



# Idea to Deliverable: The Engineering Design Process

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*Changing the World's Energy Future*

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## Overview

The engineering design process is utilized to evolve an idea into a deliverable. This progression can take years, so to experience as much of the full design process as possible, this internship period was dedicated to working on several projects in different phases of the process. The result is a completed engineering project which provides a foundation that can be used to conduct research on a system by performing experiments, collecting data, and making changes as necessary to improve the system and answer new questions.

### CMI Rare Earth Separations

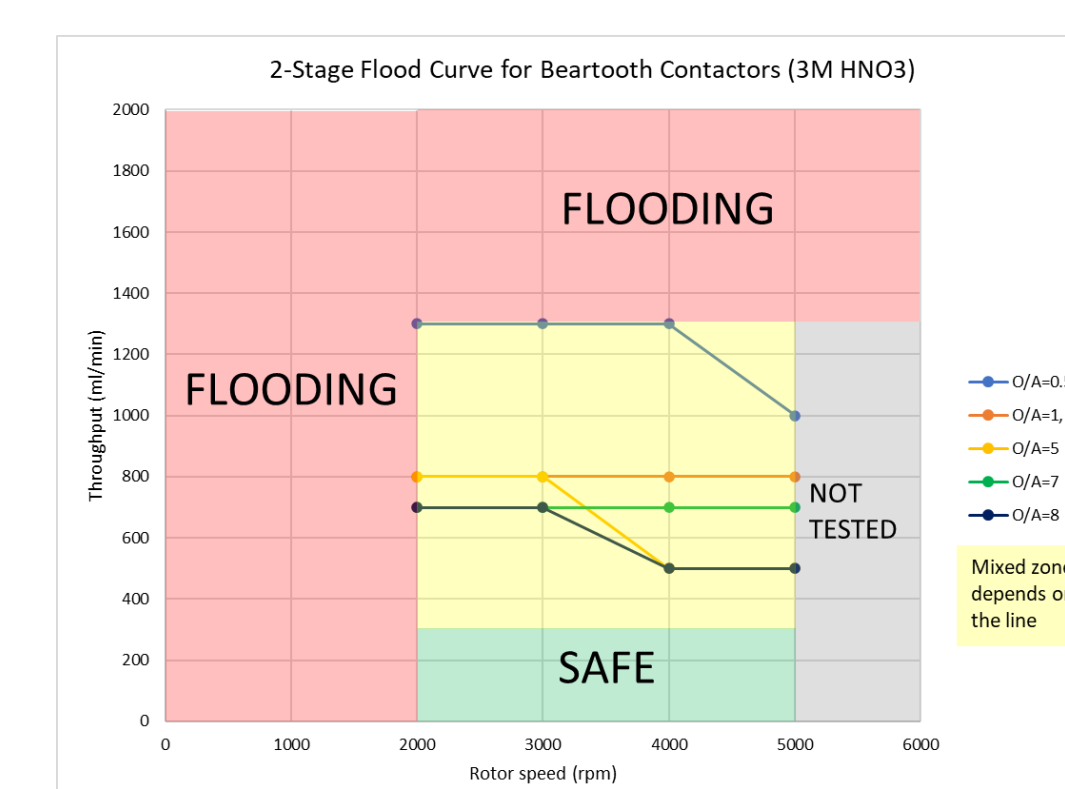
- Energy Fuels collaborated with our group to test a simulated monazite feed for selective scrubbing.
- A mixer-settler and centrifugal contactor were used for testing to compare performance in each.



Two-stage centrifugal contactor setup for Beartooth characterization tests.

### Beartooth

- Beartooth is a project dedicated to designing a transuranic glovebox for nuclear fuel reprocessing research.
- The centrifugal contactors to be used were characterized, and flood curves were developed.
- Sequence of operations documents were updated as a result of modifications to the P&IDs.



Flood curve developed from two-stage Beartooth contactor testing.

### Xenon/Krypton Off-gas System

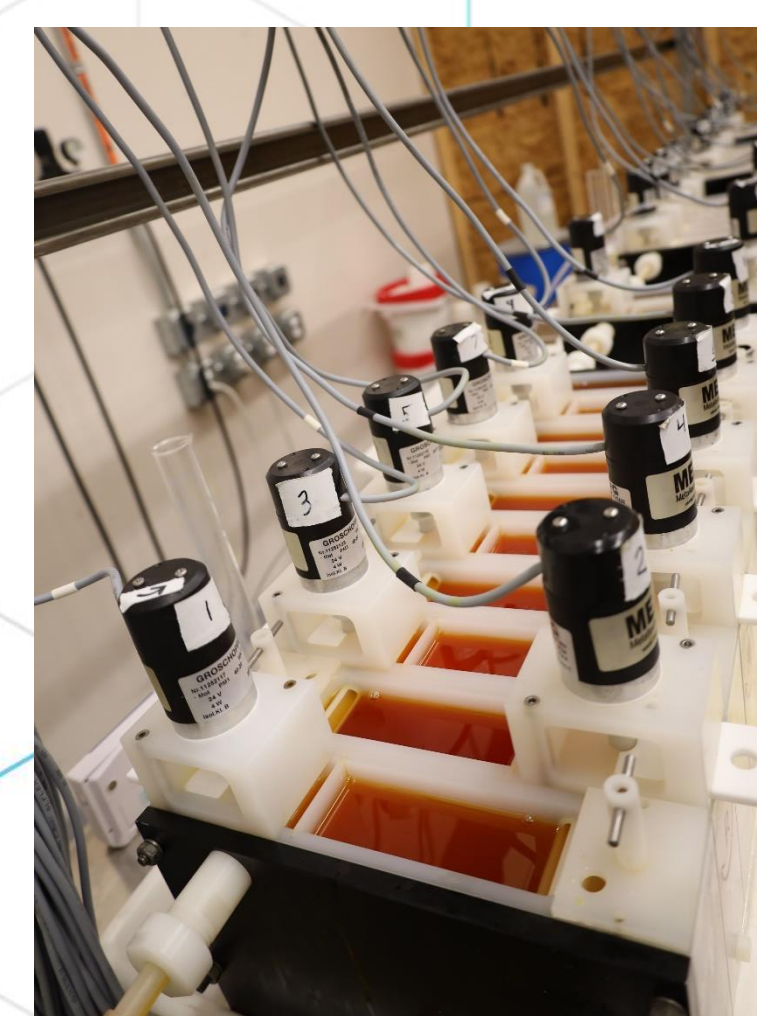
- The xenon/krypton off-gas system utilizes sorbents to separate Xe and Kr for reprocessing research.
- The goal is to concentrate Kr as much as possible to reduce the volume of radioactive waste.
- Gas chromatography is used to analyze the product gas.



