

Draft

Instructions for Completing an Application for an
Environmental Compliance Approval (ECA)
Vertical Closed Loop Ground Source Heat Pumps

Relevant Legislation for Issuance of an ECA:
Environmental Protection Act, R.S.O 1990, Section 9, 20.1 to 20.14
O. Reg. 98/12 made under the Environmental Protection Act

O. Reg. 255/11 made under the Environmental Protection Act

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Disclaimer:

These Instructions are not and should not be construed as legal advice. Please review the Environmental Protection Act (www.e-laws.gov.on.ca) and the Ministry of Environment website (www.ene.gov.on.ca) for more information on the laws that apply to the construction, alteration, extension, or replacement of Vertical Closed Loop Ground Source Heat Pumps. Should you have any questions about the application or interpretation of the laws of Ontario or have other legal questions, you should consult a lawyer.

Foreword

This document outlines the minimum expectations of the Ministry of the Environment (Ministry) for environmental compliance approval (ECA) applications relating to the construction, alteration, extension or replacement of vertical closed loop ground source heat pumps as defined in O.Reg. 98/12 (the Regulation) made under the Environmental Protection Act (EPA).

In order to obtain an ECA, an applicant is required, as a minimum, to retain a licensed engineering practitioner (professional engineer) or a professional geoscientist as defined in the Regulation (the Professional), to prepare a Work Plan that addresses the safe management of hazardous gas encountered during the drilling of holes and installation of a vertical ground source heat pump system and which:

- Identifies measures to prevent or reduce the likelihood of the migration of hazardous gas between subsurface formations or between a subsurface formation and the ground surface or otherwise manage the gas in a way that removes any potential hazard if hazardous gas is encountered and, if those measures fail, decommission the ground source heat pump.
- Includes a plan or template to notify the parties as required by subsection 4 (2) of the Regulation, if hazardous gas is encountered.

This document is intended to assist the installers of vertical closed loop ground source heat pumps, licensed engineering practitioners and professional geoscientists in the development of a Work Plan. This Work Plan is required to establish the proposed measures and procedures which will be used to protect against hazardous gas impacts while working on a vertical closed loop ground source heat pump.

This document will also be used by Ministry staff to guide their review and assessment of these ECA applications.

I. Introduction

Vertical closed loop ground source heat pumps are being installed across the province as a viable natural heating and cooling system for residential, commercial and industrial applications. There are a variety of geological conditions that may be encountered across the province when installing a heat pump system.

Pockets of hazardous gas as defined in the Regulation can be found under pressure in sedimentary bedrock. In addition, hazardous gas is also known to exist in confining zones in overburden deposits and in Precambrian bedrock in Ontario.

Installers of vertical closed loop ground source heat pumps, therefore, face the risk of encountering hazardous gas. Many vertical ground source heat pumps are installed in populated residential environments where the release of an uncontrolled flow of hazardous gas is a danger to the public. Some are also known to be located under buildings and structures where access to remedy future problems may be impossible.

Effective May 18, 2012, Ontario Regulation 98/12 (Ground Source Heat Pumps) issued under the authority of the Environmental Protection Act, R.S.O. 1990, c. E. 17 (Act), requires any person constructing, altering, replacing or extending vertical closed loop ground source heat pump that extends or will extend more than 5 metres below the original ground surface, to obtain an Environmental Compliance Approval (ECA).

The intent of the ECA is to allow the Ministry to be satisfied that a Work Plan is prepared which complies with the Regulation. Any person constructing, altering, extending or replacing a vertical closed loop ground source heat pump is required to have a professionally prepared Work Plan in place to inform the installation work and set out procedures that are to be followed in that event that hazardous gas is encountered. In preparing the Work Plan, the Professional must identify a standard of protection that is at least equal to what is required in similar circumstances by "Oil, Gas and Salt Resources of Ontario - Provincial Operating Standards", version 2.0, dated January 24, 2002 and published by the Ministry of Natural Resources, as amended from time to time.

II. Purpose

This document is intended to outline the Ministry's expectations for an ECA application for vertical closed loop ground source heat pump systems, and will also serve as a guide to Ministry staff in their review of ECA applications for vertical closed loop ground source heat pumps.

This document applies to vertical closed loop ground source heat pump systems including those that use water and antifreeze mixtures, a refrigerant or another fluid as a heat transfer fluid contained within heat transfer tubing, as long as a portion of the closed loop ground source heat pump extends or will extend more than 5.0 metres below the original ground surface.

III. Non-Application

This document does not apply to:

- a closed loop ground source heat pump that does not extend or will not extend more than 5 metres below the original ground surface. This includes most horizontal closed loop ground source heat pump;
- an open loop ground source heat pump or a submerged (surface water) closed loop ground source heat pump;
- the portion of the ground source heat pump heating and cooling system that is found in a building or a structure such as a pool; and
- a closed loop ground source heat pump that uses methanol as a heat transfer fluid and was installed before January 1, 1998.

