# CESL
## Hydrometallurgical Testwork

### What We Can Offer You
- Competitive Processes
- Process Development Expertise
- A World Class Metallurgical Facility
- Experienced Team of Professionals

### About Us

Teck has developed hydrometallurgical processes collectively known as the CESL Processes which are patented and proprietary to Teck. The CESL Processes are cost competitive and regarded as thoroughly tested. They have been developed at CESL’s world class hydrometallurgical facility in Richmond, BC, Canada.

CESL’s experienced personnel have a long history working with industry clients to develop hydrometallurgical solutions using CESL or other technology for a wide range of materials including copper, copper-nickel, copper-gold and high arsenic-copper concentrates. Let us help you.

### Our Capabilities, Facility and Personnel

The CESL facility has 5,600 m² of office, testing labs, plant and warehouse space with additional external storage. The facility is permitted to run all levels of testwork up to and including copper and gold demonstration plants. There is in-house maintenance, instrumentation and analytical capabilities to support construction, testwork and operations. Comprehensive bench testing programs are carried out using batch bench scale autoclaves. The Pilot Plant facility can be used for copper, molybdenum, or nickel and has the capability for recovery of gold and silver from the copper or nickel leach residue.

At about 30 times the size of the Pilot Plant, the Copper Demonstration Plant has a capacity of approximately 1 to 2 tonnes per day LME grade-A copper cathode. The purpose of the Demonstration plant is to test commercial materials and equipment and provide confirmatory engineering data for the project. The recently constructed Gold Demonstration Plant can recover gold and silver treating approximately 4 tonnes per day of copper plant residue.

Although these plants are currently configured to run CESL technology, the unit operations can be reconfigured to run other hydrometallurgical flowsheets or single unit operations.

The unit operations include:
- Grinding
- Pressure Leach
- Atmospheric Leach
- Evaporation
- Solvent Extraction
- Electrowinning
- Thickening & Filtration
- Neutralization
- Effluent Treatment
- Purification
- Carbon Absorption
- Cyanide Recovery

Pilot and demonstration operations, usually carried out on a 24 hour/ 7 days per week basis, provide extensive metallurgical data to ensure optimal operations are achieved in support of future engineering studies. Flowsheet design and operations are managed by a qualified technical team.

CESL has in-house engineering capabilities to generate preliminary capital and operating cost estimates as well as initial project financial analyses. Mass and energy balances are used to support flowsheet development and continuous testwork to compile a process engineering package. The CESL team has considerable experience working with external engineering companies on further evaluation, design and construction.

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Hydrometallurgical Testwork

The variety and scale of installed equipment allows CESL to manage various hydrometallurgical test programs that may be outside of the CESL Process conditions and operating parameters. This flexibility allows CESL to work on internal or client projects by technically evaluating new business opportunities, improving existing operations and developing new technologies. CESL optimizes programs and mitigates technical risk by offering three levels of testwork at our extensive facilities. They are bench, pilot and demonstration scale.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Bench Scale</strong></td>
<td>Pressure leaching testwork can be performed using batch bench scale pressure oxidation autoclaves. The CESL facility has the ability to conduct tests using 2 and 20 litre autoclaves. The purpose of bench scale testwork is to develop the basic metallurgy of a concentrate sample and generate scoping level costs. A concentrate sample of 5 to 10 kg is typically required to perform a comprehensive bench testing program. Smaller samples are sufficient for standard bench scale tests. Quantitative mineralogy is carried out using advanced analytical equipment at Teck’s Applied Research and Technology centre.</td>
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<td><strong>Pilot Scale</strong></td>
<td>CESL can conduct continuous pilot plant campaigns from concentrate re-grind through to production of 35 kg per day LME grade-A copper cathode. As well, the pilot plant facilities are capable of recovering nickel, cobalt, and zinc from sulphide concentrates. A fully integrated precious metal recovery circuit is available to recover gold and silver from the leach residue. A concentrate sample of 6 to 8 tonnes is typically sufficient to perform a 60-day campaign. The purpose of the pilot scale testing is to confirm the overall process flowsheet. Various flowsheet configurations are possible within the pilot plant facilities using standard unit operations.</td>
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<td><strong>Demonstration Scale</strong></td>
<td>The CESL Demonstration Plant consists of a fully integrated copper plant, from concentrate re-grind through to production of commercial size LME grade-A copper cathode as well as residue treatment for gold and silver recovery. A sample of several hundred tonnes of concentrate is typically required to perform a campaign. Single unit operations can also be used to evaluate various technologies. The purpose of the demonstration scale is to utilize small scale commercial equipment and collect engineering data for accurate scale-up of process equipment.</td>
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<td><strong>Commercial Scale</strong></td>
<td>Vale has constructed a 10,000 tonne per year CESL copper plant that is currently operating in the Carajás region of Brazil. The plant is intended to be a prototype, supporting construction of a much larger plant to process nearby concentrates from future Vale projects. The purpose of the plant is to train personnel in the region and to demonstrate the technology on a commercial scale. This is the first commercial hydrometallurgical facility using CESL technology. CESL process engineers and metallurgists are actively supporting operations on-site in Brazil.</td>
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