Off-gas system arrangement, including feed lines and coolers.

### CMI Lithium Capture Ligand

- Oak Ridge National Laboratory developed a ligand for extracting lithium and tasked our group with testing it.
- Batch contacts were performed to determine its suitability for a process scale by quantifying its efficiency and selectivity for lithium extraction as well as its separation qualities.



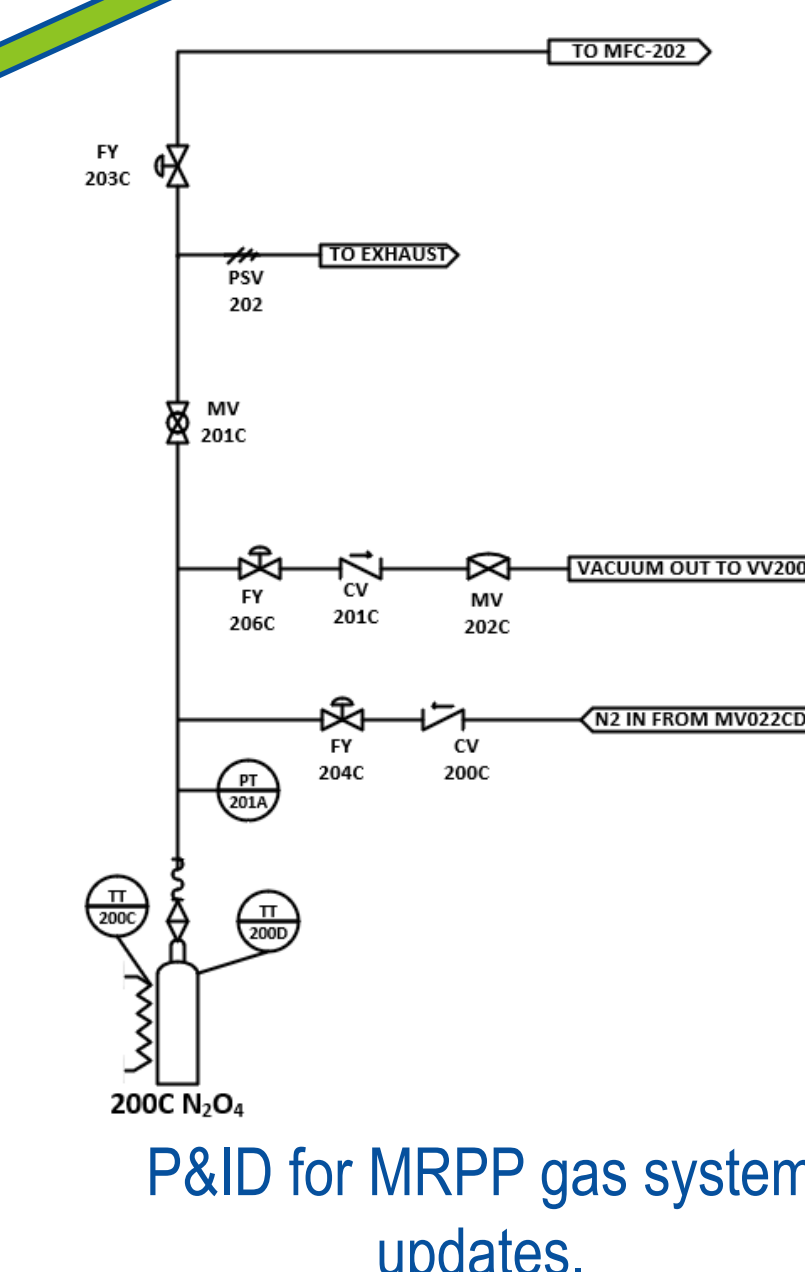
Mixer-settler configuration for Mountain Pass testing.

### Mountain Pass

- Mountain Pass developed a flowsheet for lanthanide separation and partnered with INL to run proof-of-concept tests.
- Mixer-settlers were used to confirm flowsheet design in process equipment.

### Material Recovery Pilot Plant

- The Material Recovery Pilot Plant (MRPP) is used for tests involving decladding used nuclear fuel.
- Updates to a gas system required a rebuild and therefore a commissioning plan to ensure modifications will result in expected outcomes.



### Moran

- Moran is a pilot scale PUREX plant utilized for nonproliferation research.
- Radiological work was performed to collect samples from a unit operation in a contamination area following a run.

