

## Appendix: Summary of areas of expertise in Quebec

Name	Areas of Expertise	Facilities/Equipment	Examples of Projects/Application
Centre of Chemical Process Studies of Quebec (CEPROCQ) <a href="http://www.ceprocq.com">www.ceprocq.com</a>	<ul style="list-style-type: none"> <li>. Surface treatment technologies</li> <li>. Bioindustrial technologies</li> <li>. Environmental technologies</li> <li>. Training in industrial automation</li> </ul>	<ul style="list-style-type: none"> <li>. Process simulation laboratory</li> <li>. Chemistry laboratory (bench scale and analytical chemistry)</li> <li>. Health and safety room for manipulating products</li> </ul>	<ul style="list-style-type: none"> <li>. Optimization of production, catalysis, reagents</li> <li>. Effluent and odour treatment</li> </ul>
Centre intégré de fonderie et de métallurgie (CIFM) <a href="http://www.cifm.qc.ca">www.cifm.qc.ca</a>	<ul style="list-style-type: none"> <li>. Development and optimization of metallic materials</li> <li>. Development and optimization of metallurgical processes</li> </ul>	<ul style="list-style-type: none"> <li>. Furnaces for thermal treatment of steel and aluminium</li> <li>. Carburizing, nitriding, annealing, hardening and tempering furnaces</li> </ul>	<ul style="list-style-type: none"> <li>. Recycling of scrap aluminium</li> <li>. Carburizing treatment to produce non-toxic salts</li> </ul>
Centre de transfert technologique en écologie industrielle (CTTÉI) <a href="http://www.cttei.qc.ca">www.cttei.qc.ca</a>	<ul style="list-style-type: none"> <li>. Refinement of value-added products through the reclamation of industrial wastes</li> <li>. Characterization of residual materials</li> <li>. Support to ensure regulatory compliance</li> </ul>	<ul style="list-style-type: none"> <li>. Chemistry and health and safety laboratory</li> <li>. Soil, sediment, liquid and gas sampling equipment</li> <li>. Equipment for carrying out leaching tests using EPA Method 1311 TCLP</li> </ul>	<ul style="list-style-type: none"> <li>. Production of calcium acetate and magnesium acetate from steelmill slag.</li> <li>. Evaluation of technical performance, environmental and industrial hygiene characteristics of an abrasive (Sorelmix) used for sandblasting</li> </ul>
Centre de technologie minérale et de plasturgie inc. (CTMP) <a href="http://www.ctmp.ca">www.ctmp.ca</a>	<ul style="list-style-type: none"> <li>. Purification of mineral substances</li> <li>. Crushing, grinding and screening</li> <li>. Recycling of mine tailings</li> </ul>	<ul style="list-style-type: none"> <li>. Grinder</li> <li>. Crusher</li> <li>. Pulverizer</li> <li>. Screener</li> </ul>	<ul style="list-style-type: none"> <li>. Ore processing</li> <li>. Asbestos fibre treatment</li> </ul>
Centre national en électrochimie et en technologies environnementales (CNETE) <a href="http://www.cnete.qc.ca">www.cnete.qc.ca</a>	<ul style="list-style-type: none"> <li>. Zero effluent concept</li> <li>. Reclamation of organic compounds through fermentation</li> </ul>	<ul style="list-style-type: none"> <li>. Ozone generator</li> <li>. Solid-liquid separator</li> <li>. Membranes</li> <li>. Settling tanks/filters.</li> </ul>	<ul style="list-style-type: none"> <li>. Conversion of shrimp waste into a value-added product</li> <li>. Effluent treatment</li> <li>. Electrochemistry</li> </ul>
Centre de recherche en environnement UQÀM–Sorel-Tracy (CREUST) <a href="http://www.cttei.qc.ca">www.cttei.qc.ca</a>	<ul style="list-style-type: none"> <li>. Characterization of fine and ultrafine residues</li> </ul>	<ul style="list-style-type: none"> <li>. Capillary porosity, specific surface area and chemisorption</li> <li>. Thermo-gravimetric analysis and differential thermal analysis</li> <li>. Zeta potential and electrokinetic amplitude</li> <li>. Gas ultracycrometer for solids and powders</li> <li>. Particle size analyzer (Matec APS-100)</li> </ul>	<ul style="list-style-type: none"> <li>. Production of pigment-based paint from carbon steel dust</li> <li>. Treatment of contaminated sediments</li> <li>. Bioavailability of metals</li> </ul>
Department of Chemical Engineering Université de Sherbrooke <a href="http://www.usherbrooke.ca/gchimique/personnel/profs/soucy">www.usherbrooke.ca/gchimique/personnel/profs/soucy</a>	<ul style="list-style-type: none"> <li>. Industrial application of plasma technologies</li> </ul>	<ul style="list-style-type: none"> <li>. Arc torches</li> <li>. Arc furnace, plasma arc furnace, oxyfuel furnace, oxygas furnace</li> <li>. Induction heating</li> <li>. Comprehensive analytical laboratory</li> </ul>	<ul style="list-style-type: none"> <li>. Reclamation or destruction of solid, liquid and gaseous wastes</li> <li>. Synthesis of ultrafine ceramic powders</li> </ul>

