

Well Logging Requirements

Directive PNG010

November 2015

Revision 1.0

Governing Legislation:

Act: *The Oil and Gas Conservation Act*

Regulation: *The Oil and Gas Conservation Regulations, 2012*

Record of Change

Revision	Date	Author	Description
0	September, 2015	PNG	Draft
1.0	November, 2015	PNG	Added Directive Number, updated document

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1. Introduction

This Directive sets out the requirements of the Saskatchewan Ministry of the Economy (ECON) for logging of oil and gas wells in Saskatchewan. It provides details on what well logs must be submitted for a variety of well types. The well logs that will be required for a proposed well must be disclosed at the time a licence application is submitted in the Integrated Resource Information System (IRIS).

This Directive covers the logging requirements for vertical, directional, re-entry and horizontal wells. Logging requirements for injection wells are outlined in *Directive PNG008: Disposal and Injection Well Requirements*.

Questions concerning the requirements set out in this document should be directed to the PNG support line at 1-855-219-9373.

1.1 Governing Legislation

The requirements outlined in this Directive are based on *The Oil and Gas Conservation Act (OGCA)* and *The Oil and Gas Conservation Regulations, 2012 (OGCR)*. The objective of the regulations is to ensure appropriate well log data is available for stratigraphic unit identification, correlation, and determination of reservoir and petrophysical parameters.

Clause 17(1)(j) of the *OGCA* provides the legislative authority to set requirements for well logging. Regulations pertinent to well logging are found in section 90 of the *OGCR*. This section requires that well logs be submitted by the licensee and allows ECON to obtain additional well logs beyond what is specified in this Directive. Licensees should consult these regulations in conjunction with this Directive.

It is the responsibility of all operators, as specified in the legislation, to be aware of Ministry requirements and to ensure compliance with all requirements prior to submission of a well licence application.

1.2 Definitions

Defined pool: means a pool that has a pool boundary defined by Minister's Order.

Miscellaneous pool: means a pool established by ECON other than a defined pool.

Directional well: means a well drilled directionally from surface that is not horizontal.

Horizontal well: means a well drilled that has a productive portion that is at least 80 degrees from vertical for a minimum of 100m or as otherwise deemed to be horizontal via Minister's Order.

Multi-well pad: means a surface lease that contains more than one well.

Re-entry well: means a well that has been abandoned and is being entered again, or a well that is being entered in order to alter trajectory or deepen to a new stratigraphic unit.

Single-well pad: means a surface lease that contains one well.

Intermediate casing shoe: means the base of the intermediate casing string.

Build section: means the portion of a horizontal well where the path angle is transitioning from vertical to horizontal.

'As-run' format: means measured depth is the reference scale.

'Corrected-to-TVD' format: means corrected and displayed in reference to true vertical depth.

Landing point: refers to the point where the well path has reached horizontal or near horizontal position within the target pool.

TVD: means true vertical depth.

2. Logging Requirements for Vertical and Directional Wells

2.1 Single-Well Pads

For a well on a single-well pad, logging is required with the following exceptions:

- The well is within a defined pool that stipulates logging requirements other than those specified within this Directive and the licensee is meeting the logging requirements of that pool.
- Viking Sand Oil Wells – for wells drilled for the production of oil from this stratigraphic unit, logs are to be run on the first well drilled in each quarter Section. For subsequent wells, the licensee must, at a minimum, take an acceptable cased-hole log from total depth to the base of the surface casing, unless, pursuant to the above exception, the well is within a defined pool that stipulates other logging requirements.

2.2 Multi-Well Pads

- For the first well on a multi-well pad, the licensee must take an acceptable open-hole log from the total depth of the well to the base of the surface casing.
- The total depth of the open-hole logged well must be equivalent to or deeper than the total depth of the deepest stratigraphic unit penetrated by all wells on the pad.
- For all remaining wells on the same pad, the licensee must, at a minimum, take an acceptable cased-hole log from total depth to the base of the surface casing.

2.3 Re-entry Wells

If a well is being re-entered, open hole logs are required on any new open-hole portion that is drilled. If the re-entry does not result in new drilling, all logging requirements are waived unless otherwise required by the Ministry.

3. Acceptable Logs for Vertical and Directional Wells

The licensee must take an acceptable resistivity or standard electrical log. The licensee must also take an approved radioactivity log, including both natural and induced radioactivity, or an approved porosity curve.

All logs are to be run from the total depth of the well to the base of the surface casing and shall record all pertinent data.

3.1 Open Hole

The logging requirements for open hole logs are as follows:

- gamma ray;
- induction or resistivity or standard electrical log on a 1:240 scale (including conductivity on a 1:600 scale); and
- sonic porosity or neutron porosity, and density porosity on a 1:240 scale (including bulk density on a 1:600 scale and photoelectric on 1:240 scale).

3.2 Cased Hole

The logging requirements for cased holes are as follows:

- gamma ray; and
- neutron porosity on a 1:240 scale.

4. Horizontal Wells

4.1 Open Hole

Open-hole logging requirements are waived on horizontal wells.

