PROFFESSIONAL AFFAIRS

Geo-Ethics: What to do When Approval Authority Decisions Contradict Sound Science?

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SUMMARY
Three case studies in Canada are evaluated where a regulatory authority ruled that measures considered by some professionals to be without scientific basis and less protective of human health or the environment were the required courses of action. The three projects were in the field of environmental geoscience. In all three cases, the solution proposed by a Professional Geoscientist (P.Geo.) was opposed by a representative of a regulatory body that held authority for approval. The final outcomes that were approved by the Regulator were less protective of human health (increased exposure to potential contaminants) and/or the environment (more resources used, higher contaminant exposure). In two of the three cases, the solutions were also more expensive to the client and the taxpayer.

This paper explores the practice of professionalism in geoscience versus regulatory authorities that hold jurisdiction over geoscience in a broad sense. In each of the three cases, the professional opinions and analysis of the P.Geo. working for a private sector client were overridden by a professional (P.Geo. or Professional Engineer) in an approval authority. These three studies highlight the ethical decisions required by professional geoscientists in the face of regulators who hold control over areas of geoscience. Although the training of professionals is similar, regulators appear to be influenced by perceived risk as opposed to actual risk based on scientific evidence. Similarly, some policies do not have a solid scientific basis. As a result, sound scientific reasoning and resulting rational decisions may be hindered in regulatory decision-making.

RÉSUMÉ
Trois études de cas canadiens sont évaluées, où une autorité règlementaire a statué comme requises des mesures qui avaient été déclarées par des professionnels comme étant sans fondements scientifiques et moins protectrices pour la santé humaine ou les milieux de vie. Il s'agit de trois projets du domaine des géosciences des milieux de vie. Dans les trois cas, la solution proposée par un géologue professionnel (P.Geo.) a été contestée par un représentant d'un organisme règlementaire décisionnel. Les résultats définitifs approuvés par l'organisme règlementaire protégeait moins la santé humaine (augmentation de l'exposition aux contaminants potentiels) et/ou le milieu de vie (plus de ressources utilisées; augmentation de l'exposition aux contaminants). Dans deux des trois cas, les solutions étaient également plus coûteuses pour le client et le contribuable.

Le présent article explore la pratique professionnelle en géosciences par rapport à celle des autorités règlementaires qui ont juridiction dans le domaine des géosciences en général. Dans chacun de ces trois cas, les avis professionnels et l'analyse de P.Geo. travaillant pour un client du secteur privé ont été supplantés par celui d'un professionnel (P.Geo. ou ingénieur professionnel) œuvrant a sein d'une autorité règlementaire. Ces trois études mettent en lumière des décisions éthiques attendues de géoscientifiques professionnels face à des autorités règlementaires décisionnelles en certains domaines géoscientifiques. La formation de ces professionnels est similaire, mais il semble que les régulateurs soient influencés par le risque perçu plutôt que par le risque réel établi scientifiquement. De même, certaines politiques n'ont pas une base scientifique solide. Il s'en suit qu'un raisonnement scientifique solide et des décisions rationnelles qui en résultent peuvent être contrecarrés par une décision règlementaire.

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INTRODUCTION

Three case studies in Canada are evaluated where a representative of a regulatory authority ruled that measures considered to be without sound scientific judgment and not necessarily protective of human health or the environment were the required courses of action. These case studies were in the field of environmental geosciences and took place in three different jurisdictions in Canada, involving at least one Professional Geoscientist (P. Geo.) and other professionals. This paper is based on a presentation given at the 35th International Geological Congress in Cape Town, South Africa, in August 2016.

Case 1: Groundwater Pumping and Treatment

In this case, the environmental regulator required that treated groundwater be discharged to a sanitary sewer as opposed to being returned to the aquifer.

A chlorinated volatile organic compound (cVOC) plume in shallow overburden was to be remediated with an interim pump-and-treat system. A pumping well was installed with a large granular activated carbon treatment train (Fig. 1) to treat the contaminated groundwater. The consultant's pilot tests showed very high cVOC removal using this system. In fact, the water was typically, but not always, within drinking water standards for these cVOC compounds. It is noted that the formation was an unconfined aquifer in an urban setting where a law prohibited the use of groundwater as a potable source.