IV. Clarification of Terms

Refer to the Appendix for a glossary of terms that are used in these Instructions.

For clarification, a ground source heat pump is also known as an earth energy system or low temperature geothermal system.

V. Application

These Instructions are intended to guide anyone constructing, altering, extending or replacing a vertical closed loop ground source heat pump, licensed engineering practitioners and professional geoscientists on Ministry expectations for multi-site ECA applications.

Where appropriate, the Ministry can issue a single multi-site ECA to an installer that will allow the installation of vertical closed loop ground source heat pumps at various locations throughout the province without having to obtain an approval for each individual site.

The Instructions should be read and used in conjunction with the Regulation, the Act (specifically sections 9 and 20.1 to 20.14) and the application form approved by the Ministry for the vertical closed loop ground source heat pump ECA application.

These Instructions are also for the use of Ministry staff during the review of these applications.

VI. Mandatory Requirements

The authority to issue the ECA is set out in the Environmental Protection Act. Regulation 255/11 made under the Act (E-laws - http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_110255_e.htm) sets out the requirements for ECA applications. Ontario Regulation 98/12 (E-laws - http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_120098_e.htm) sets out additional requirements for ECA applications relating to the construction, alteration, extension or replacement of vertical closed loop ground source heat pumps.

Ontario Regulation 98/12 requires that the application for an ECA include, as a minimum, a Work Plan meeting the following criteria:

- (a) is prepared by a licensed engineering practitioner or professional geoscientist as defined in the Regulation;
- (b) identifies equipment and procedures to be used to monitor for the presence and migration of hazardous gas;
- (c) identifies measures to be taken to prevent or reduce the likelihood of the migration of hazardous gas, whether through the hole or otherwise, during construction, alteration, extension or replacement of the vertical closed loop ground source heat pump, including detailed requirements for:
 - (i) ensuring that any space around the underground heat exchanger is sealed to prevent any movement of hazardous gas between

subsurface formations or between a subsurface formation and the ground surface, or otherwise managing the gas in a way that removes any potential hazard; and

- (ii) decommissioning the heat pump if measures under subclause (i) are not taken, or are taken but do not remove all potential hazard.
- (d) identifies minimum measures to be taken to prevent an adverse effect if hazardous gas is encountered;
- (e) identifies a standard of protection that is at least equal to what is required in similar circumstances by “Oil, Gas and Salt Resources of Ontario - Provincial Operating Standards”, version 2.0, dated January 24, 2002 and published by the Ministry of Natural Resources, as amended from time to time; and
- (f) includes a health and safety plan.

Explanations of the Ministry’s expectations for meeting the above requirements are provided in section VIII “Content of the Work Plan”.

VII. Considerations

The Regulation requires that the Professional preparing the Work Plan (as described in section VI “Mandatory Requirements”) consider the following legislation and guidance documents:

1. The Oil, Gas and Salt Resources Act, R.S.O. 1990, c. P. 12;
2. Ontario Regulation 245/97 (Exploration, Drilling and Production) made under the Oil, Gas and Salt Resources Act, R.S.O. 1990, c. P. 12;
3. “Oil, Gas and Salt Resources of Ontario - Provincial Operating Standards”, version 2.0, dated January 24, 2002 and published by the Ministry of Natural Resources, as amended from time to time;
4. Annex A (Environmental Guidelines for Earth Energy Heat Pumps and Underground Thermal Energy Storage (UTES) Systems) of CAN/CSA-C448.1-02 (Design and Installation of Earth Energy Systems), dated October 2009 and published by the Canadian Standards Association, as amended from time to time; and
5. “Water Supply Wells - Requirements and Best Management Practices”, dated December 2009 and published by the Ministry, as amended from time to time.

VIII. Content of Work Plan

In order to meet the requirements specified in the Regulation, an applicant must demonstrate through a Work Plan that measures will be put in place to protect the environment and the public from hazardous gas if encountered when constructing, altering, replacing or extending vertical closed loop ground source heat pumps. Applicants are required to submit the Work Plan to the Ministry, which, in order to be considered for an ECA must be prepared and presented in accordance with the following information details and format.

At a minimum, the licensed engineering practitioner or professional geoscientist will provide to the applicant a Work Plan that applies to all sites where a person does work on a vertical closed loop ground source heat pump.

The Work Plan must address new construction, alterations, replacements or extensions in the following scenarios:

Overburden and Precambian Systems:

- completing a vertical closed loop ground source heat pump in any overburden deposits and above the top of bedrock where hazardous gas is unlikely to be encountered under significant pressure; and
- completing a vertical closed loop ground source heat pump in any Precambrian aged bedrock where hazardous gas is unlikely to be encountered under significant pressure.

Sedimentary Bedrock Systems:

- completing a vertical closed loop ground source heat pump in any competent sedimentary bedrock of Cambrian age or younger (which will require the bottom of a surface casing be placed and cemented at least 15 metres below the top of competent sedimentary bedrock).

