulting salt can be recycled by electrodialysis (ED), such as the Solvay process used at Molycorp for NaCl recycle to HCl and NaOH.

3. **Direct Extraction/Recovery from PLS:** It can be separated from the Rare Earth salts by diffusion dialysis.

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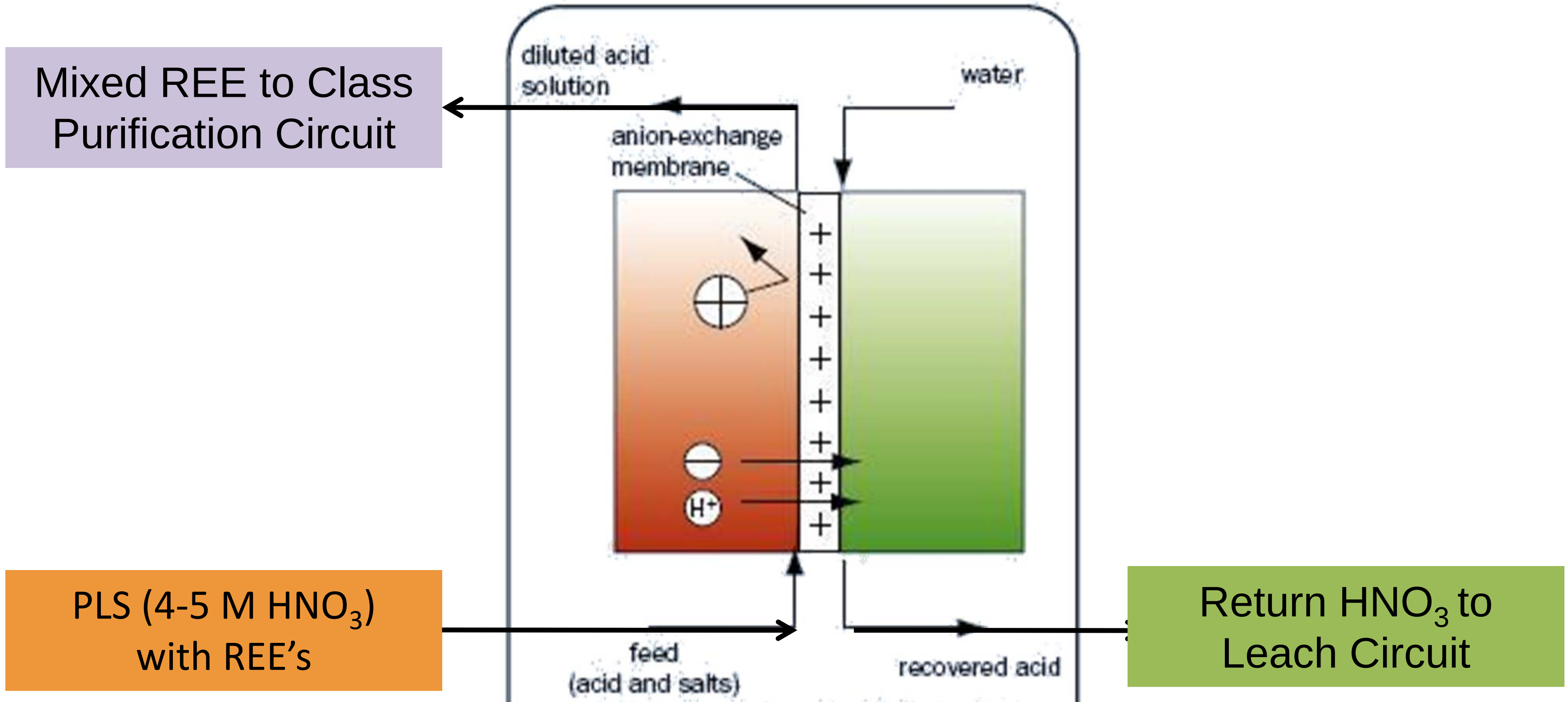
Recovery of HNO3 from PLS by Diffusion Dialysis



Schematic drawing of a diffusion dialysis process for the recovery of acid

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Environmental and Carbon Footprint Differential

Estimated GHG reduction over life of mine : 284,000 tonnes of CO_2

Summary (1,500 tpd mine production case)	**Tonne CO_2 reduction**	
Switching sulfuric to nitric acid	Per Day	LOM
Reduction of freight from Asia (80% recycling of HNO_3)	17.39	62,611
Reduction of acid consumption and leaching temperature	9.71	34,972
Waste heat recovery from power plant	36.67	132,019
Switching diesel to natural gas power generation	5.23	18,824
X-ray ore sorting (52% reduction in grinding energy)	9.89	35,612
TOTAL	**78.90**	**284,039**

U/G mine & no tailings on surface at closure results in very small footprint and minimizes impacts.

