



Use of Geophysical Instruments in Near-Surface Investigations

V1.0
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The Association of Professional Engineers,
Geologists and Geophysicists of Alberta

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FOREWORD

Engineers and geologists have been the subject of complaints for having used geophysical instruments in ways that allegedly involve the practice of geophysics. Some of these individuals have found themselves before APEGGA's Discipline Committee and have been disciplined accordingly. Under the Engineering, Geological and Geophysical Professions Act, the practice of geophysics is restricted exclusively to professional geophysicists and registered professional technologists (geophysical).

Engineers and geologists contend that their education and experience should allow them to utilize geophysical equipment in accordance with that knowledge, oftentimes obtained through university faculties of engineering and geo-science. In many instances, the practice involves use of geophysical instruments for engineering and environmental projects. APEGGA members ask what they are allowed to do with geophysical equipment without violating the *Act*. Similarly, non-APEGGA individuals and organizations have also been confronted for allegedly practicing geophysics without being licensed and have raised similar arguments.

This document has been prepared to address those issues. It outlines APEGGA's position on which practices are exclusively the domain of geophysicists. Conversely, it identifies, as best as possible, the areas of practice in which non-geophysicists may use geophysical instruments for near-surface applications that do not violate the restricted practice provisions of the *Act*.

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1 OVERVIEW

The practice of geophysics is regulated under the *Engineering, Geological and Geophysical Professions Act*, restricting that practice to those individuals who are registered with APEGGA as Professional Geophysicists or Registered Professional Technologists (Geophysical). Geophysical investigations normally fall within the scope of practice of geophysicists and are regulated under the Act. However, there are some applications where geophysical techniques and instruments may be used by non-geophysicists.

1.1 SCOPE

This guideline indicates those activities which are exclusive to geophysicists and those where non-geophysicists may utilize geophysical instruments without violating the exclusive scope of practice provisions for geophysics as defined in the Act. The scope of this guideline is deliberately limited to “near-surface” applications as defined below.

The guideline is not a legal interpretation of the Act. Members and non-members will still need to assess the specific application of geophysical instrumentation to ensure that an exclusive-practice violation does not occur.

1.2 PURPOSE

The purpose of the guideline is to assist in determining the allowable use of geophysical instruments by non-geophysicists. As such, it is intended to serve as a guide to APEGGA members as well as to non-members. Furthermore, it is intended to serve as a reference for APEGGA's regulatory committees and boards to assist them in the course of their duties.

1.3 DEFINITIONS

For the purposes of this guideline, the following terms and definitions apply.

4-D monitoring

The use of geophysical techniques collected in a series of 3D data volumes at various calendar dates (hence the 4th dimension of time). However, the term has also come to be used more generically for any temporal monitoring of the subsurface at any scale by geophysical techniques. Time-lapse geophysical monitoring is another equivalent name that also has wide usage.

Anthropogenic

Resulting from the influence of human beings on nature.

Archaeological surveying

The use of geophysical techniques to assess a site, to help focus efforts as to which areas to work on initially, and to generally prepare for excavation or to have areas protected.

Bathymetry

Determining underwater topography, i.e., the measurement of water depth at various places in a body of water.

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Bedrock mapping

Finding the depth to the bedrock.

Blast monitoring

The use of standardized recording instruments to measure the properties of the seismic waves produced during blasting for any reason.

Coal exploration

Searching for coal deposits and assisting in the detailed delineation of a coal body once found.

Contaminant mapping (vadose and anthropogenic)

The delineation of zones in which contaminants have moved.

Downhole exploration

The use of geophysical well logging and other downhole instruments to help in any interpretation of borehole data.

Forensic work

Assisting authorities in accident and criminal investigations.

Geophysicist

An individual registered with APEGGA as a professional geophysicist or registered professional technologist (geophysical).

Groundwater resource exploration

The search for useable groundwater and the delineation/evaluation of this resource.

Marine geophysics

Any geophysical technique, modeling, or data analysis used in a marine or freshwater environment.

Mineral exploration

The search for minerals and the delineation/evaluation of this resource.

Near-surface

The zone of investigation from the ground surface and extending into the bedrock. It includes soil, unconsolidated and consolidated surficial material, and confined and unconfined groundwater aquifers that can be measured using appropriate geophysical applications. Without limitation, this zone may extend from a few metres to hundreds of metres.

Permafrost mapping

Delineation of permafrost and ground ice distribution.

Rippability determination

Assessment of the ability of rock to being excavated.

Subsurface metal mapping

Delineation of anthropogenic metal not including utilities and unexploded ordnance.

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Unconventional hydrocarbon resource identification

Delineation of unconventional hydrocarbons, e.g., coal bed methane, shales, hydrates.

Underground utility location (non-standard)

Location of utilities (e.g., electrical, water, sewer, gas, cables) in complex and high-risk locations.

