Ordre des géologues du Québec

# Acquisition of basic professional competence through initial experience

*a short overview of tools developed for guiding the apprenticeship of junior geologists and of the process that led to the creation of these tools*

October 2014

## Mission

The Ordre des géologues was created in 2001by the Geologist's Act. The mission of the Ordre des géologues is to protect the public through the control of the practice of geologists and the surveillance of practice in geology. The Ordre accomplishes its mission by controlling the competency and practice of geologists and enforcing against illegal professional practice with the tools available under the Professional Code of Quebec.

The practice of geologists is aimed at:

- supporting the discovery and exploitation of the mineral, energy and hydraulic resources of the earth, and,
- improving the human environment and public safety through the siting of works and constructions, the prevention of natural hazards, and the prevention and rehabilitation of contamination of terrains and groundwater.



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# Acquisition of basic professional competence through initial experience: guiding the apprenticeship of junior geologists

## Summary

The *Ordre des géologues du Québec* (OGQ) is implementing a compulsory apprenticeship (or guided training) process for junior geologists (geologist or geoscientist-in-training, GIT). This process is aimed at improving the acquisition of practical knowledge and skills by earth science graduates (in the formative years of their first jobs) in order for them to consistently achieve the required level of competence for independent professional practice.

This apprenticeship process is similar to that found in other professions (such as chartered accountants). Under this process, the supervisor is charged with overseeing the professional development of the GIT following guidance provided by OGQ.

The guidance provided for supervised apprenticeship was developed based on the *Compendium of competencies for entry level geologists* adopted by OGQ in 2012.

This paper provides a summary description of the development and substance of the Compendium of competencies and the Apprenticeship process that result[1].

## Background

### Deliverance of professional geologist permit

Under Québec legislation, eligibility to professional licensure requires a diploma accredited[2] for admission to a specific profession. Accreditation of diplomas for entry into a regulated profession (such as law, medicine or engineering) is the general practice in Canadian jurisdictions; geology/geoscience is an exception to this general rule and Québec is the only jurisdiction with such

[1] All activities and resulting reports and documents referred to in present article were done in French. Translation of some of these documents is underway or pending.

[2] Accredited diplomas for all professions are listed in the *Regulation respecting the diplomas issued by designated educational institutions which give access to permits or specialist's certificates of professional orders*. Note that OGQ is party to the accreditation process in Québec. A person lacking an accredited diploma may be eligible after evaluation of equivalency of training. Geology diplomas from four Québec universities are presently accredited for admissions to a Geologist's Permit.

accreditation. Eligibility may also be dependent on specific additional conditions: for geologists, such conditions include the requirement for minimal qualifying experience after studies[3].

## The challenges

The first challenge we face is the ever renewed difficulty of assessing the academic qualifications of applicants who do not have an accredited degree (i.e., those trained outside Québec). It is always challenging to evaluate the equivalency of degrees of persons of multiple origins, all the more so when we are legally required to take into account the experience of the applicant if the academic training is deemed insufficient.

The second challenge comes from the difficulty in ensuring the effective competence of applicants: there is a clear consensus in the profession that minimal professional competence is only achieved after a period of practice under the supervision of more experienced practitioners. However, contrary to many professions (e.g., medicine, accounting or law), there is no structured system of guided apprenticeship for geologists. As a consequence, organisations licensing geologists (including OGQ) have relied on more or less formalized reviews of performance and behaviour by supervisors to provide evidence of adequate competence of applicants. In practice, the acquisition of desired competencies by junior geologists (GITs) is left to the initiatives of the individuals and their employer with minimal guidance. In fact, GITs work for a great variety of employers who generally have no specific programs for the apprenticeship of their junior employees. In the worse situations, the employer takes no interest or responsibility for the professional development of their personnel. Considering the reality of short term employment and the disappearance of commitments to employee training by bottom line driven employers, combined with the increasing demands on licensure, the traditional process is questioned.

## The "competence path"

The Board of directors of OGQ recognized the dual challenges of assessing qualifications of persons of multiple backgrounds and ensuring minimal competency for all persons being granted registration. Two of the factors favouring a review of the traditional approach for admission to the profession were: first, international agreements on labour mobility look at competence; second, the great disparity in experience of applicants had been a source of concern for some time. In 2008, it was

[3] The requirement for qualifying experience after academic training exists in other professions and is generally found at organisations licensing professional geologists or engineers.

therefore decided to update the tools and approaches of the admissions process by introducing competence based tools in order to achieve two goals:

1. Develop competence based assessment tools for applicants of all origins;
2. Develop methods and tools to ensure that GIT (and foreign trained applicants) achieve consistent professional competence in their period of supervised practice.