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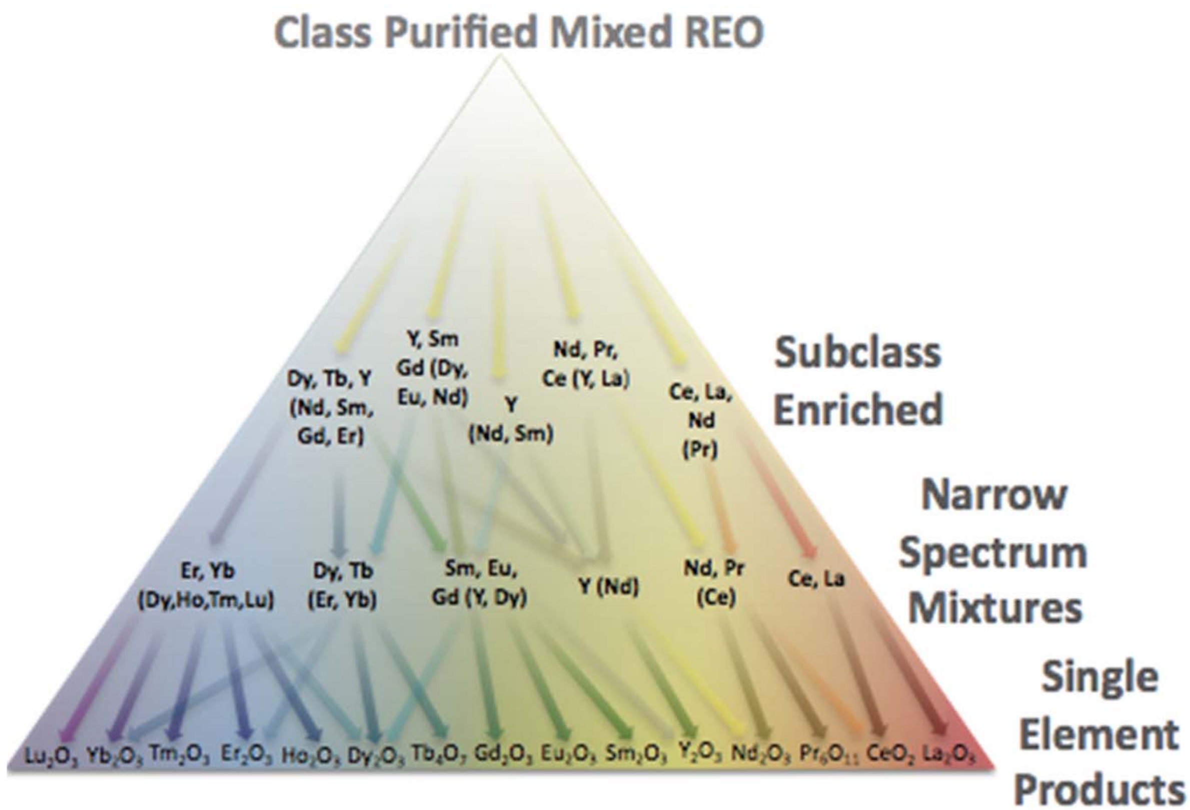
