MINING

Process Research Services

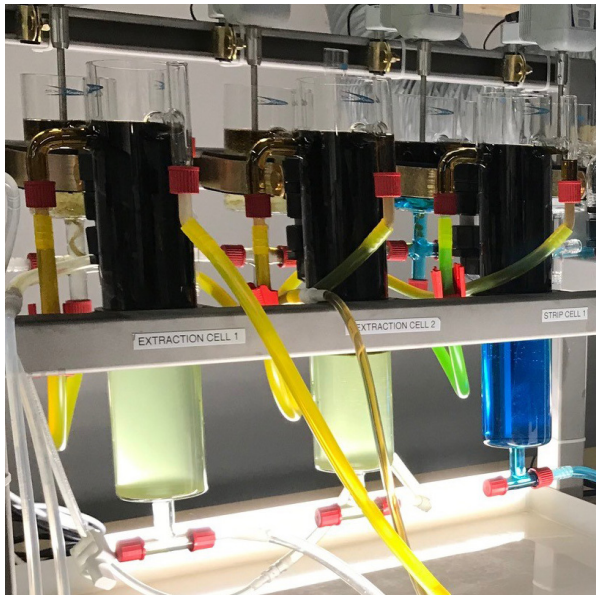
Model & Test Systems to Solve Complex Problems Efficiently

We offer independent process and flow sheet development through bench testing, pilot scale testing and computer modeling. These investigations supply critical engineering design data in order to minimize overall risks and reduce costly retrofits after a facility is commissioned. We're fully equipped to conduct this work remotely at our facility, or at a client site.

Unique Tools & Flexible Solutions

- **Engineering data** is used for thorough cost evaluations, and to clearly communicate viability and risks to stakeholders.
- **Scale testing** enables HDR to help quantify, minimize and communicate project risk from concept through detailed design and commissioning for full-scale operation.
- **Unit operations** can be studied on a bench scale to better understand the product, consumables, reaction kinetics and materials handling.
- **Pilot scale efforts** are continuous in nature and lend themselves to more rigorous economic analysis of final design. They study a collection of unit operations in concert to gather critical real world design data under a range of conditions.

PROBLEM FRAMING	MODELING & SIMULATION	BENCH TESTING & SCALING	FEASIBILITY, COST ESTIMATION & PLANNING	DESIGN, BID, BUILD & OPERATE
INDIVIDUAL OR INTEGRATED SERVICES				
• Problem Definition • Options Assessment • Screening Analysis • Class 5 Cost Assessment • Literature Review and Feasibility	• Process Flow Diagrams • Mass Balance Analysis • Energy Balance • OLI Modeling and Process Simulation • Test Planning • Conceptual Optimization	• Field Sample Collection and Storage (MSHA & OSHA) • Static Process Testing • Logistical Assessment • Continuous Flow Lab-Based Pilot Testing • On-site Pilot Testing • System Scale-Up Planning	• Feasibility Assessment • CAPEX Cost Estimation • OPEX Estimation • Scheduling • Permitting • Strategic Communications • Operation and Training	• Budgeting and Detailed Cost Estimation • Detailed Engineering and Bid Preparation • Construction Oversight • Commissioning • Final System Operation and/or Handover and Operator Training



Our project research capabilities include hydrometallurgical, pyrometallurgical, electrowinning, and mineral purification processes. In addition to our research and development, we provide a full range of design engineering and cost estimation for industrial chemical plants and mineral treatment facilities. Waste characterization and treatability studies, waste reduction analysis, and valuable byproduct recovery from waste streams are routinely performed for our industrial clients.

Better Planning & Budgeting:

Off-site bench and pilot testing supports more robust budgeting.

- Accurate Cost Estimates for CAPEX and OPEX
- Better Logistics Planning
- Early Supply Chain Establishment
- Reduced Field Time and Risk Exposure for Personnel
- Data-Centered and Risk-Based Decision Making
- Reduced Rework on Full Scale Design

Applications for HDR Pilot Testing:

- Extractive Metallurgy
- Material Science Development (i.e. fracking materials, catalysts or micron materials)
- Combustion Studies
- Water and Wastewater Studies
- Soil Remediation
- Waste Minimization
- Emissions Planning
- Process Harmonization
- Pre-Feasibility Studies

Our Mining Clients Have Utilized HDR's Expertise to Develop Processes Including:

- Solvent Extraction
- Electrowinning
- Absorption and Desorption
- Ion Exchange
- Drying
- Crystallization
- Selective Precipitation
- Evaporation and Mass Transfer
- Kiln and Autoclave
- Fluidized Beds

Industrial Processes That Benefit From Pilot Testing Include:

- Metals Leaching
- Filtration
- Chemical Reaction/Mixing
- Acid Rock Generation Potential

How Can We Help?

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