# Development of a competence compendium

## The concept of competence

In technical terms, professional competence is the ability to conceptualize and act in order to adequately respond to complex professional situations using an integrated set of resources (knowledge, skills, behaviours, attitudes, values, etc.). In layman terms, competence for a professional geologist is the ability to undertake a project on his (her) own and complete it satisfactorily. Competence can be observed in action, it is "job related".

For the purpose of discipline under the legal mandate of the Ordre des géologues, a definition of competence has been adopted which is useful in the present context:

> *The professional competence of a member is measured by his or her:*
> - *knowledge of geology as well as the applicable laws, regulations and standards in the field in which he or she practises;*
> - *ability to update his or her knowledge and to apply it and use it skillfully in various and complex situations so as to avoid damage to the parties relying on his or her services and the public in general;*
> - *ability to determine the limitations of his or her expertise, to so inform those requesting his or her services and to call on the appropriate professional resources, where required;*
> - *ability to set up his or her records, ensure the confidentiality thereof and to carry out his or her mandates successfully;*
> - *ability to administer his or her professional practice appropriately;*
> - *physical and psychological abilities in the practice of the profession.*
>
> *The professional incompetence of a member is measured by the continuous or repeated failure to meet any one of these criteria.*

## The process

Development of the *Competence compendium* was achieved by a project team of consultants supported by OGQ staff and nearly fifty seasoned geologists volunteering their opinions and experience. The project was done in four stages:

1. Definition of broad areas of practice;
2. Construction of draft profile of tasks and skills in each area;
3. Validation and refinement of each profile in targeted workshops;
4. Preparation and validation of *Competence compendium*

## 1. Areas of practice

Areas of practice, or domains, were delimited with the purpose of regrouping in a set area of practice, all the professionals who generally work together for common objectives. This was done by combining the common workplace environments and the common purpose of the professional work. The areas of practice so defined are not meant to limit the areas of practice of individuals (who can work in multiple areas) but these areas effectively constitute "silos" where practitioners can spend a career.

It is understood that individual practitioners in any specific area work in many types of organisations and that the practice of individual practitioners may overlap more than one area either at any one time or in the span of a career. For practical reasons, three domains were retained which could have been further divided:

a) **Resource geology**: this includes geology applied to mineral (metallic, industrial, and energy minerals) exploration and exploitation. The work place environments include Junior exploration companies, mining and hydrocarbon producers, and consultants servicing the industry. Government surveys managing mineral titles and territorial mapping are also included in this area.

b) **Engineering & environmental geology and hydrogeology**: this includes geology applied to constructions (siting, foundations, materials, drainage, etc.) and natural hazards management, site contamination assessment and remediation, and ground water protection and supply. The work place environment is largely made up of consulting companies large and small and some regulatory or planning agencies.

c) **Geophysics and remote sensing**: this includes all types of geophysical practice from small site investigations to airborne surveys. Remote sensing is included in this area due to multiple similarities in the practice. The work place environment is to a large degree found in firms providing specialized services to different users.

## 2. Draft profile

In each domain, one expert was recruited to work with the project team so as to draft a profile of the "entry level" practice of the profession with statements describing:

a) the nature of tasks performed by "junior geologists";
b) the contexts and conditions of these tasks; and
c) the skills and personal attributes required to perform these tasks.

This information was used to prepare working documents for the next step presenting:

- Domain definitions: summary statement with a listing of main tasks;
- Task descriptions: summary statements followed by detailed breakdown of activities in each task plus additional details;
- Conditions of performance of tasks: autonomy, work environment, regulations, tools and technology used, risks and stress factors, other requirements;
- Requirements for effective performance of tasks in terms of personal qualities and skills;
- The regulatory environment that has to be taken into account.

In addition, a table listing multiple (over 180) sets of knowledge and skills (obviously including geoscience plus also other disciplines) was prepared to be rated by workshop participants with respect to relative importance of for someone to be proficient in the domain (at the entry level).

### 3. Domain analysis workshop

For each domain, 8 to 12 senior representative specialists were recruited from active professionals with supervisory responsibilities representing the various work place environments and specialties. The specialists were convened for 2 day workshops of guided discussion aimed at validating and fleshing out the draft profiles prepared in step 1. Representatives of universities and other organizations were invited to attend the workshops as observers. Draft reports for each workshop were validated by all participants with contributions of additional specialists who had not been able to participate. After this validation, a "*Domain analysis report*" was prepared for each domain or practice area defined before[4].