The Work Plan should reflect best drilling practices with respect to works relating to a vertical closed loop ground source heat pump system such as drilling the hole, installing heat transfer tubing into the hole, and placing materials to fill the void space left in the hole around the heat transfer tubing in order to prevent the movement of hazardous gas.

At a minimum, the Work Plan should include and provide for the following, as detailed in this section, organized into the following headings

1 Qualifications and Discussion of Documentation Considered

The person preparing the Work Plan for the applicant shall be a Professional as defined in the Regulation. The Professional shall address the mandatory requirements set out in the Regulation and in section VI above. The Professional preparing the Work Plan must consider the documents listed in section VII above.

The Professional preparing the Work Plan for the applicant shall document how the documents listed in section VII above were considered with regard to identifying a standard of protection that is at least equal to what is required in similar circumstances by “Oil, Gas and Salt Resources of Ontario - Provincial Operating Standards”, version 2.0, dated January 24, 2002 and published by the Ministry of Natural Resources, as amended from time to time.

2 Health and Safety Plan

An effective health and safety plan that incorporates, at a minimum, the following:

- procedures, practices, resources, key safety-related activities and monitoring measures to ensure the safety of the proposed work or activity;
- means to comply with safety-related requirements of legislation such as the Occupational Health and Safety Act and its regulations;
- safety measures identified through the hazard identification and risk evaluation process;
- safety measures identified as part of a safety program needs assessment; and
- safety commitments made as part of the drilling activities.

3 General Provisions

The General Provisions of the Work Plan are generic and can be applied to all sites covered under the Multi-Site ECA. The General Provisions are to be prepared by the Professional.

3 (1) Hazardous Gas Monitoring and Detection Plan

- (a) A description of the type(s) of gas detection and monitoring equipment and procedure(s) that will be used to monitor hazardous gas, including as a minimum:
 - (i) in the hole while drilling, including hydrocarbon detection on mud stream, or other acceptable method;
 - (ii) above the ground surface near the top of the hole; and

- (iii) the experience and qualifications, as applicable, of the person(s) who are responsible for operation of the equipment identified.
- (b) A description of the observations that will be made and the procedures that will be followed to monitor for hazardous gas. The observations could include:
 - (i) gas noise, visual changes in the air, odours or bubbles associated with water coming out of the hole at drill rig site;
 - (ii) a pressure kick in the hole; and
 - (iii) in rotary drilling, a change in drilling rate, a change in pumping pressure, a change in surface fluid rate, a reduction in drill pipe weight or change in quality of drilling mud.

3 (2) Drilling Plan

A step by step description of drilling activities, in sequence, to proceed and build any hole of a vertical closed loop ground source heat pump that includes, as a minimum:

- (a) the type(s) of drilling machines that will be used to construct holes;
- (b) the types of drilling method(s) that will be used to construct holes;
- (c) The experience and qualifications, as applicable, of the person(s) who are responsible for operation of the drilling machines;
- (d) the types of drilling fluids that will be used during drilling such as air, water or drilling mud;
- (e) casing and cementing details;
- (f) a general cross sectional diagram of each type of finished hole that will be into overburden or Precambrian aged bedrock and a second general cross sectional diagram of the hole filled with the heat transfer tubing and material that fills the remaining void space. The diagram provide estimated measurements including hole diameter and tubing diameter;
- (g) a general cross sectional diagram of each type of finished hole that will be into sedimentary bedrock (i.e., younger than Cambrian age bedrock), including the surface casing being cemented into a depth of at least 15 metres from the top of competent bedrock, and a second general cross sectional diagram of the hole filled with the heat transfer tubing and material that fills the remaining void space. The diagrams must provide estimated measurements including hole diameter and tubing diameter; and
- (h) the procedures to have the drilling plan on the site at the time of installing the vertical closed loop ground source heat pump.

3 (3) Standard Requirements for Drilling Overburden and Precambrian Systems

The Work Plan should specify the measures that will need to be followed in overburden deposits underlain by Precambrian bedrock including, but not limited to, prescribing the drilling methods, equipment and procedures that are to be employed in order to prevent or reduce the likelihood of the migration of hazardous gas including, as a minimum:

- (a) provisions for killing the hole; and
- (b) provisions for venting, dispersing and if necessary, flaring the gas in a safe manner.

Note: "Killing the hole" is an industry term which means the placing of drilling fluids and additives in a hole to temporally stop the upward flow of a fluid, gas or any other material out of the hole, until such time as further mitigation occurs.