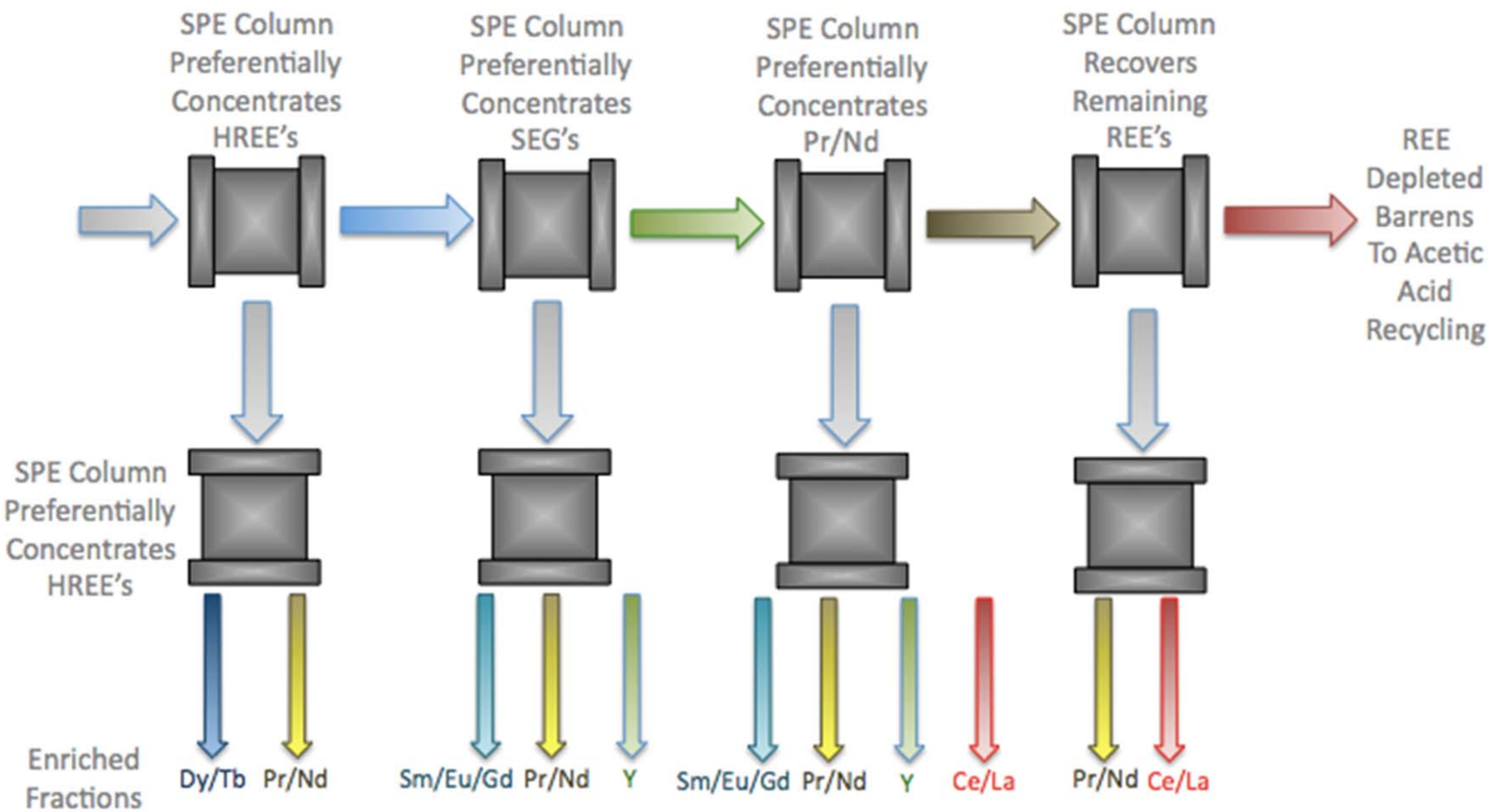
Part Four
REE Element Production With SPE