### 4. Competencies compendium

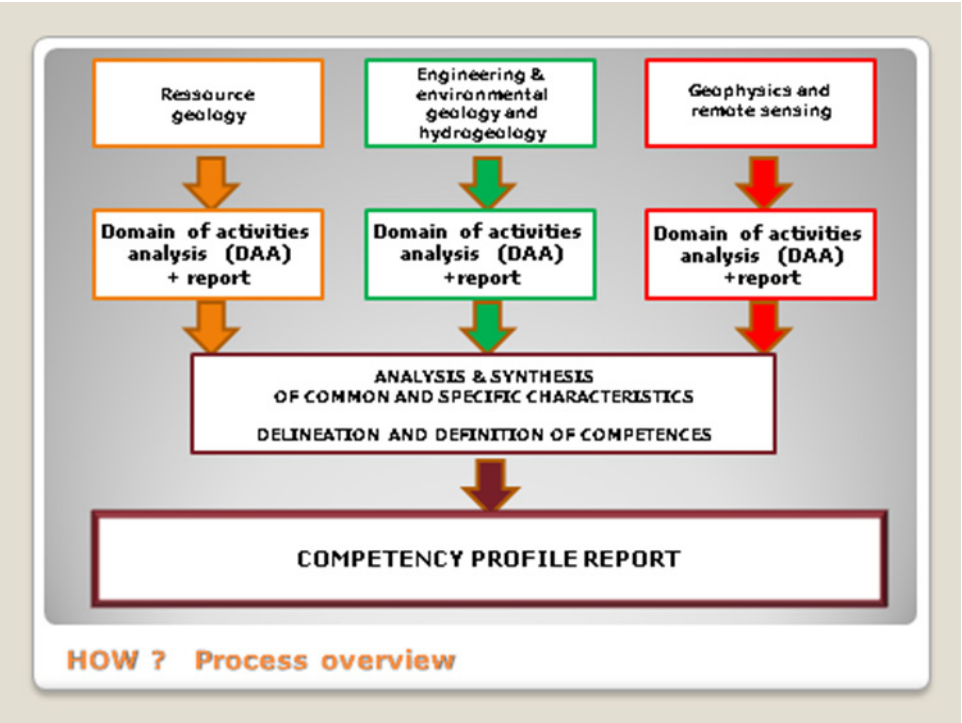
The *Domain analysis reports* formed the bases for a draft *Competencies compendium* outlining the common and distinct competencies for each domain. A validation workshop was convened to review and refine the draft *Competencies compendium*. This workshop assembled over 20 professionals

[4] Analyse de champ d'activité : GÉOLOGIE DU TERRITOIRE ET DES RESSOURCES MINÉRALES, PÉTROLIÈRES OU GAZIÈRES, Ordre des géologues du Québec, May 2012, 63p.

Analyse de champ d'activité : GÉOLOGIE DE L'ENVIRONNEMENT, DE L'AMÉNAGEMENT ET HYDROGÉOLOGIE, Ordre des géologues du Québec, May 2012, 73p.

Analyse de champ d'activité : GÉOPHYSIQUE ET TÉLÉDÉTECTION, Ordre des géologues du Québec, May 2012, 72p.

familiar with all aspects of the practice of the profession and its regulation. The final report was approved by the Board of directors of OGQ in May 2012.




## The product

The final report presents a compendium of competencies[5] expected of a young geologist being admitted to autonomous professional practice. Acknowledging that there is no universal method for defining competencies, important characteristics of the compendium to be noted are:

- The *Compendium of competencies* is based is Bloom's Taxonomy on cognitive development[6]: "application" is the minimal verb level used for the description of competencies.
- Competency statements overlap in a three level conceptual structure of Professional competencies, Contextual competencies and Functional competencies.
- Equal proficiency in all competencies is not expected of applicants for licensure.

[5] RÉFÉRENTIEL DES COMPÉTENCES INITIALES DES GÉOLOGUES DU QUÉBEC, Ordre des géologues du Québec, Montréal, June 2012, 33p.

[6] Bloom, Benjamin S. *Taxonomy of Educational Objectives* (1956). Published by Allyn and Bacon, Boston, MA.

- Methods for assessment of competencies are not defined in the Compendium though some may be evident.
- The Compendium also deals specifically with background knowledge required to facilitate workplace integration for internationally-trained persons (*not covered herein*).