3 (4) Standard Requirements for Drilling Sedimentary Bedrock (of Cambrian age or younger) Systems

The Work Plan should specify the measures that need to be followed when competent sedimentary bedrock is encountered. These measures should include but not be limited to the prescribing of drilling methods, equipment and procedures that are designed to prevent or reduce the likelihood of the migration of hazardous gas including, as a minimum, the following:

- (a) The minimum size of hole that will be drilled to:
- (b) create a uniform Annular Space or Annular Clearance of at least 3.8 centimetres between the side of the hole and a surface casing and
- (c) minimize cement channelling in the Annular space or Annular Clearance and ensure successful cementing of the hole between the surface casing,
- (d) Casing specifications, including size and grade and the cited reference(s) that considers sections 3.5 (Design of Casing Program) and 3.8 (API Standards) in the Provincial Operating Standards
- (e) The placing and seating into bedrock of the bottom of the surface casing at least 15 metres into competent bedrock and 15 metres below the lowest potable bedrock groundwater zone and, if necessary, the placing and seating of other casing strings that go into the hole
- (f) The types and use of centralizers

- (g) The minimum distance between centralizers needed to centre the surface casing and other casing strings in the hole and the cited reference(s)
- (h) The type of cement and water that will be used to form a cement including, if necessary, sulphate resistant cement in sulphur water environments
- (i) The mixture specifications for the cement and water that will be used for a cement and the cited reference(s)
- (j) Cementing of the annular space procedures using the displacement method and considers section 3.9 (Design of Cementing Program) in and section 3.11 (Drilling Surface Hole - Casing and Cementing) in the Provincial Operating Standards

3 (5) Preparation for Gas Mitigation Contingency Plan

The Work Plan should specify the measures that need to be followed to prepare for encountering hazardous gas, including as a minimum, a description of:

(a) Equipment and Materials

- (i) provisions for the use and type of a blow out prevention equipment or venting, dispersion and flaring equipment;
- (ii) provisions for the use of drilling fluids with additives to counterbalance the formation pressure;
- (iii) the types of drilling fluids, with weighted additives, and the volume of drilling fluids needed to kill the hole;
- (iv) plan to have sufficient drilling fluids (e.g. bentonite) with additives (e.g., barite) on-site to counterbalance the formation pressure to kill the hole at the vertical closed loop ground source heat pump site; and
- (v) plan to have the equipment on site to kill the hole at the vertical closed loop ground source heat pump site or equipment available to safely vent gases if the hole cannot be “killed”.

(b) Training and Qualifications

- (i) Person(s) to be available on-site who will be responsible for, and are trained in the equipment, materials, techniques and procedures to drill, construct while monitoring for hazardous gas and implement, should the need arise, the immediate mitigation requirement (e.g., kill the hole or vent, disperse or flare the hole) under section 5 (Gas Mitigation Contingency Plan), all to address the risk of encountering hazardous gas.
- (ii) For bedrock holes where there is a potential for pressurized hazardous gas, further training and qualifications of persons

are needed to drill the hole and operate blow out prevention equipment on the casing.

(c) **Notification Contact List**

(i) A template notification contact list form that includes the parties identified in the notification requirements found in section 4 of the Regulation as well as the following contact information;

- I Fire department <include contact info>
- II Occupant of the building <include contact info>
- III Ministry's Spills Action Centre <1-800-268-6060>
- IV Owner of the property <include contact info>
- V Purchaser of the pump <include contact info>
- VI The name of a licensed engineering practitioner or professional geoscientist who can be contacted if hazardous gas is encountered.

(ii) The Work Plan must specify that the template notification contact list form will be fully completed with the relevant site specific information prior to the drilling of the initial hole.

3 (6) Installation under Buildings and Structures

Procedures that reflect consideration of the risk associated with the potential migration of hazardous gas where any hole for a vertical closed loop ground source heat pump is underneath buildings and structures.

3 (7) Standard Completion Report

As a minimum, the Work Plan should provide that the following information will be prepared after the installation of the vertical closed loop ground source heat pump for which hazardous gas was not detected or observed during installation:

- (a) Provisions for a Standard Completion Report to be provided by the installer to the owner of the vertical closed loop ground source heat pump confirming that hazardous gas was not detected or observed during the installation of the vertical closed loop ground source heat pump.
- (b) The Standard Completion Report where hazardous gas is not encountered should include a log of drilling observations for each

hole and details of how the system was constructed and the holes were sealed.

4 Preliminary Site Preparations

These are site specific procedures for investigating and documenting the anticipated conditions at each site as well preparations that need to be undertaken specifically for each site prior to drilling including, as a minimum:

- 4 (1) A review of available area geological reports and records to obtain a geological prognosis of the tops of formations and expected oil, gas, water and loss of circulation zones and pressures including the examination of the following records:
 - (a) Oil and gas well records are available from the Oil, Gas and Salt Resources Library, Ministry of Natural Resources, 669 Exeter Road, London, ON, N6E 1L3 or (519) 686-2772, <http://www.ogsrlibrary.com>;
 - (b) Well records from the Ministry of the Environment; and
 - (c) Other available sources of information such as geological maps.