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<p>NSERC- Polytechnique-UQAT Environment and Mine Wastes Management Industrial Chair</p> <p><a href="http://www.enviro-geremi.polymtl.ca">www.enviro-geremi.polymtl.ca</a></p> <p>NSERC Industrial Chair in Site Remediation and Management</p> <p><a href="http://www.polymtl.ca">www.polymtl.ca</a></p>	<ul style="list-style-type: none"> <li>.Development of geo-environmental tools and techniques</li> <li>.Characterization of mine tailings and environmental impacts</li>   <li>.Site conservation and rehabilitation</li> <li>.Fundamental knowledge of biotechnology applied to site remediation</li> </ul>	<ul style="list-style-type: none"> <li>.Leach columns</li> <li>.Triaxial cells for permeability testing and cells for oxygen diffusion and consumption testing</li> <li>.Tempe cells</li> <li>.Sedimentation and consolidation of treatment sludge and tailings</li> <li>.Mercury-pump porosimeter and scanning electron microscope</li> <li>.<i>In situ</i> and <i>ex situ</i> biofilters</li> <li>.Permeable reactive walls</li> </ul>	<ul style="list-style-type: none"> <li>.Integrated management of wastes while the mine is in operation</li> <li>.Remediation of storage sites that generate acid leachate after a mine is closed</li>   <li>.Development of simple and inexpensive biotechnology solutions for treating and containing organic pollutants and heavy metals in soils, contaminated residues and groundwater</li> </ul>
<p>INRS–Eau, Terre et Environnement</p> <p><a href="http://www.inrs-ete.quebec.ca">www.inrs-ete.quebec.ca</a></p>	<ul style="list-style-type: none"> <li>.Reclamation of organic materials, treatment of mine wastes</li> <li>.Statistical and numerical analysis methods, modelling, remote sensing and geomatics techniques applied to flows</li> </ul>	<ul style="list-style-type: none"> <li>.Atomic absorption spectrophotometer (flame and graphite furnace)</li> <li>.Inductively coupled plasma emission spectrophotometer (ICP)</li> <li>.UV-visible spectrophotometer</li> <li>.Scintillation counter</li> <li>.Gamma counter</li> <li>.Particle counter</li> <li>.Microscopes and image processing room</li> <li>.Liquid, gas and ion-exchange chromatography</li> <li>.Organic and inorganic carbon analyser</li> <li>.NCS analyzer</li> <li>.Technicon-type autoanalyzers</li> <li>.Clean room</li> </ul>	<ul style="list-style-type: none"> <li>.Reclamation of municipal sludges</li> <li>.Decontamination, stabilization</li> </ul>
<p>INRS-Énergie</p> <p><a href="http://www.inrs-ener.quebec.ca">www.inrs-ener.quebec.ca</a></p>	<ul style="list-style-type: none"> <li>.Expertise in energy and in laser–material interactions</li> </ul>	<ul style="list-style-type: none"> <li>.Laser units</li> </ul>	<ul style="list-style-type: none"> <li>.Generation of extremely hot plasma</li> </ul>
<p>McGill Metals Processing Centre (MMPC)</p> <p><a href="http://www.mmpc.mcgill.ca">www.mmpc.mcgill.ca</a></p>	<ul style="list-style-type: none"> <li>.Optimization of metal processing</li> </ul>	<ul style="list-style-type: none"> <li>.Electric resistance furnace</li> <li>.Direct heat furnace</li> <li>.Metal quality analyzers</li> <li>.Characterization equipment</li> </ul>	<ul style="list-style-type: none"> <li>.Control of steel rolling</li> <li>.Monitoring of metal quality</li> </ul>