This *Compendium of competencies* provides a frame of reference comprised of a set of competencies divided into three categories, each highlighting key components of professional practice:

1. **Professional competencies** cover professional situations common to all geologists. Professional competencies are based on context and inform on actions and activities specifically related to the professional practice of geologists. *These are listed in Table 1 with actions for one competency listed in Table 1a.*
2. **Contextual competencies** concern professional practice specific to each of the three domains. Contextual competency takes into account contexts, practices, principles and specific knowledge which govern professional practice in a given field of activity. *These are listed in Table 2 with key actions for one competency listed in Table 2a.* It is important to understand that Contextual competencies are defined at a relatively high level and refer to the *capacity to undertake and perform the various stages (in general five) of a task/project from planning, through project start-up, data collection, interpretation and analysis and final reporting and archiving*.
3. **Functional competencies** cover areas of common knowledge. Though they largely inform on required knowledge, functional competencies provide the foundations for professional and contextual competencies which are based on functional competencies. These also provide basic indications to inform agencies and organizations which provide education in geology. *These are listed in Table 3.*

# Guiding and assessing apprenticeship

## Selection of what is to be assessed

Professional competence can only be assessed by its components. In view of the large number of components identified in the *Compendium (see tables 1 - 3)*, and with their inherent partial overlap, an assessment strategy was developed with the aim of focussing the assessment effort on job related competencies. Taking into account the fact that the normal path to a professional license is an accredited diploma, as a first step, faculty members from accredited institutions were asked to identify the degree of attainment expected from their respective programs for each of the listed competencies. As expected, the consensus was that the university programs essentially provide for a large part of the *Functional competencies* but provide for limited to no *Professional* or *Contextual competencies*.

Acquisition of knowledge in academic environments is subject to assessment through exams and other means: verification of learning outcomes is thereby done in a controlled environment.

Again, academic training in geology does not equate with professional competence which requires a minimal period of practical experience. This experience brings knowledge and skills that are not part of the academic curriculum and also provides the means whereby a person can acquire and show competence by “doing it”.

Therefore, the assessment effort is focussed on *Contextual* and *Professional competencies*.

Fundamental review of the factors affecting performance of individuals in complex tasks typical of the work of geologists brought forward the need to also consider personal qualities when evaluating professional competence.

There is a general reluctance and even justified barriers to reviewing personal qualities in an academic environment. However, in a professional environment, personal qualities often make the difference between success and failure. By including these in the professional development program for junior geologists, the apprenticeship process provides the opportunity for the GIT to improve personal qualities to the benefit of their future professional careers.

## Assessment conundrum

There are many challenges in assessing competencies acquired through work experience. Alternative methods for assessing and documenting competencies include:

1. Direct observation in real time: undoubtedly the most effective method of assessing work related competencies. Unfortunately, it is unrealistic to try to perform direct observation of geologists in a great variety of tasks and work environments.
2. Simulation: observing an individual performing a predefined task in a controlled environment. This approach is not suitable for the practice of geology.
3. Examinations: exams cannot be used to assess many important skills nor can they be used to assess personal attributes;
4. Documentation of work done in a Portfolio: this allows continuous documentation of tasks undertaken and challenges met and, with proper controls, provide the means for assessing the professional competence of a person in any domain.

It was therefore decided to develop a Portfolio based system for assessment of professional competence.

## The Portfolio

### Benefits

A Portfolio based system was developed for the purpose of providing guidance both for junior geologists and their training supervisors while at the same time providing the means to document the progress of the junior geologist towards attaining professional competence sufficient for entry to autonomous practice of the profession.

A portfolio provides three benefits:

1. The junior geologist is given the responsibility for his-her evaluation
2. It provides for a continuous and progressive assessment based on elements that are observable and measurable in a real life context
3. It encourages reflective practice and auto regulation on the part of the junior geologist.

## Objectives of apprenticeship program

The junior geologist (GIT) is expected to develop and document 7 professional competencies (CP4 through CP10), 2 (out of 13) contextual competencies and 6 personal qualities (*Interpersonal relations, Adaptability, Responsibility, Leadership, Autonomy, Stress management*) under the direction of a training supervisor using guidance provided by OGQ.

With respect to contextual competencies, two levels of performance are defined:

- Level 1 corresponds to a broad exposure to the tasks involved and requires demonstration of rigor and accuracy in data collection, management and reporting.

- Level 2 corresponds to achieving effective autonomy in most tasks involved. The GIT is expected, among others to show adequate capacities for logistics, judgment, interpretation, reporting and communication.

The junior geologist is expected to attain level 2 in one competency and level 1 in another. On a practical note, it is observed that many junior geologists approach level 1 in one competency at the time of graduation due to summer work experience.