- 4 (2) That the following information will be prepared and made available to all persons who will be doing work at the site:
 - (a) completed Notification Contact Form;
 - (b) documentation of the results of the Preliminary Site Assessment and Geological Prognosis (Assessment);
 - (c) a diagram of the location of all holes to be drilled on a site, wells, buildings, other structures including the location of above and underground utilities, Preliminary Site Assessment and Geological Prognosis (Assessment); and
 - (d) a site specific drilling program

5 Gas Mitigation Contingency Plan

5 (1) Immediate Gas Mitigation Measures

An Operating Procedure, titled “Immediate Gas Mitigation Measures”, which describes the immediate measures to be taken upon detection of hazardous gas in any hole that is part of a vertical closed loop ground source heat pump. The Operating Procedure should consider, as a minimum, a description of the equipment and procedures for taking the immediate action such as:

- (a) the requirement to temporarily cease of drilling;
- (b) the use of the measures in Section 3.5 (General Provisions Preparation for Gas Mitigation Contingency Plan);

- (c) applying sufficient drilling fluids with additives to the hole to counterbalance the formation pressure and kill the hole;
- (d) venting, dispersing or flaring the gas in a safe manner; or
- (e) otherwise safely controlling the flow of gas in the well.

5 (2) Notifying the Individuals Identified on the Notification Contact List

An Operating Procedure, titled “Hazardous Gas Notification”, which should consider, as a minimum, the procedures for immediately notifying the individuals identified on the Notification Contact List.

5 (3) Permanent Gas Mitigation Measures

An Operating Procedure, titled “Permanent Gas Mitigation Measures”, which should consider, as a minimum, a description of the measures, equipment and procedures to be taken after detection of hazardous gas in any hole that is part of a vertical closed loop ground source heat pump to properly install or decommission the closed loop ground source heat pump in order to prevent the migration of hazardous gas.

(a) Procedures for Proper Installation

A step by step description of an installation program, in sequence, to place heat transfer tubing into a hole of a vertical closed loop ground source heat pump including the filling of the remaining void space in the hole after the tubes have been installed that includes, as a minimum:

- (i) if necessary, the types of spacers and centralizers that will be used to centre the tubing in the hole and away from the side of the hole’s wall;
- (ii) the minimum annular clearance required to allow for a material to adequately seal between the heat transfer tubes and the side of the hole;
- (iii) the materials and mixtures used to fill the void space in the hole after the heat transfer tubing has been placed into the hole;
- (iv) if necessary, the types of casing and cement that will be used to seal off any hazardous gas from escaping into the hole; and
- (v) any additional measures needed to prevent the migration of hazardous gas.

(b) **Procedures for Proper Decommissioning**

A step by step description of the decommissioning of a vertical closed loop ground source heat pump, in sequence, including how to proceed with the plugging of any hole if required pursuant to clause 4 (1) (b) of the Regulation, having regard to section 11 of the Provincial Operating Standards and Chapter 15 of the Water Supply Well – Requirements and Best Management Practices that should at the least include:

- (i) Any overdrilling that is necessary to remove existing materials and heat transfer tubing
 - (ii) If necessary, the type and placement of casings that will be needed to assist in the plugging of any hole or re-drilled hole
 - (iii) The type and mixture of cement that will be used to plug any hole or re-drilled hole in the bedrock
 - (iv) The materials and mixtures that will be used to plug any hole or re-drilled hole in the overburden
 - (v) The method of filling the hole with cement to prevent the migration of hazardous gas
- (c) Any additional measures needed to prevent the migration of hazardous gas.

5 (4) Other

Any other recommendation on the advice of the Professional in order to comply with subsection 3 (3) of the Regulation.

5 (5) Mitigation Completion Report

- (a) As a minimum, the Work Plan should describe the procedures for a licensed engineering practitioner or professional geoscientist to prepare a written Mitigation Completion Report that:
 - (i) documents the measures and safeguards that have been fully implemented to effectively install or decommission the ground source heat pump system and that those measures and safeguards are at least equal to what is required in similar circumstances by “Oil, Gas and Salt Resources of Ontario - Provincial Operating Standards”, version 2.0, dated January 24, 2002 and Chapter 15 of the Water Supply Wells – Requirements and Best Management Practices.
- (b) As a minimum, the Work Plan should describe the procedures to Make the Mitigation Completion Report available to the persons who are identified on the notification contact list and the local district or area office of the Ministry of the Environment

08 June 2012

Appendix A- Glossary of Terms

The following definitions and clarification of technical terms in the text of these Instructions are provided, and are for the purpose of and use with this document:

The terms described in this document may have other meanings in different contexts or in relation to other legislation. Unless otherwise indicated, they are derived from the ordinary dictionary meaning of the word.

“Annular Space” means an open space between a casing and the side of a hole and includes:

- the space between two different casings, and
- Any void space after the heat transfer tubing has been placed into a hole.

“Annular Clearance” means the open space between the casing and the side of a hole or the open or void space between a heat transfer tube and the side of a hole.