Element Separation Strategy

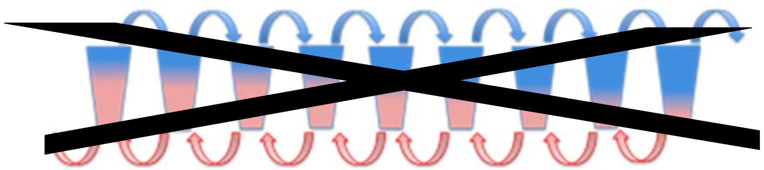


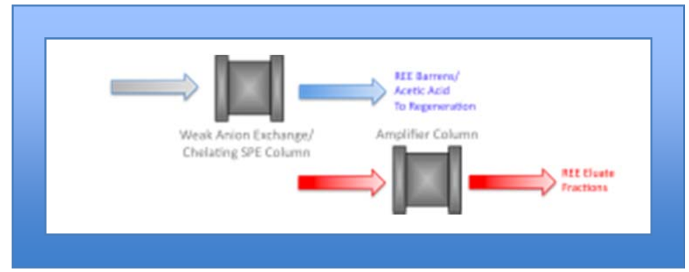
Subclass Enrichment – The First Step



Process Simplification Relative to Conventional Processing

1. Process Simplification – Process reduced to a discrete two column process rather than many SX columns acting in series.

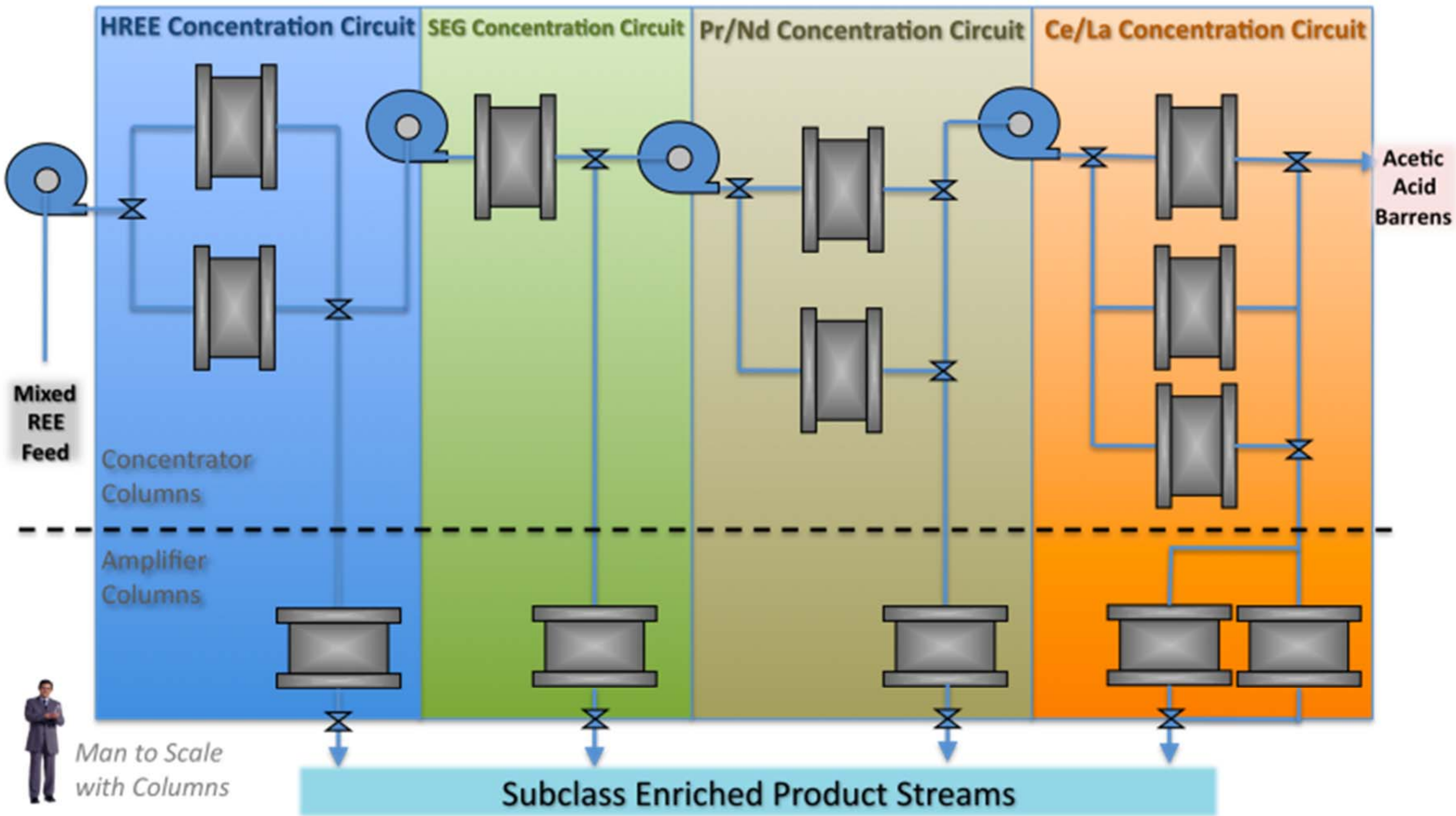




2. High Purification Factor – Substantial purification factors obtained in first processing step. Most of mass transfer (acid/base cost) obtained in one load/elution step.