## Structure and contents of Portfolio

The portfolio guidance and tools provided to junior geologists and their supervisors includes a number of different documents:

- ❖ Guidance papers:
  - An extensive guidance and instruction guide for junior geologists[7]
  - A short guide for training supervisors[8] and mentors
- ❖ Reporting/assessment templates[9]
  - Templates for each contextual competency
  - A template for the professional competencies
  - A template for personal qualities
- ❖ Summary tables for the purpose of reporting on all objectives

The junior geologist is thereby provided with instructions and tools for building his/her portfolio in accordance with stipulated objectives. In addition to the various reporting templates and tables, the portfolio of the junior geologist will include "artefacts" safeguarded in electronic format and available for examination by OGQ during the admissions process.

- ❖ Artefacts

  The junior geologist is expected to retain copies of notes, memos and reports produced on the job so as to provide adequate documentation of the level of competence attained. The training supervisor is to authorize the retention of these documents.

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[7] Durand, M.J., Nokam, N.T., Beaudry, P., *Le guide du portfolio: outil de développement personnel et professionnel*, Ordre des géologues du Québec, draft Octobre 2013, final March 2014, 35p.

[8] Guide général à l'intention du maître de stage, Ordre des géologues du Québec, January 2014, 12p.

[9] In total, 60 templates, tables and forms are made available for use by the GIT. Note that no more than 12 of these are used by any one GIT depending on the selection of the contextual competencies to be developed.

## Assessment by the supervisor

The assessment of different competencies and personal attributes varies as follows:

- Contextual competencies are subject to evaluation by the supervisor according to a set of criteria. The junior geologist is informed of the assessment of the progress achieved and invited to continue development towards the set criteria.
- Professional competencies are subject to "coassessment" according to set criteria. In practice, the junior geologist is expected to evaluate personal progress in relation to set criteria. This personal assessment is presented to the supervisor who does an independent evaluation before feedback to the GIT.
- Personal qualities are subject to "coassessment". The junior geologist self-assesses and the supervisor confirms or contradicts the opinion thereby expressed. The supervisor comments upon the self-assessment and provides an appreciation of qualities developed. If a tangible improvement is required, the supervisor suggests avenues for improvement. In case of disagreement with the GIT, the supervisor refers to factual observations so as to help the GIT understand.

Contextual competencies are truly "job related" and are therefore assessed with respect to the work assigned to the junior geologist in accordance with general but fairly detailed criteria. Each subtask is thereby assessed as to whether the product is satisfactory, and, if not, desired improvements are outlined by the training supervisor. Tables 4 through 4c provide examples of task assessment templates to be used by the supervisor showing task, criteria, indicators and artefacts.

Professional competencies are evaluated with respect to predefined fixed criteria at four levels of performance:

- Level A: performance not acceptable
- Level B: performance expected of a recent graduate starting apprenticeship
- Level C: performance expected of a junior geologist ready for autonomous practice
- Level D: performance achieved by a seasoned professional.

At the end of a training period, a global assessment is made based on accrued documents and reports.

## Management of the apprenticeship

The apprenticeship process herein described is governed by regulation[10]. Under this regulation, the junior geologist is responsible for his/her portfolio and for periodic reporting to the *Ordre des géologues*. The junior geologist must register each occupation (or job) at the start and the training supervisor concerned must be identified and assume responsibility for supervision.

Reporting is to be done at each change in occupation (or job) or at least yearly. All reports by the GIT are to be vetted by the training supervisor. Periodic reports are to be assessed by OGQ with the aim of ensuring that the junior geologist is effectively progressing towards minimal professional competence expected of a licensed geologist. At the end of the prescribed training period, the GIT may submit the collected reports and summary sheets in support of an application for licensure.

The role and responsibility of the training supervisor are:

1. To provide the junior geologist with opportunities to develop the required competencies;
2. To review and comment on work and documents prepared by the GIT;
3. To provide feedback to the GIT and complete the required evaluations.

## Practical consequences and expected outcomes

This new guided apprenticeship process will have three practical consequences:

1. The workload at OGQ is expected to increase with respect to managing the process and reviewing the progress of geologists in training.
2. The GIT will be given clear objectives and tools for development while being placed in full charge or responsibility for his/her personal progress.
3. The training supervisor will be given clear obligations with respect to a commitment to active supervision which may entail a modest increase in workload. This may entail that some geologists in such positions may have to develop new competences. The training supervisor will also have to ensure that the apprenticeship process is integrated into the processes and policies of the organisation.

The main expected outcome of this apprenticeship process will be that future candidates for licensure will be better prepared for autonomous practice through consistent development of all competencies required for such practice.