“Bedrock” means

- (a) The solid rock underlying unconsolidated material such as gravel, sand, silt and clay, or
- (b) solid rock that is exposed at the ground surface

Clarifications for Bedrock:

- Bedrock does not include glacial erratics or boulders as they are loose and unstratified and considered to be overburden.
- Competent bedrock is considered solid bedrock that is not “weathered bedrock”
- Weathered bedrock means weathered unconsolidated rock in the basal subsoil or highly fractured rock commonly found above the competent (solid) bedrock. Based on its characteristics and the behaviour of groundwater in weathered bedrock, unconsolidated rock in the basal subsoil is generally considered as part of the overburden rather than as bedrock.

“Casing” means metallic or non-metallic pipe placed in the hole for the purpose of supporting the sides of the hole and to act as a barrier preventing subsurface migration of a fluid or gas out of or into the hole, but does not include a “well” screen or “heat transfer tubing”. [modified from Provincial Operating Standard]

“Decommission” with respect to an ground source heat pump system includes the permanent removal and sealing of a vertical closed loop ground source heat pump hole when it is taken permanently out of service.

“Diversion equipment” means equipment used to properly vent, disperse, flare or otherwise manage gas in a safe manner at or above the ground surface.

“Drilling Mud” means a mixture of clay, water and chemical additives circulated into a hole during the drilling a hole by injection in the drill pipe and through the drill bit to control formation pressure, to lubricate the drill pipe, keep the drill bit cool and to transport the drilled material to the surface.[Provincial Operating Standard]

“Direct Exchange (DX) ground source heat pump” is a type of closed looped ground source heat pump that eliminates the need for an antifreeze mixture heat transfer fluid. In DX systems, the heat transfer fluid is a refrigerant

“Formation” means a body of rock or overburden characterized by a degree of homogeneous lithology that forms an identifiable geologic unit that can be mapped on the earth's surface or is traceable in the subsurface. A formation can include an aquifer. [Provincial Operating Standards]

“Ground Source Heat Pump” means a system that is designed to heat and cool a building or structure by using a heat-transfer fluid to exchange heat with the ground or groundwater. [section 1 of Ontario Regulation 98/12]

“Hazardous gas” means a gas or mixture of gases that,

- (a) contains hydrocarbons (including methane), hydrogen sulphide or both,
- (b) originates from the natural environment, and
- (c) is present in an atmospheric concentration that may be explosive or flammable, may cause asphyxia or is otherwise hazardous; [section 1 of Ontario Regulation 98/12]

“Heat Transfer Fluid” means a liquid consisting of:

- in a closed loop system, water and antifreeze agents and includes chemical inhibitors.
- In a direct exchange (DX) system, a refrigerant and includes chemical inhibitors.

“Heat Transfer Tubing” means the continuous, sealed, tubing that makes up an exterior loop of a closed loop or direct exchange ground source heat pump through which a heat-transfer fluid passes. For most closed loop systems, the tubing is constructed of high density polyethylene (HDPE). For most direct exchange (DX) systems the tubing it is constructed of copper.

“Holder” when used in reference to a licence, permit or approval, means a person who is bound by the licence, permit or approval. [Act]

“Horizontal Closed Loop Ground Source Heat Pump” is a type of closed loop ground source heat pump where the tubing is often installed into horizontal trenches that are typically excavated to a depth of 1 to 2.5 m depth below the ground surface. It also means a “vertical closed loop ground source heat pump” as described in Ontario Regulation 98/12 (see this glossary for term vertical closed loop ground source heat pump).

“Hole” includes a vertical or diagonal hole made in the ground for the sole purpose of installing heat transfer fluid tubing as part of a closed loop ground source heat pump. For clarification, a hole that is part of a closed loop ground source heat pump that extends or will extend more than 5.0 metres below the original ground surface is not exempt from an environmental compliance approval.

“Killing the hole” means the placing of drilling fluids and additives in a hole to temporarily stop the upward flow of a fluid, gas or any other material out of the hole until such time as further mitigation occurs.

“Licensed engineering practitioner” means a person who holds a licence, limited licence or temporary licence under the Professional Engineers Act (see section 1 of Ontario Regulation 98/12)

“Original ground surface” means the surface of the ground at the ground source heat pump site immediately prior to the time the system construction, alteration, extension or abandonment activities take place.

“Overburden” means loose or unconsolidated material overlying competent bedrock

“Permanent” means a one time installation that is intended to last indefinitely

“Professional Geoscientist” means a person who holds a certificate of registration under the Professional Geoscientists Act, 2000 and is a practising member, temporary member or limited member of the Association of Professional Geoscientists of Ontario; [section 1 of the Ground Source Heat Pump Regulation (Ontario Regulation 98/12)]

“Professional” means either a Professional Geoscientist or a Licensed Engineering Practitioner

“Provincial Operating Standards” means the standards set out in “Oil, Gas and Salt Resources of Ontario Operating Standards”, published by the Ministry [of Natural Resources], as amended from time to time”. – website
http://www.ogsrlibrary.com/documents/Provincial_Operating_Standards_v2_Jan_24_2002.pdf

“Sedimentary Bedrock” for the purposes of this document means sedimentary bedrock of Cambrian age or younger.