The minimum logging requirement is that a compensated neutron porosity log or equivalent be run through casing from a point at or near the intermediate casing point (ICP).

Logs that reach a minimum of 70 degrees from vertical or that contact the top of the target pool will be accepted. This applies to wells with an ICP or monobore design.

Logs must be submitted in 'as-run' (measured depth), and 'corrected-to-TVD' formats.

4.2 Cased Hole

Cased hole logging for horizontal wells is not required in the following situations:

- A stratigraphic test well is to be drilled and open-hole logged prior to re-entering for horizontal drilling.
- There is existing sufficient log coverage (see Figure 1) within the vertical well drainage unit(s) containing the build section (surface to intermediate casing point or landing point) of the proposed horizontal well. The total vertical depth of the logged well must be equivalent to or deeper than that of the proposed horizontal well.
- There is existing sufficient log coverage (see Figure 1) of a well within a 300 m radius of the build section of the proposed horizontal well. The total vertical depth of the logged well must be equivalent to or deeper than that of the proposed horizontal well.

- Multiple horizontal wells are sharing a surface pad and the first well drilled shall be logged. The total depth of the logged well must be equivalent to or deeper than the total vertical depth of the deepest zone penetrated by all wells on the pad.

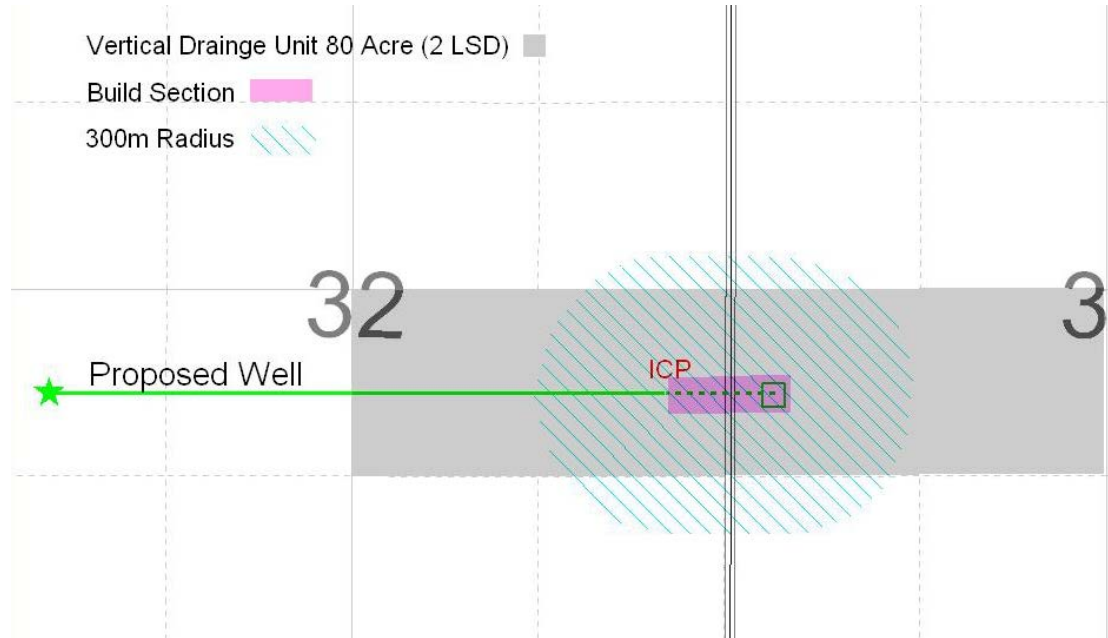


Figure 1 – Logging coverage example. If there was log coverage to sufficient depth within the solid grey or blue hatched areas, cased-hole logging requirements are waived for the proposed horizontal well.

5. Application for Waiver of Logging Requirements

As outlined in sub-section 90(1) the *OGCR*, a licensee may apply for relief from the well logging requirements of this Directive where special circumstances warrant.

ECON may grant waivers from these well logging requirements as the result of an unplanned technical or operational event that inhibits the successful completion of the planned well logging program.

Providing confirmation that open-hole logging is not required in the licence application process will cause a cased-hole logging obligation to be set automatically on non-horizontal wells. For shallow-water-source wells and water-source observation wells, cased-hole logs may not be possible. In these situations a logging amendment application may be submitted for review. The logging amendment application should not be made until the licence has been issued and the logging requirement obligations have been set. If a company does not make an application for logging amendment prior to commencement of drilling, they may be subject to a penalty if logs are not submitted.

A licensee may make an application to amend their logging requirements after obtaining a well licence, but the application would need to provide all reasoning and technical support for the request to amend or waive the logging requirements.

If an emergency situation occurs in the course of drilling the well that prevents the required logs from being run, a logging waiver request may be made to the PNG support line, at 1-855-219-9373 or 1-844-764-3637 (after business hours), additional details may be required. A verbal approval to waive logs may be granted. Further to a verbal approval, an email confirmation from the approver is required. The licensee can then apply for a waiver of logging requirements, and must provide the correspondence on the approval as part of their logging amendment application within IRIS.