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[10] *Regulation respecting the conditions and procedures for the issuance of permits by the Ordre des géologues du Québec*

## Caveat

This process is new to the profession, and though similar processes have existed in other professions for a long time, it will be considered a minor revolution by some. There will therefore be some resistance and the need for education. It is also evident that the tools developed are not perfect and that these will be subject to improvement and refinement over the short and long term. Notwithstanding the obvious difficulties in implementing such a process, there is clear support for such action in the profession in Québec.

# Appendix: summary tables and examples of details

Table 1: Professional competencies

| | |
|---|---|
| CP1 | Characterize Earth substances, structures and phenomena at surface and underground |
| CP2 | Interpret geoscience information |
| CP3 | Define, design and develop geological models, projects and solutions |
| CP4 | Act in an advisory role in the field of geology |
| CP5 | Ensure regulatory compliance in practicing the profession |
| CP6 | Perform continuous quality control in practicing the profession |
| CP7 | Communicate complex information related to the practice of the profession |
| **CP8** | **Perform management activities in practicing the profession** |
| CP9 | Act in accordance with professional ethics |
| CP10 | Ensure maintenance and development of professional competence |

Table 1a: Details of Professional competence **CP8**

| | |
|---|---|
| **CP8:** Perform management activities in practicing the profession<br><br>*Note : The mandate or complexity of the task determines whether each step should be undertaken individually or as a unit.* | *PROJECT PLANNING PHASE*<br>1. Define (or collaborate to the definition of) the project's goals<br>2. Elaborate (or participate in the elaboration of) a project in terms of scheduling, resources (human, material, physical), financials, logistics<br>3. Estimate costs, prepare a budget<br>4. Write and evaluate estimates, project specifications, proposals and bids<br>5. Write and enter into professional service agreements<br>6. Ensure availability of financing, insurance and guarantees<br>*PROJECT START-UP PHASE*<br>7. Organize work based on mandate, time and available resources as well as the urgency of the situation<br>8. Ensure the acquisition of existing relevant data for the project<br>9. Establish and validate the workplace health, safety and environment protection plan<br>10. Obtain required permits and authorizations<br>11. Control qualifications of available or required human resources<br>12. As needed, proceed with the selection of suppliers and with awarding of contracts<br>*WORK/EXECUTION PHASE*<br>13. Ensure compliance with applicable regulations<br>14. Ensure application of health and safety regulations on the workplace<br>15. Monitor and ensure respect of work plan and apply appropriate corrective actions<br>16. Ensure continuous quality control<br>17. Control costs and monitor budgets<br>18. Inform the client of any discovery or significant event<br>19. As needed, negotiate amendments to the contract<br>*COMMUNICATION OF INFORMATION PHASE*<br>20. Ensure production / conveying of deliverables in compliance with terms of contract<br>*GENERAL MANAGEMENT TASKS*<br>21. Perform a project wrap-up and draw appropriate lessons<br>22. Participate/collaborate in internal audits<br>23. Ensure recordkeeping and archive management |