“Subsurface” means below the ground surface.

“surface casing” means a string of pipe or casing installed from the ground surface into the hole. and the annular space is completely sealed with cement along the casing’s entire length. [Provincial Operating Standards]

“Regulation” means O. Reg. 98/12 made under the Environmental Protection Act

“Vertical Closed Loop Ground Source Heat Pump” means a ground source heat pump that uses a continuous, sealed, underground heat exchanger consisting of subsurface tubing through which the heat-transfer fluid passes. For clarification purposes, a new vertical closed loop ground source heat pump requires an environmental compliance approval as long as a portion of the closed loop ground source heat pump extends or will extend more than 5.0 metres below the original ground surface.

“Work Plan” means a Work Plan developed, in accordance with Ontario Regulation 98/12 as part of an application for an Environmental Compliance Approval and the Work Plan approved as part of an Environmental Compliance Approval.

Appendix B – Documents to be Considered

a) The Oil, Gas and Salt Resources Act, R.S.O. 1990, c. P. 12

The Oil, Gas and Salt Resources Act (OGSRA) gives the Minister of Natural Resources authority for regulating the exploration, drilling and production of petroleum resources including natural gas. The OGSRA and its regulations govern operations of the petroleum industry to ensure its activities do not pose a hazard to public safety or pollute the natural environment.

b) Ontario Regulation 245/97 (Exploration, Drilling and Production) made under The Oil, Gas and Salt Resources Act, R.S.O. 1990, c. P. 12

This regulation requires operators of a work governed by the OGSRA to comply with the Provincial Operating Standards set by the Ministry of Natural Resources. The OGSRA and its regulations govern operations of the petroleum industry to ensure its activities do not pose a hazard to public safety or pollute the natural environment and that holes are controlled at all times.

Oil, Gas and Salt Resources of Ontario -of Ontario - Provincial Operating Standards”, version 2.0, dated January 24, 2002 and published by the Ministry of Natural Resources, as amended from time to time

This document provides technical standards that cover oil and gas wells and works regulated under the OGSRA. These standards are the minimum requirements for the design, installation, operation, abandonment and safety of wells and works. It is not intended for use as a design handbook. The requirements of the Provincial Operating Standards are adequate under conditions normally encountered in oil, gas and salt resource industry activities involving wells and works. Requirements for abnormal or unusual conditions are not specifically provided for, nor are details of engineering or construction prescribed. It is intended that all work performed within the scope of these standards should meet or exceed the safety standards expressed or implied herein.

c) Annex A (Environmental Guidelines for Earth Energy Heat Pumps and Underground Thermal Energy Storage (UTES) Systems) of CAN/CSA-C448.1-02 (Design and Installation of Earth Energy Systems), dated October 2009 and published by the Canadian Standards Association, as amended from time to time; and

This document provides guidance to help further protect the environment from the movement of gas and fluids in vertical holes. The CAN/CSA-C448.1-02 standards, includes requirements for the construction or renovation closed loop

and direct exchange ground source heat pumps (earth energy systems) including types of heat transfer tubing that is to be used in the installation of the system and pressure testing of the tubing for leaks and cracks.

- d) **“Water Supply Wells - Requirements and Best Management Practices”, dated December 2009 and published by the Ministry, as amended from time to time.**

This document includes minimum requirements and best management practices for the methods and materials used in the construction and proper abandonment (plugging) of water supply wells.

Regulation 98/12 ECA Application & Approval Process

One-time application to apply for a Multi-Site ECA

Applicant

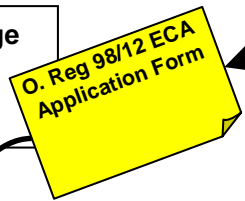
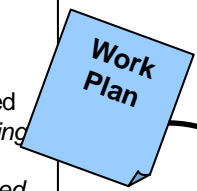
Pre-submission Consultation
•Optional

Prepare Work Plan:
Applicant retains **Professional** to prepare **Work Plan**:
•Prepared in accordance Reg. 98/12 and 255/11
•Prepared following the instructions outlined in the document: "Instructions for Completing an Application for an Environmental Compliance Approval (ECA), Vertical Closed Loop Ground Source Heat Pumps"

Submit the ECA Application Package
• O.Reg 98/12 Application Form with complete checklist
• **Work Plan** prepared by a **Professional**

