

Directive 044

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Requirements for Surveillance, Sampling, and Analysis of Water Production in Hydrocarbon Wells Completed Above the Base of Groundwater Protection

The Alberta Energy Regulator has approved this directive on March 15, 2016.

[<original signed by>]

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1 Introduction

This directive details surveillance, sampling, and analysis of water production requirements and processes related to all hydrocarbon wells with completions above the base of groundwater protection (BGWP). The term “hydrocarbon well” refers to conventional and unconventional wells (including oil sands wells) that are not part of a water recycle program.

2 What’s New in This Edition?

In this edition of Alberta Energy Regulator (AER) *Directive 044*, all references to *Directive 019: Compliance Assurance*, which has been rescinded, and related information have been removed. No changes were made to any requirements except for requirement 3. The change to requirement 3, which did not alter the intent of the requirement, was as follows:

- Old wording: “Within 30 days of the AER either advising that testing is required or issuing an enforcement action, the licensee must...”
- New wording: “Within 30 days of the AER requiring produced water testing, the licensee must...”

3 Surveillance of Water Production

3.1 Identification of Wells Exceeding the Prescribed Trigger Volume

- 1) Well licensees must perform ongoing self-audits on all hydrocarbon wells that have completions above the BGWP. While monthly production records are a principal source of information for these self-audits, companies are expected to have in place internal management systems that will accelerate the exchange of accurate water production information between the field and head office to enable the timely identification of wells that produce water in excess of 30 m³/month.
- 2) If through a self-audit, a hydrocarbon well with completions above the BGWP is identified as having water production equal to or greater than 30 m³/month at any time, the well licensee must submit within 30 days a notification to the appropriate AER contact listed in section 5. The notification must include disclosure of threshold exceedance, specified water volume produced, current wellbore configuration (including packer placement), unique well identifier (UWI), and top and bottom depth (total vertical depth [TVD] and measured depth [MD]) of all completed intervals both above and below the BGWP.

3.2 Action Required for Wells Exceeding the Prescribed Trigger Volume

Following review of the notification provided by the licensee, the AER will advise if interval segregation and produced water testing is required. This is to avoid multiple testing in the same hydrogeological unit and collection of produced water for analyses from areas with established

groundwater data. If groundwater testing is not required, the AER may still require a mitigation plan for wells with multiple perforations.

- 3) Within 30 days of the AER requiring produced water testing, the licensee must
 - determine the source (intervals) and composition (by sampling) of the water, and
 - e-mail one electronic copy (pdf format) of a report of the findings and proposed mitigation action plan to the AER at ResourceCompliance@aer.ca.

Upon receipt of the required report, the AER will review the findings and proposed mitigation plan and determine the appropriate actions to be taken by the licensee. The AER will provide a timeframe within which the actions are to be completed. Actions may include segregating or abandoning the completions above the BGWP. Wells that are on production should not be shut in except as needed to conduct the required tests or as directed by the AER, as shutting in may increase the risk of cross-flow in the wellbore.

- 4) The licensee must take the actions directed by the AER and notify the AER in writing upon their completion.
- 5) Information regarding the source and composition of the water must be collected and filed with the AER even if the well licensee proposes to abandon the perforations above the BGWP. Source determination and sampling of the water must be done in accordance with section 3.2.1.

See appendix 1 for an outline of the *Directive 044* testing flow chart.

3.2.1 Requirements for the Sampling and Analysis of Water Production for Hydrocarbon Wells Completed Above the Base of Groundwater Protection

Section 11.070 of the *Oil and Gas Conservation Rules* and *Directive 040: Pressure and Deliverability Testing Oil and Gas Wells* require the analysis of produced fluid samples, including produced water, from all oil and gas pools. Historically, most produced water was saline water from deep formations. However, increased development of shallower reservoirs that have the potential to produce nonsaline water necessitates a more precise determination of produced water salinity in order to ensure that nonsaline groundwater is protected. This information will be used by the AER to assess the need for remedial wellbore action or water diversion authorization and to evaluate possible alternative uses for the produced water.

The AER will, in consultation with the operator, identify zones to be tested for each well based on the particular geological setting. A licensee should be prepared to present evidence to support its testing proposal. Data collected to date under *Directive 044* have shown that the wide variety of geological scenarios across the province make the use of a specific testing distance between zones impractical.