The only pathway for human impact from cVOCs was from groundwater via soil vapours seeping into buildings. The treatment was always to a level that would have prevented such impacts to indoor air. Transmission of cVOC to indoor air would only occur if concentrations in groundwater exceeded drinking water standards.

The P.Geo. recommended discharge of the treated groundwater to an infiltration trench downstream (Fig. 2) in order to minimize interruption to the natural groundwater flow system, enhance movement of clean water off-site, and blanket the plume with cleaner water to limit soil vapour impacts. The recommendations were also considered to reduce sanitary sewer loading and costs and allow uninterrupted discharge of treated water.

The Regulator did not allow discharge of the treated groundwater to an infiltration trench downstream, citing concerns that the treatment might be ineffective, or that the trench might become plugged. Questions were also raised about the commitment of the client to a long-term system, and uncertainties about where the infiltrated water would go.

The following responses were provided to the Regulator by the P.Geo. and client:

1. The system proved effective based on a pilot test. Regular monitoring of flow rates, effluent water quality and overall performance would be undertaken. In fact, there would be no issue if the system did not work perfectly as this would still be better than the *status quo*.
2. Plugging was highly improbable because dissolved solids were extremely low in the extracted groundwater and the water was fully oxygenated already (so metals would not be precipitated causing plugging) and there were no suspended solids in the raw and treated water. Also, the subsurface consists of coarse sand, gravel and cobbles, so the trench could be excavated and unplugged, if necessary.
3. Financial resources for the clean-up had been accrued, with money set aside for ongoing groundwater remediation at this site.
4. Groundwater modelling conducted to show the impact of pumping and recharge demonstrated that the plume was in a buried channel aquifer composed of coarse-grained material and that the flow direction remained consistent.

Figure 1. Treatment train for removing cVOCs from groundwater at the site in Case Study #1.

Figure 2. Possible location for discharge of treated groundwater to the aquifer (note the coarse-grained material in foreground).

In order to advance the project, the P.Geo. and the client agreed to the Regulator's demand to discharge treated water to sanitary sewer. The Regulator was represented by a Professional Engineer (P.Eng.) and supporting staff. The P.Geo. did not appeal this decision as there was pressure to start pumping groundwater as soon as possible. The benefit of pumping and controlling off-site movement of contaminated groundwater was positive. The system (Fig. 1) pumped clean water to the sanitary sewer at about 200,000 litres per day for about three years (i.e. a total of approximately 200 million litres of clean water was discharged to the sewer). The Municipality was compensated for the discharge by the client.

Case 2: Nitrate Dilution in Groundwater

In this case, regarding an assessment for a septic system, the Regulator (conservation authority) provided approval based on less land area available for dilution than was originally proposed.

In parts of Canada, privately-serviced lots that use water wells and septic systems must be large enough to allow precipitation to dilute septic effluent (i.e. nitrate) in the subsurface to acceptable levels. The assessment takes into account precipitation, evapotranspiration, runoff and infiltration, hard surfaces and, of course, the available land area (Ontario Ministry of the Environment and Climate Change 1996a, b). The lot in question was divided by a watercourse which was a groundwater divide. The Regulator (conservation authority) was represented by a P. Geo. and supporting staff.

The consulting P.Geo. recommended a proposed severance located on the east side of the watercourse (Fig. 3; yellow-shaded area). However, the Regulator approved the larger lot that included the west side of the watercourse (Fig. 3; red outline). The approved lot was larger in area, but the area that was available for dilution of any septic discharge was smaller (0.32 ha) compared to the original proposal (0.40 ha).

The P.Geo. representing the Regulator stated that the proposed area was too small, and would therefore only allow the larger lot. However, this decision did not consider that much of the larger lot was not available for dilution, being on the opposite side of the creek from the septic system. Scientific reasoning suggests that the larger approved lot was potentially worse for the environment, in that the area would provide less water for infiltration to dilute the septic effluent.