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Centre de recherche industrielle du Québec (CRIQ) <a href="http://www.criq.qc.ca">www.criq.qc.ca</a>	<ul style="list-style-type: none"> <li>. Expertise in biotechnology applications for the environment (water, air, soil)</li> </ul>	<ul style="list-style-type: none"> <li>. Preparatory HPLC</li> <li>. Chemical reactors</li> <li>. CO2 extractor</li> <li>. Tournaire extractor-evaporator</li> <li>. Vacuum reactor Extractor-pulverizer</li> <li>. Thermokinetic mixer</li> </ul>	<ul style="list-style-type: none"> <li>. Treatment of soils contaminated with heavy metals and phenols</li> <li>. Process control</li> <li>. Automation</li> </ul>
CANMET Energy Techology Centre <www.cedrl.mets.nrcan.gc.ca>	<ul style="list-style-type: none"> <li>. Reduction in greenhouse gas emissions</li> <li>. More sustainable use of energy</li> <li>. Enhancement of companies' ability to innovate</li> </ul>	<ul style="list-style-type: none"> <li>. Multi-purpose laboratories and facilities that can be used for various energy configurations</li> </ul>	<ul style="list-style-type: none"> <li>. Enhancement of the energy efficiency of processes and buildings</li> </ul>
COREM, mineral research consortium <a href="http://www.corem.qc.ca">www.corem.qc.ca</a>	<ul style="list-style-type: none"> <li>. Pre-competitive research in processing and transformation of mineral substances</li> </ul>	<ul style="list-style-type: none"> <li>. Grinder</li> <li>. Shredder</li> <li>. Static mixers</li> <li>. Drum filter and belt filter press</li> <li>. Fluidized bed with a magnetic field</li> <li>. Screen/reactor</li> <li>. Membrane with electric field</li> <li>. Electrolyzer</li> <li>. Settling tank</li> <li>. Solid-liquid separator</li> <li>. Incinerator</li> <li>. Disc filter</li> </ul>	<ul style="list-style-type: none"> <li>. Addition of coke in the iron pellet production process</li> <li>. Management of primary and secondary energy sources in iron pellet baking furnaces</li> </ul>
Biotechnology Research Institute (BRI) <a href="http://www.bri.nrc.ca">www.bri.nrc.ca</a>	<ul style="list-style-type: none"> <li>. Development of bioprocesses</li> <li>. Biological treatment of soils, groundwater, sediments, air and contaminated industrial effluents</li> </ul>	<ul style="list-style-type: none"> <li>. Bioreactors of various sizes</li> <li>. Analytical equipment</li> <li>. Fractionation equipment</li> </ul>	<ul style="list-style-type: none"> <li>. Decontamination processes</li> <li>. Biotechnology application to separate and treat contaminants</li> </ul>
Industrial Materials Institute (IMI) <a href="http://www.imi.nrc.ca">www.imi.nrc.ca</a>	<ul style="list-style-type: none"> <li>. R&amp;D work focussing on materials, their composition/formulation, forming and related process control</li> </ul>	<ul style="list-style-type: none"> <li>. Formulation and forming equipment for metals and polymers</li> </ul>	<ul style="list-style-type: none"> <li>. Design related to the formulation and forming of metals</li> </ul>
Laboratoire des technologies de l' énergie (LTE) <a href="http://www.hydroquebec.com">www.hydroquebec.com</a>	<ul style="list-style-type: none"> <li>. Developing and promoting effective and innovative applications for electricity</li> </ul>	<ul style="list-style-type: none"> <li>. Static mixers</li> <li>. Membrane with electric field</li> <li>. Evaporator</li> <li>. Induction heating</li> <li>. Plasma arc furnace.</li> </ul>	<ul style="list-style-type: none"> <li>. Treatment of organic sludges by plasma-assisted oxidation, with ash recovery</li> </ul>

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<p>Observatoire de l' environnement et du développement durable in Sherbrooke (Theme 5: waste management)</p> <p><a href="http://www.usherbrooke.ca/observatoire/recherche/axes.html">www.usherbrooke.ca/observatoire/recherche/axes.html</a></p>	<p>More than 20 professor/researchers with their high-calibre teams.</p> <ul style="list-style-type: none"> <li>.Reduction and reuse</li> <li>.Recycling of residual materials</li> <li>.Reclamation of industrial wastes and by-products</li> </ul>	<ul style="list-style-type: none"> <li>. All the leading-edge equipment needed for chemical and physical characterization, as well as micro - and nanostructural characterization of materials</li> <li>.Several research laboratories on campus</li> </ul>	<ul style="list-style-type: none"> <li>. Reclamation of industrial by-products (cement and concrete)</li> <li>Reclamation of deinking residues</li> <li>. Reclamation of organic polymers</li> <li>. Reclamation of red clays</li> <li>. Reclamation of urban wastes and biomass</li> </ul>
<p>Chaire de valorisation du verre dans les matériaux</p> <p><a href="mailto:a.tagnit@usherbrooke.ca">a.tagnit@usherbrooke.ca</a></p>	<ul style="list-style-type: none"> <li>. Reclamation of industrial by-products in cement and concrete</li> <li>.Physico-chemistry of cementitious systems</li> <li>.Development of new cementitious systems</li> </ul>	<ul style="list-style-type: none"> <li>. All the leading-edge equipment needed for chemical and physical characterization, as well as micro - and nanostructural characterization of materials</li> <li>.A very advanced cement and concrete laboratory</li> </ul>	<ul style="list-style-type: none"> <li>. Reclamation of glass contained in with concrete</li> </ul>