The identification of intervals producing water may require the use of wellbore cameras or zonal segregation and testing for the production of water.

6) For each water source interval sampled, the following collection and analysis techniques must be followed:

- a) Representative water samples must be collected in a manner that allows for accurate analysis of the samples. As most samples will be gathered during swabbing, it is recommended that multiple samples be taken during this process to ensure that a representative sample is obtained.

Water samples from drillstem tests or flow tests taken during the completion of the well are generally contaminated with drilling mud and are not acceptable.

Samples are to be collected, filtered, and bottled in accordance with laboratory specifications suitable for the intended analysis.

In keeping with Alberta Environment and Parks' mandate, the methodology for calculating the TDS of groundwater described in the *Standard Methods for the Examination of Water and Wastewater* (published jointly by the American Public Health Association (APHA), American Water Works Association, and the Water Environment Federation, 1998) appears to yield reproducible results. The calculated TDS value based on a sum of measured ion concentrations and alkalinity ($0.6 \times$ total alkalinity as calcium carbonate $[\text{CaCO}_3]$), and the measured TDS value determined using APHA Method 2540C – Total Dissolved Solids Dried at 180°C must be included on the laboratory report for every analyzed groundwater sample.

b) At a minimum, samples must be analyzed for the following:

- pH
- calcium
- magnesium
- sodium
- potassium
- chloride
- sulphate
- carbonate
- bicarbonate

- total dissolved solids
 - ionic balance
- 7) Laboratory reports must include the following:
- complete and accurate UWI
 - sampling point
 - sampled interval
 - sampled formation
 - kelly bushing and ground-level elevation
 - sample date
- 8) Copies of each water analysis must be included in the lab report to the AER.

All produced water analyses must also be submitted electronically to the AER via the Well Test Capture system, in accordance with *Directive 040*, section 3.5.

3.3 Resolution of Production Accounting Errors

3.3.1 Required Process

- 9) If a licensee determines that the reported water production above the prescribed trigger volume was due to a production accounting error, the AER will require a 24-hour in-line production test at the wellhead.

After conducting the 24-hour in-line production test, the licensee must e-mail one electronic copy (pdf format) of the findings and analysis to the AER at ResourceCompliance@aer.ca. If testing supports that an accounting error has occurred, then amendments must be made to the production through the Petroleum Registry of Alberta within 30 days of the supporting test date.

3.3.2 Clarification

The AER will not accept the following as evidence of, or reason for, a production accounting error:

- truck tickets
- arguments that third-party accounting providers are responsible. Well licensees are responsible for ensuring that water production for their wells is reported accurately and that any errors in reported water production volumes are corrected.

4 Additional Matters

Well licensees are reminded to ensure that all well completion records required for perforations and other completion activities under *Directive 059: Well Drilling and Completion Data Filing Requirements* are complete and up-to-date at all times.

In October 2009, the Energy Resources Conservation Board (predecessor to the AER) published *Report 2009-B: Status Report on Enhanced Groundwater Protection Efforts under Directive 044: Requirements for the Surveillance, Sampling, and Analysis of Water Production in Oil and Gas Wells Completed Above the Base of Groundwater Protection (BGWP)*. This report is available on the AER website (www.aer.ca) and from AER Order Fulfillment, Suite 1000, 250 – 5 Street SW, Calgary, Alberta T2P 0R4; telephone: 403-297-8311 or 1-855-297-8311 (toll free; option 2); fax: 403-297-7040; e-mail: InformationRequest@aer.ca.

5 Contacts

General questions about this directive and the reporting of wells with completions above the BGWP that produce water volumes equal to or greater than the trigger volume should be directed to the AER Resources Applications Group by e-mail: ResourceCompliance@aer.ca or fax: 403-297-8122.

Questions about the measurement and reporting of water volumes, the determination of the source of water production, or the sampling and analysis of potential nonsaline water described in section 3.2.1 should be directed by e-mail: Enviro.Services@aer.ca, telephone: 403-297-8330, or fax: 403-297-2691.

Appendix 1 *Directive 044* Testing Flow Chart