Table 2: Contextual competencies

| | |
|---|---|
| **Resources geology** | |
| In their professional practice in Resources geology, the role of geologists is to ensure or contribute to: the improvement of knowledge about Quebec geology; and the exploration, development and extraction of mineral, oil and gas resources.<br>Geologists are mostly called upon to propose and implement exploration strategies aimed at discovering or characterizing deposits and ore bodies in terms of geology, geometry and geochemistry as well as evaluating the development potential and contributing to optimal extraction of mineral resurces.<br>In this field, geologists are mostly called upon to perform technical and scientific activities for private or public firms, consulting firms, governmental agencies and other stakeholders. | |
| **CC1** | **Perform geoscience surveys (geological, geochemical, geophysical, etc.)** |
| CC2 | Carry out exploration programs aimed at describing geological formations or mineral or hydrocarbon deposits |
| CC3 | Contribute to the evaluation of mineral or hydrocarbon resources |
| CC4 | Contribute to the development and to the optimal extraction of mineral resources |
| **Environmental and engineering geology and hydrogeology** | |
| In this field, the general role of geologists is to assess ground conditions, resources and materials for specific purposes such as contaminated site remediation, civil works or water supply.<br>More specifically:<br>• the role of geologists in the environmental field is to perform or participate in the design, implementation, and monitoring of activities concerning site conditions (unconsolidated deposits, rock and groundwater) which they characterize, protect or restore in order to safeguard life, property and the environment;<br>• the role of geologists in engineering geology is to perform or participate in the design, implementation, and monitoring of activities and work aimed at characterizing or correcting ground conditions so as to ensure the sustainability of buildings or civil works and to protect life and property. They also characterize the quality and quantity of earth materials for the purpose of future use as construction materials.<br>• the role of geologists in hydrogeology is to assess geological and hydraulic conditions which govern the origin, movement, quality and properties of groundwater for the purpose of prospection, extraction or protection.<br><br>Characterization and exploitation of geothermal potential as well as the identification and prevention of natural geological hazards are also included in this field of activities.<br><br>The geologists in these fields of activity are mostly called upon to perform technical and scientific activities for the benefit of private or public firms, consulting firms or specialized laboratories, companies (construction, decontamination, etc.) or governmental agencies as well as any other stakeholder. | |
| CC5 | Perform geoscience surveys (geological, geochemical, geophysical, geotechnical, hydrogeological, geothermal) |
| CC6 | Carry out investigation or characterization programs pertaining to constituents and conditions of the ground or pertaining to water or materials resources |
| CC7 | Establish actions required for the purposes of construction, protection, extraction, correction or remediation. |
| CC8 | Control geoscience parameters when carrying out and monitoring actions required (as per CC7) |
| **Geophysics and remote sensing** | |
| The role of geologists in the fields of geophysics and remote sensing is to observe and examine the land/sea surface or underground using instruments or images in order to evaluate the physical or geometric properties of the ground or to find objects. Techniques used may require land-based (on surface or by drilling), airborne, satellite or seaborne equipment or observations.<br>Geophysicist are called upon to work in fields such as mineral, oil and gas exploration, engineering geology, environmental geology, hydrogeology, geothermal, archeology and search for objects.<br>These geologists are mostly called upon to perform technical and scientific activities for private and public firms, contractors, consulting firms, governmental agencies or independent clients. | |
| CC9 | Plan geophysical or remote sensing operations |
| CC10 | Perform geophysical surveys or acquire remote sensing data |
| CC11 | Process raw data obtained from geophysical or remote sensing surveys |
| CC12 | Interpret processed data |
| CC13 | Participate in technological innovation in the fields of geophysics and remote sensing |

Table 2a: Key actions for Contextual competency **CC1**

| **Competency** | **Key actions** |
|---|---|
| **CC1:** Perform geoscience surveys (geological, geochemical, geophysical, etc.) | *PROJECT PLANNING PHASE*<br>1. Determine / analyze goals and scope of the mandate<br>2. Verify regulations and applicable standards<br>3. Collate and compile existing data<br>4. Validate gathered information (georef., historical work, verification of land/mining title, etc)<br>5. Prepare / analyze work plan in terms of methodology, human and material resources, budget, logistics, health, safety and environment in the workplace, completion schedule, constraints (environmental, social, etc.) deliverables, etc<br>6. Prepare / analyze quality control programs<br>7. As required, write an estimate<br>*PROJECT START-UP PHASE*<br>8. Choose suppliers, award contracts<br>9. Obtain required permits and authorizations<br>10. Inform stakeholders and other interested parties<br>11. Coordinate work with various stakeholders<br>12. Identify and evaluate hazardous conditions and risks<br>13. As required, coordinate site and camp set up<br>*DATA COLLECTION PHASE*<br>14. Apply work health and safety and environment protection protocols<br>15. Comply with applicable regulations<br>16. Perform/supervise/collaborate in the execution of work according to plan<br>17. Do surface mapping, gather observations using various methods<br>18. Collect and transmit samples for geological or geochemical analyses<br>19. Perform / obtain geophysical surveys<br>20. Take instrument readings and measurements and analyze logs<br>21. Monitor and manage collected data<br>22. Ensure continuous quality control of collected data<br>23. Manage and monitor work in compliance with the work plan<br>***ANALYSIS AND INTERPRETATION PHASE***<br>24. Analyze, synthesize and interpret data<br>25. Create maps, geological sections and conceptual models<br>26. Establish findings and formulate hypotheses<br>***COMMUNICATION AND CONSERVATION OF DATA PHASE***<br>27. Produce deliverables (reports, maps, charts, etc) and write recommendations<br>28. Control the quality of deliverables<br>29. Communicate and explain information to client and other stakeholders, as needed<br>30. Save, secure and archive documents, databases and samples |