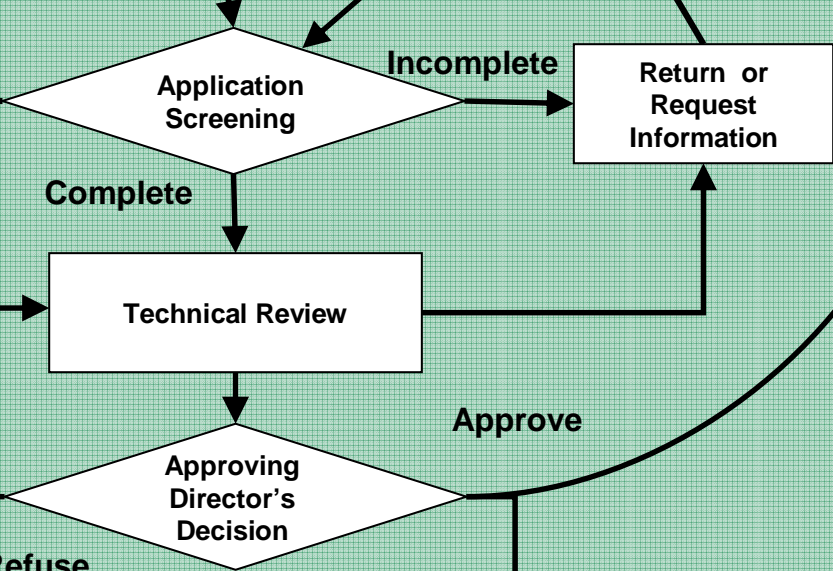
Note:
The requirement is that a Work Plan be prepared by engineer or geoscientist and be submitted as part of the one-time application for an ECA.

Based that one-time application the ministry can issue a single "**Multi-Site ECA**" that will allow the holder to undertake projects at different locations.



Address Deficiencies

Ministry of the Environment



Public
EBR Proposal Notice posted for min. 45 days
EBR comments from Public

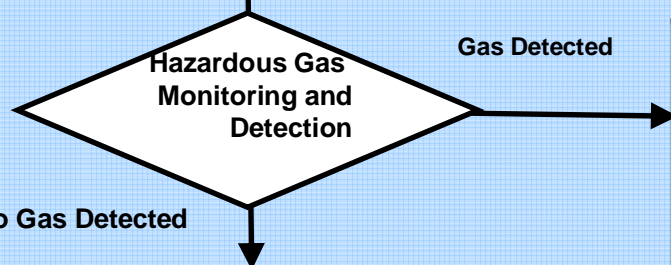
EBR Decision Notice
Appeal Provisions

O.Reg 98/12: Content of Work Plan:

Standard Plan
Qualifications and Discussion of Documentation Considered <ul style="list-style-type: none"> •The person preparing the Work Plan shall be a Professional. •Description of how referenced documents were considered
Health and Safety Plan
General Provisions A description of all the procedures that t will be done by ECA Holder at all sites as part of a drilling program: <ul style="list-style-type: none"> •Hazardous Gas Monitoring and Detection Plan •Standard Requirements for Drilling Overburden and Precambrian Systems •Standard Requirements for Drilling Sedimentary Bedrock Systems •Installation under Buildings and Structures •Site Documentation Requirements •Preparation for Gas Mitigation Contingency Plan
Preliminary Site Preparations A description of all the specific preparations that will be done by the ECA Holder at each site before drilling: <ul style="list-style-type: none"> •Prepare Notification Contact List •Check Local Geology: <ul style="list-style-type: none"> •View and Document Gas and Oil Well Records •View Check and Document Water Well Records •Other recommendations of the Professional •Describe Drilling Program •Prepare Diagram of Site •Made available to all persons working at site

Note:
 The requirement is that a Work Plan be prepared by an engineer or geoscientist and be submitted as part of the one-time application for an ECA. The Work Plan will include recommendations on the site-specific preparations and procedures that would be done at each site before, during and after drilling.

 Based on that one-time application the ministry can issue a single "Multi-Site ECA" that will allow the holder to undertake projects at different locations.



Standard Plan - Continued
Provisions for Completing Drilling and Installation
Standard Completion Report Provisions for preparing a Standard Completion Report: <ul style="list-style-type: none"> •Prepared by ECA Holder •Description of the format of the Report •Confirming that hazardous gas was not detected or observed during the installation •Should include a log of drilling observations details of installation •Provide to Owner

Gas Mitigation Contingency Plan
Provisions for Implementing Immediate Mitigation <ul style="list-style-type: none"> •Stop Drilling •Implement immediate actions to kill the hole or otherwise mitigate
Notification Procedures <ul style="list-style-type: none"> •Notify contacts on Notification Contact List
Provisions for Implementing Permanent Mitigation <ul style="list-style-type: none"> •Properly install or decommission the hole.
Mitigation Completion Report Provisions for Preparing a Mitigation Completion Report: <ul style="list-style-type: none"> •Description of the format of the Report •Signed off by a Professional •Must confirm that the hole was properly installed or decommissioned •Provide to contacts on Notification Contact List and Local Ministry District Office