

MATERIALS, METALLURGICAL, AND MINERAL PROCESSING: DISCIPLINE-SPECIFIC INDICATORS

Competency Category 1 – Technical Competence		Overall Level: 3
Competencies		
1.1	Demonstrate knowledge of regulations, codes, standards, and safety - this includes local engineering procedures and practices as applicable	1. <i>Identify and comply with legal and regulatory requirements for project activities.</i> 2. <i>Incorporate knowledge of codes and regulations in your area of practice.</i> 3. <i>Understand regulations that affect the handling, transportation and disposal of waste materials.</i> 4. <i>Experience using standards (e.g. ASTM) for testing.</i> 5. <i>Demonstrate awareness of safety documents, standards and regulations (WorkSafeBC, ASHRAE, material safety data sheets)</i>
1.2	Demonstrate knowledge of materials, or operations as appropriate, project and design constraints, design to best fit the purpose or service intended and address inter-disciplinary impacts.	1. <i>Demonstrate knowledge of materials application, usage and/or operations: Cost, Storage, Quality & Handling problems</i> 2. <i>Develop and implement evaluation, maintenance or rehabilitation programs for facilities and operations.</i>

		3. <i>Coordination with other disciplines.</i> 4. <i>Materials selection and design for specific applications (e.g. biomedical, automotive, aerospace, electronics).</i>
1.3	Analyze technical risks and offer solutions to mitigate the risks	1. <i>Demonstrate familiarity with metallurgical system protection objectives, philosophies, and functions.</i> 2. <i>Identify risk areas.</i> 3. <i>Demonstrate an understanding of the development of risk management plans.</i> 4. <i>Demonstrate an understanding of the difference between technical risk and public safety issues.</i> 5. <i>Demonstrate awareness of Statistical Process Control and its role in detecting process deviations and associated risks.</i>
1.4	Apply engineering knowledge to design solutions	1. <i>Perform heat and mass balance calculations including data reconciliation.</i> 2. <i>Report on metallurgical accounting in a plant.</i> 3. <i>Circuit design and selection. Equipment sizing including throughput, residence time, and chemical kinetics calculations.</i> 4. <i>Failure analysis using microstructural and analytical characterization techniques (OM, SEM, TEM, XRD, AA). Demonstrate understanding of failure modes (e.g. creep,</i>

		<i>fatigue, corrosion, hydrogen cracking)</i> 5. <i>Use of equilibrium phase diagrams (Temperature-Composition, eH-pH, and Evans Diagrams) or non-equilibrium diagrams (TTT diagrams), or experimental determination of phase equilibria.</i> 6. <i>Perform alloy composition calculations. Demonstrate understanding of effects of alloying ingredients and strengthening mechanisms.</i> 7. <i>Pilot-scale testing of new processes</i> 8. <i>Design and implementation of environmental control technologies for gas, liquid, and solid waste streams. Demonstrate understanding of strategies for tailings disposal.</i> 9. <i>Demonstrate understanding of mechanical properties and testing: stress-strain behaviour, fracture mechanics, fatigue, creep, toughness.</i> 10. <i>Design for corrosion prevention (coatings, thin films, materials selection).</i> 11. <i>Design weld parameters and prepare welding procedures.</i>
1.5	Be able to understand solution techniques and independently verify the results.	1. <i>Participate in an independent review-process</i> 2. <i>Demonstrate an understanding of the engineering principles used in the application of computer design programs</i>

1.6	Safety awareness: be aware of safety risks inherent in the design; and Demonstrate Safety Awareness – on-site and possible safety authorization/certificate as appropriate	1. <i>Use of non-destructive evaluation techniques for weld evaluation.</i> 2. <i>Review and assess results for equipment and material evaluation.</i> 3. <i>Understand and account for safety risks associated with processes. Identify relevant metallurgical processes and personal protection equipment to mitigate safety risks.</i> 4. <i>Review, identify and incorporate safety procedures, system operating procedures, processes and equipment.</i> 5. <i>Demonstrate specific knowledge of safety regulations.</i> 6. <i>Incorporate explicit human and public safety considerations in design and all other professional activities.</i>
1.7	Demonstrate understanding of systems as well as of components of systems	1. <i>Demonstrate understanding of complex Process Flow Diagrams and of each unit operation in the process.</i> 2. <i>Development of process improvement initiatives. Demonstrate understanding of continuous improvement philosophy and practice.</i> 3. <i>Demonstrate understanding of effects of process modifications on downstream processes and final product.</i> 4. <i>Demonstrate familiarity with control systems and strategies. Demonstrate understanding of limitation of process control.</i>

1.8	Exposure to all stages of the process/project life cycle from concept and feasibility analysis through implementation	1. <i>Demonstrate awareness of project concerns and roles of other stakeholders in the project stages:</i> <i>I Identification: generation of the initial project idea and preliminary design</i> <i>II Preparation: detailed design of the project addressing technical and operational aspects</i> <i>III Appraisal: analysis of the project from technical, financial, economic, social, institutional and environmental perspectives</i> <i>IV Preparation of specifications and tender documents: preparation of tender document, inviting and opening of tenders, pre-qualification, evaluation of bids and award of work</i> <i>V Implementation and monitoring: implementation of project activities, with on-going checks on progress and feedback</i> <i>VI Evaluation: periodic review of project with feedback for next project cycle.</i>
1.9	Understand the concept of quality control during design and construction including independent design check and independent reviews of design, field checks and reviews.	1. <i>Conduct Field Checks to verify the validity of design and fabrication</i> 2. <i>Complete Quality Management Plan Checklist, and follow Quality Management Plan</i> 3. <i>Prepare quality assurance plans, including frequency and test parameters, for specific construction processes or products</i> 4. <i>Evaluate test results and determine</i>

		<i>adequacy</i> 5. <i>Carry out or supervise field testing of materials or welds.</i> 6. <i>Carry out or supervise implementation of new processing equipment.</i>
1.10	Transfer design intentions to drawings and sketches; Understand transmittal of design information to design documents.	1. <i>Demonstrate communication of ideas and concepts to project team members.</i> 2. <i>Demonstrate understanding of value of project completion reports and lessons learned reports to application in future projects by self or others.</i> 3. <i>Ability to review designs of others and communicate findings and issues, including suggested alternatives.</i> 4. <i>Development of welding data cards.</i>