The consultant (P.Geo.) did not object because the overall area (including land outside the severance) was sufficient for nitrate dilution and planning regulations did not allow for additional lots (and therefore septic systems) in the area around the severance. The client did not object because they obtained their severance. The Regulator (P.Geo.) was comfortable because the 'lot area' met the policy. Had the planning regulations not been in effect, the consultant would have had to decide on whether to accept the severance with the larger overall area but with a lower ability to dilute septic effluent or not.

Case 3: Re-use of Excess Material

In this case, excavation and disposal of excess material (marginally contaminated soil) that posed minimal health risks was ordered to be completely removed from a site, which posed greater environmental risks than leaving it in place.

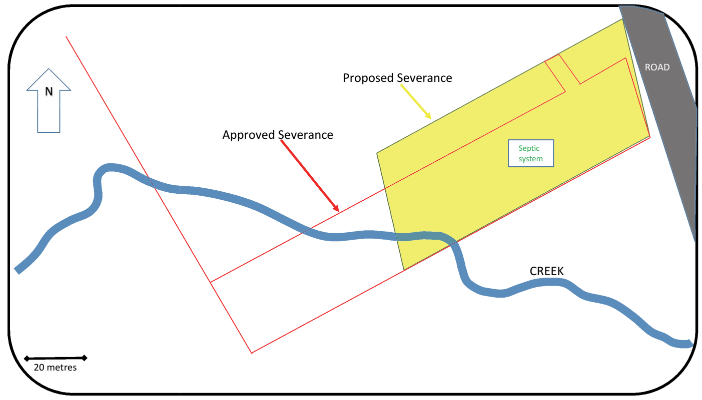

Figure 3. Outline of proposed severance (yellow shading) and approved severance (red outline) at the site in Case Study #2.

Figure 4. Example of test pit excavation to assess soil quality in the area of infrastructure renewal in Case Study #3.

Infrastructure projects typically generate excess soil when excavation for installation or renewal of buried services is required. In older urban environments, this material may be affected by various contaminants. Testing of material prior to construction is typically conducted (Fig. 4) to determine if it is 'contaminated' based on clean-up criteria and the numerical concentration values for potential contaminants in the soil. In some cases, the author has noted that there has been public pressure to remove all disturbed 'contaminated soil' despite there being no risk from leaving it onsite.

In environments where groundwater is not approved as a potable source there is typically limited risk in leaving marginally contaminated soil in the ground, but regulators sometimes require the removal of all contaminated soil (native or fill) from excavations associated with infrastructure renewal. The additional handling, testing, transport and disposal costs present a higher environmental risk compared to re-use of the soil in an area with no potential human or ecological risk, i.e. up to 5 metres below a paved street in a service trench (Fig. 5).

The consultant (P.Geo.) did not object to the requirement for removal and disposal of this marginally contaminated

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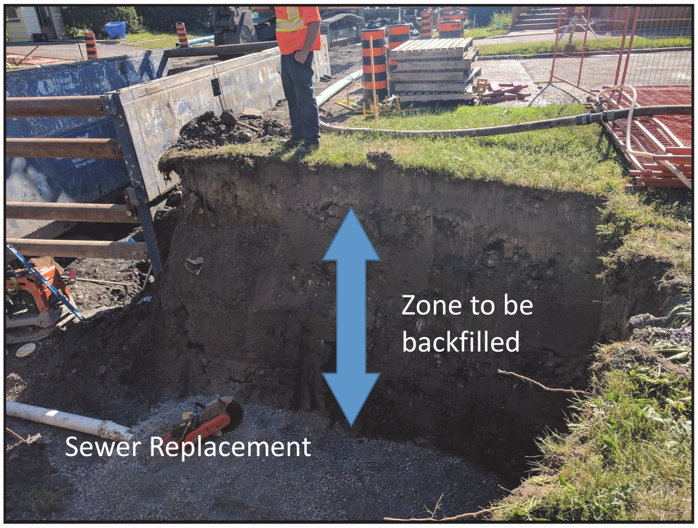

Figure 5. Typical profile in the area of infrastructure renewal showing zone of potential contaminated soils in excavation above services.

material, because human health and the environment was protected. However, there are additional fees and negative environmental impacts from transportation of soil and fill, and disposal of soil. These impacts include significant fossil fuel consumption during the transportation of materials from the site to the disposal facility and the extraction, processing and transportation of replacement soil from a source to the site. The professional for the Regulator was comfortable with the low risk of removal, and the client (land owner) concurred with soil removal as it appeared to be the most prudent method of dealing with material. The contractor concurred because it was simple and resulted in additional charges to the client.