Single Pass Subclass Enrichment Results			
Concentrate	Enrichment Factor	% Byproduct Removal	Major Impurity Reduction
Heavy	2.9	65%	83% Ce/La Removal, 69 % Didymium Removal
SEG	2.8	64%	78% Ce/La Removal, 68% Yttrium Removal
Yttrium	1.3	26%	47% SEG Removal
Didymium	1.2	16%	41% Heavy Removal
Ce/La	4.0	75%	96% Heavy Removal, 90% SEG Removal

The Bokan Subclass Enrichment System for 2,200 tpa REO



The Cost Advantage of Step Reduction

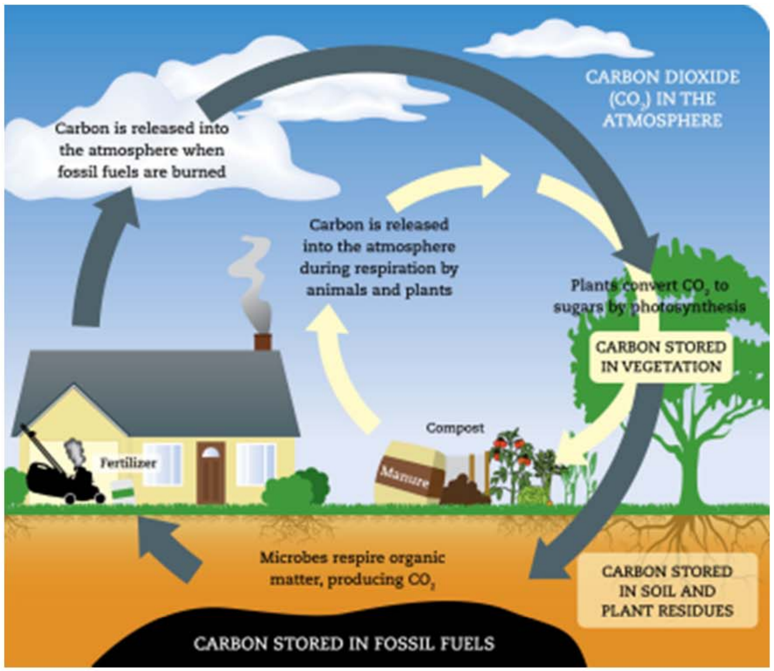
Factor	Solvent Extraction	Solid Phase Extraction
Number of stages	~1000	~100
Acid/base equivalents	2-3	1.15
Stages A/B Equivalents	~2000-3000	~115

Reagent Recycling to Reduce Cost/Waste

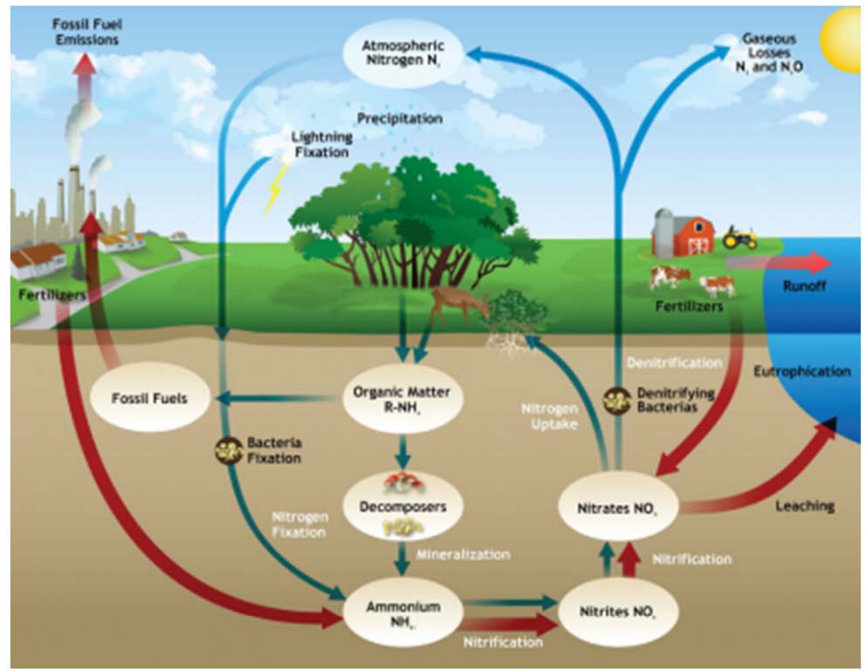
Nature Uses Element Cycles to Recycle Valuable Materials