Unexploded ordnance mapping

The search for potentially dangerous unexploded ammunition, usually on current or former military test ranges.

Vadose Zone

The zone between land surface and the water table within which the moisture content is less than saturation.

Void detection

Detecting voids within the earth, such as old mine workings or natural karsting.

2. EXCLUSIVE AND NON-EXCLUSIVE ACTIVITIES

2.1 RATIONALE

The guiding principles which govern the rationale behind determining which activities are exclusive to geophysicists follow, along with some illustrative examples.

Conformance with the definition of geophysics in the Act

APEGGA has a duty to uphold the provisions of the *Engineering, Geological and Geophysical Professions Act*. According to the definition in Section 7 of the Act, "practice of geophysics" means:

- reporting on, advising on, acquiring, processing, evaluating or interpreting geophysical data, or geophysical surveying that relates to any activity
 - that is aimed at the discovery or development of oil, natural gas, coal, metallic or non-metallic minerals or precious stones or other natural resources or water or that is aimed at the investigation of sub-surface conditions in the earth, and
 - that requires in that reporting, advising, evaluating, interpreting, or geophysical surveying, the professional application of the principles of the geophysical sciences, or
- teaching geophysics at a university.

Where the use of geophysical instruments does not conflict with the definition, the Act is not contravened. For example, if an individual uses geophysical instruments to evaluate the integrity of a man-made structure, the individual would not be considered to be practicing geophysics and would not need to be a geophysicist.

Protection of the public

Improper selection or use of geophysical instruments or incorrect interpretation of geophysical data by unqualified individuals can lead to erroneous conclusions about

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sub-surface conditions may put the public at risk. In these instances, the scope of practice is restricted to geophysicists.

Historical practice

Certain geophysical instruments have historically been used in applications without the involvement of a geophysicist. For example, line-locating and pin-finding use electromagnetic instruments to locate buried lines, cables, survey pins, etc. There is no intent to make these practices exclusive to geophysicists. However, the limitations of the geophysical instrument or method still need to be understood by the operator and the person requesting the study.

Investigation of engineered structures

Geophysical instrumentation and techniques are often applied to the investigation of engineered structures, e.g., non-destructive testing. Since these activities do not involve the investigation of “sub-surface “conditions” in the earth *per se*, they are considered a non-exclusive use of geophysics and are not restricted to geophysicists. For example, the geophysical exploration of roads or engineered earthworks is not exclusive to geophysicists.

2.2 ACTIVITIES

The following table provides a non-exhaustive list of activities in which geophysical instruments are used for near-surface investigations. The activities are grouped into three categories:

- those which require the involvement of a geophysicist,
- those which might or might not require the involvement of a geophysicist, and
- those which do not require the involvement of a geophysicist.

Required (Activities Exclusive to Geophysicists)

These activities require the involvement or supervision of a geophysicist. Activities in this category have the potential to place the public at risk.

Possibly Not Required (Activities Requiring Further Consideration)

Certain activities cannot be determined without further consideration. A geophysicist should be consulted prior to undertaking these activities to determine whether or not a geophysicist’s involvement is needed. It is possible that these activities might not require the involvement or supervision of a geophysicist for various reasons. However, in cases where there is some complexity or high risk, a geophysicist would be required.

Not Required (Activities Not Exclusive to Geophysicists)

These activities do not require the involvement of a geophysicist. Typically, these activities do not place the public at risk.

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Geophysicist Involvement in Activities		
Required	Possibly Not Required *	Not Required
<ul style="list-style-type: none"> ▪ 4-D monitoring ▪ Bedrock mapping ▪ Channel mapping ▪ Coal exploration ▪ Contaminant mapping (groundwater) ▪ Forensic work ▪ Groundwater resource exploration ▪ Ice thickness mapping ▪ Marine geophysics ▪ Mineral exploration ▪ Overburden thickness ▪ Permafrost mapping ▪ Subsurface metal mapping ▪ Unconventional hydrocarbon resource identification ▪ Underground utility location (non-standard) ▪ Unexploded ordnance mapping ▪ Void detection 	<ul style="list-style-type: none"> ▪ Bathymetry ▪ Blast monitoring ▪ Contaminant mapping (vadose & anthropogenic) ▪ Downhole exploration ▪ Rippability determination ▪ Training and teaching geophysics 	<ul style="list-style-type: none"> ▪ Archaeological surveying ▪ Soil bulk density measurement ▪ Soil moisture measurement ▪ Soil salinity measurement (vadose zone) ▪ Underground utility location (standard)

* A person who considers undertaking any of these activities is strongly encouraged to involve a geophysicist. Choosing not to involve a geophysicist and being found to have performed the work in an unskilled manner could result in action being taken against such a person under the *Engineering, Geological and Geophysical Professions Act* or under another professional regulatory act where the person is registered under such an act.