It is noted that, subsequent to this case study, regulators (municipal and provincial governments) have been looking more closely at the possible re-use of excess materials in construction projects. This has been driven by more science-based discussions between regulators and practitioners and owners. Guidelines are being developed for a more rational evaluation of excess materials and possible re-use (*Excess Soil Management Policy Framework*, Government of Ontario, December 2016).

COMMON THEMES

Several common themes are identified with these three case studies. In all cases, the Regulator and consultant (P.Geo.) did not agree on the approach. The consultant considered actual risk and practicalities, but the Regulator wished for no risk (either real or perceived), and a professional disagreement ensued.

Geo-Ethical Implications

Geoscience is regulated in almost all jurisdictions in Canada. Regulation is on a provincial level and each professional association has its own legislation, processes, code of ethics and discipline procedure. Despite all this, professional geologists are independent and work within the bounds of professionalism and the laws of the jurisdiction in which they work. In many locations in Canada, there can be up to five levels of regulatory authority – Federal, Provincial, Municipal (two levels) and independent Boards or Authorities – all with authority over the opinions of consulting geoscientists.

The ‘professional disagreements’ noted in the above case studies indicate that regulators do not always evaluate risks in a similar manner to proponents or consultants who are professional geoscientists. Regulators are guided by policies in which guidelines are commonly taken as ‘statutory’, and not simply as guidelines; risk is sometimes only ‘perceived risk’, not ‘real risk’, but regulators are averse to either form. A Professional Geoscientist in a regulatory position may have other constraints on his or her decision-making beyond purely scientific judgments, and public perception may affect regulatory decisions.

References to Code of Ethics

The following are excerpts from the Association of Professional Geoscientists of Ontario (APGO) Code of Ethics Regulation (Professional Geoscientists Act (Ontario) 2000). These pertain to the conduct of professional geoscientists and requirements for behaviour and interactions with others:

Code of Ethics of Professional Geoscientists
Service and Human Welfare

2. A professional geoscientist shall be guided in his or her professional conduct by the principle that professional ethics are founded upon *integrity, competence and devotion to service and to the advancement of human welfare* and by the conviction that his or her actions enhance the dignity and status of the profession.

Duty to Others and the Environment

5. (1) When acting in a professional capacity, a professional geoscientist shall at all times act with,
   (b) *due regard to public needs*;
   (2) A professional geoscientist shall,
   (a) regard his or her duty to *public safety and welfare as paramount*;
   (4) A professional geoscientist has a duty to *co-operate with other professionals with whom he or she is called upon to work*.
   (5) A professional geoscientist shall *have proper regard for the natural environment* in his or her work.

The italicized items noted above are those which were considered in the three case studies discussed herein. The italics were introduced by the author for emphasis.

RECOMMENDATIONS

A review of these three case studies provides an interesting insight into geo-ethical issues facing consultants and regulators. The following recommendations are made for situations where regulatory decisions contradict ‘sound science.’

Do not over-ride a Regulator’s decision (if they are a registered professional) *unless* there is an imminent danger to life, health of humans or the environment; however, in cases of imminent danger, the professional is *required* to object to such decisions. Professional geoscientists should ensure that their proposal is based on sound science and has been reviewed and documented. Regardless of differences in opinion, professionals should cooperate.

Furthermore, a record of *rational decision making* should be presented to the Regulator, and a post-project 'lessons-learned' evaluation specific to the difference in professional opinions should be undertaken. Finally, professional bodies should promote workshops or information-sharing sessions between professional geoscientists who are practitioners and those who are regulators.

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