Table 3: Functional competencies

| | |
|---|---|
| EARTH SCIENCES | |
| CF1 | Grasp essential characteristics related to Earth processes, materials, geological domains, as well as to its history, and to the evolution of life |
| CF2 | Search for and validate geological information |
| CF3 | Use appropriate geological nomenclature and terminology |
| CF4 | Distinguish appropriate methods and techniques for identification, investigation, interpretation and intervention in geology |
| CF5 | Recognize steps and outcomes relative to a project in geology |
| CF6 | Analyze and design geological models |
| CF7 | Apply state of the art or innovative approaches in practicing the profession |
| CF8 | Adapt to situations or professional contexts that are unusual or vague |
| CF9 | Recognize geologists' contributions both historically and sociologically |
| CF10 | Recognize the factors and trends that may influence the practice and development of the profession |
| CF11 | Grasp the roles and mandates of the principal actors who exert influence on the profession (industries, businesses, agencies, etc) |
| MATHEMATICAL, SCIENTIFIC AND TECHNOLOGICAL TOOLS | |
| CF12 | Apply the scientific method for analyses, problem solving and conceptualization purposes |
| CF13 | Apply the principles and techniques of physics, chemistry, hydrology, biology and engineering when practicing the profession |
| CF14 | Use mathematical tools for purposes of calculation, approximation and modeling |
| CF15 | Perform qualitative and quantitative analyses of geological data |
| CF16 | Use computer science tools such as office software, databases, specialized software, archiving and security tools |
| CF17 | Use specialized devices and instruments |
| CF18 | Grasp the scope and limits of technological tools |
| ENVIRONMENT AND SOCIETY | |
| CF19 | Grasp environmental and social issues and impacts connected with the general practice of the profession and with one's own professional practice |
| FINANCE AND ECONOMICS | |
| CF20 | Grasp financial aspects and impacts associated with one's professional practice |
| CF21 | Grasp the influence of macroeconomic factors of the fields of activity in geology |
| ADMINISTRATION AND MANAGEMENT | |
| CF22 | Plan and manage projects |
| CF23 | Prepare a budget |
| CF24 | Write service agreements, bids and quotes |
| CF25 | Manage human resources |
| CF26 | Manage risk |
| CF27 | Evaluate hazardous conditions and apply occupational, environmental, health and safety rules and practices |
| CF28 | Work in sole discipline and multidiscipline teams |
| CF29 | Apply the principles of professional and business ethics |
| COMMUNICATION | |
| CF30 | Language: master French (spoken and written); have functional command of English |
| CF31 | Grasp information, directives or concepts transmitted by third parties |
| CF32 | Communicate information, directives or concepts and ideas orally and in writing |

Table 4: Typical criteria for evaluation of common tasks associated with contextual competencies

| ***Elements of competency*** | ***Evaluation Criteria*** |
|---|---|
| Plan | **Adequacy** of planning *(see table 4a)* |
| Start project | **Efficiency** of project-start-up |
| Collect data | **Accuracy** of collected data |
| Analyse and interpret | **Pertinence** of analysis and interpretation |
| Report and archive | **Quality** of reporting and archiving |

Table 4a: Indicators for criterion linked to one task for levels 1 & 2 of a contextual competency

| ***Criterion*** | ***Indicators - Level 1*** *(see table 4b)* | ***Indicators - Level 2*** |
|---|---|---|
| **Adequacy of planning** | Context is accurately portrayed | Clear & concise statement of objectives. |
| | | Complete planning of all elements of a project. |
| | All elements of work plan, regulations and applicable standards are accurately identified. | Work plan is prepared in full compliance with applicable regulations and standards. |

Table 4b: Actions & documents to produce in support of documenting Indicators for **Level 1.**

| ***Indicators - Level 1*** | ***Actions*** | ***Examples of documents to produce*** |
|---|---|---|
| Context is accurately portrayed | Describe context, objectives, mandate | • Text/notes outlining context, objectives, mandate<br>• ∫Δ[11] |
| | Prepare short description of physiography & geological environment | • Text/notes outlining physiography & geological environment<br>• ∫Δ |
| All elements of work plan, regulations and applicable standards are accurately identified. | Grasp the work plan & designated tasks | • Text/notes outlining the work plan & retained methodology<br>• Check-list of tasks to be performed<br>• Documents or artefacts showing participation in planning |
| | Outline applicable regulations & standards | • Text/notes outlining applicable regulations or standards<br>• ∫Δ |

Table 4c : Typical check-list for assessment of Contextual competences

| **Criterion : Adequacy of planning** | | | | |
|---|---|---|---|---|
| **List of actions** | **Yes** | **Modify** | **No** | **Comments** |
| Prepare short description of physiography & geological environment | | | | |
| Apply health, safety and environmental protection rules | | | | |
| Warn of hazardous situations | | | | |

[11] ∫Δ : the pictograms indicate that verification by the training supervisor (comments, notes, corrections, validation, etc.) must be documented in the portfolio.