and Avoid any Permanent "Waste" in the Environment

Carbon Cycle



Nitrogen Cycle



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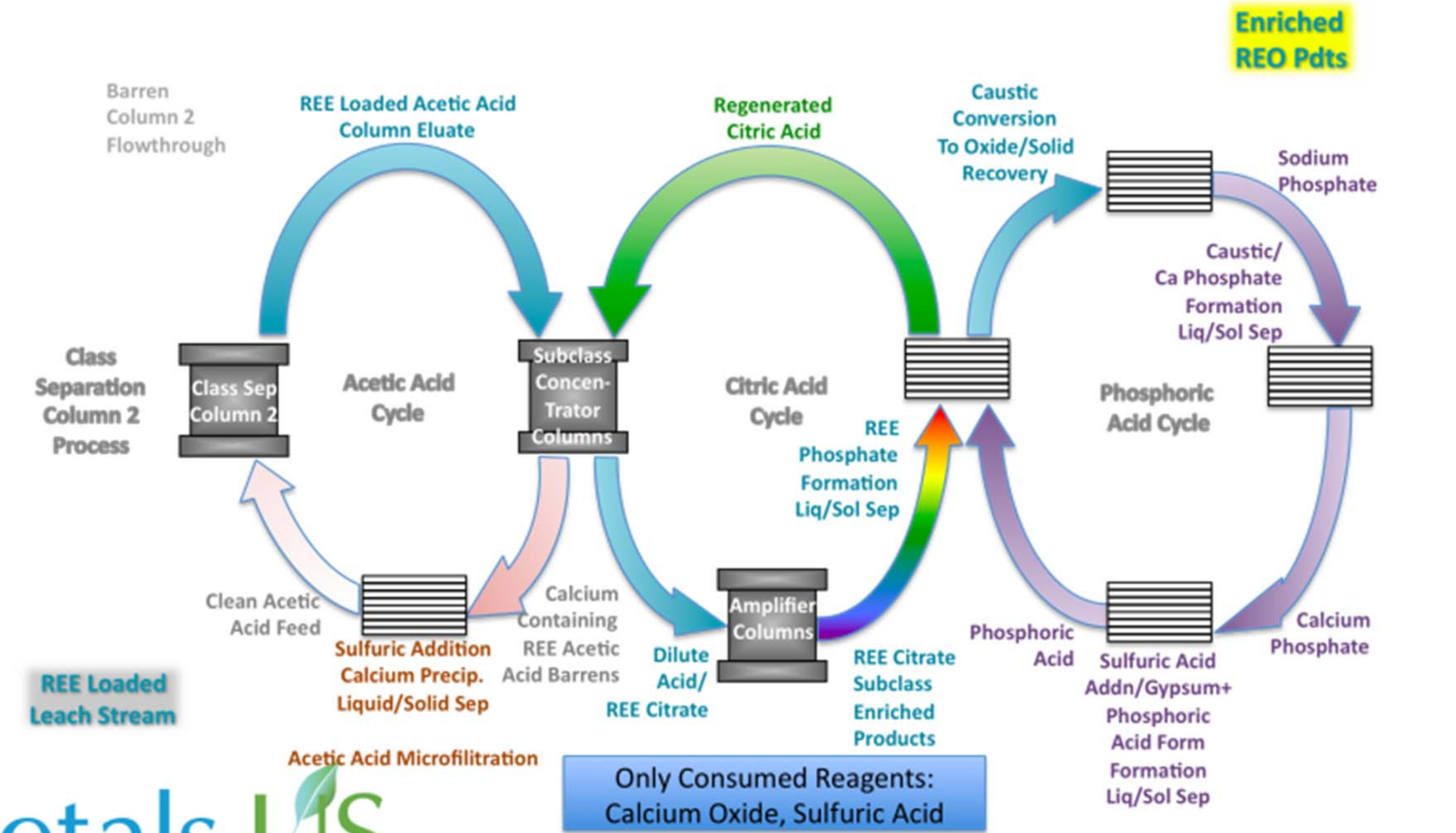
Process Cycles To Produce Enriched REO From Acid Leach

SPE Columns Enable Efficient Recycling of Process Reagents



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Cost of Rare Earth Element Separation Mines with Solvent Extraction Plants Compared to Solid Phase Extraction?

1. Molycorp: > $1 Billion of capital expense

1. Lynas Corp: > $1 Billion of Capital expenses

2. Quest Rare Minerals announces $ 300 M separation plant for 10,423 tpa of produced elements

3. Ucore's Preliminary Economic Assessment finds entire capital cost for the mine and the 2500 tpa RE element production plant to be $221M. This includes the SPE plant for less than $30M

Part Five

Summary

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Permitting and Organization Usually Wags the Dog

- **Process Intensive:** The mine permitting process is a combination of approvals of mine plan operations and closure and involves the politics of the agencies involved
- **Agency Support:** Ucore has worked with US Department of Defense to get an initial technical "buy in" for the project.
- **Peer Review:** This was done by means of a grant from DOD to Ucore to IntelliMet to describe the process parameters and economics. We gave DOD a 200+ page report with the model of the RE element separation process for the 2250 tpa plant to purify all of the REE's.
- **Community Support:** Ucore has established excellent relationship with the regional Native American constituency with the prospect of local jobs
- **Government Bond Offsets:** Ucore has received legislative approval for $145 M bond issue to support the Bokan Mountain mine.
- **Permitting Support:** This "buy in" by the State political structure should be helpful in reducing the permitting times
- **Reducing Footprint:** The mine plan is near-zero emissions

Attention to Overall Package Pays Off

Alaska Legislature Unanimously Approves $145 Million Bond Funding Legislation for Ucore's Bokan-Dotson Ridge

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April 28, 2014 – Halifax, Nova Scotia – Ucore Rare Metals Inc (TSX-V:UCU) (OTCQX: UURAF) ("Ucore" or "the Company") is pleased to comment on the passage of Senate Bill 99 ("SB 99" or "the Bill") by the Alaska State Legislature in a unanimous vote, with all 38 representatives in attendance voting in favor of the Bill.

SB 99 was introduced by Senator Lesil McGuire (AK-R). Senator Bert Stedman (AK-R) proposed the amendment which would authorize the Alaska Industrial Development and Export Authority ("AIDEA") to issue bonds to finance the infrastructure and construction costs of the Bokan-Dotson Ridge rare earth element project up to a principal amount of $145 million, subject to its own internal due diligence and Board approval. SB 99 was presented to the House by Representative Feige (AK-R) and cross-sponsored in the House by Representatives Munoz (AK-R), Kito III (AK-D), Kreiss-Tomkins (AK-D), Wilson (AK-R) and Isaacson (AK-R).

"I am thrilled to have been able to take the next step toward realizing Alaska's potential for rare earth minerals mining," said Alaska State Senator Lesil McGuire (R- Anchorage). I have long seen the need for a US source of these important materials and the potential benefit for Southeast Alaska and our state economy. Senate Bill 99 offers Ucore the chance to partner with AIDEA and make this tremendous project a reality."

Summary – How to Streamline Mine Opening/Closure

Reduce – Reduce Size (High Througput units), modularize, and simplify process to reduce cost, permitting, power consumption, and implementation time

Reuse – Employ processes that minimize waste output and environmental impact to avoid permitting and remediation barriers

Recycle – Recycle reagents to minimize reagent consumption Opex and tailings pond waste

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With Better Technology you
Can Have both kinds of
Green