

Ministry of Energy and Resources

Notice of Proposed Directive Amendments

Directive PNG015: Well Abandonment Requirements

Background

The Ministry of Energy and Resources (ER) is consulting with the oil and gas industry on an amended version of *Directive PNG015: Well Abandonment Requirements* (the amended Directive). The amended Directive will replace *The Oil and Gas Conservation Regulations, 2012* with respect to technical requirements for well abandonments in Saskatchewan and will include information on applying to ER for an authorization to conduct a well abandonment.

The Process

Over the past several months, ER has been developing the amended Directive in collaboration with an industry working group including representation from the Canadian Association of Petroleum Producers, the Explorers and Producers Association of Canada and the Saskatchewan Headquartered Oil Producers. ER is now launching broader industry consultations on the amended Directive from **March 26, 2019** to **April 16, 2019**. Once this consultation period has concluded, ER will review feedback received in the preparation of a final draft of the amended Directive to be brought forward for approval.

The amended Directive is expected to come into effect in the spring of 2019.

Summary of Proposed Changes

The amended Directive aims to create efficiencies for industry and ER in the well abandonment process. At present, industry must submit applications to ER for all types of well abandonments and ER must review and approve these before abandonment operations may commence. Under the amended Directive, straightforward, “routine” abandonments may be conducted without prior ER review and approval and will only require notification to ER. The amended Directive supports this new approach by providing specific instructions on carrying out a routine abandonment. “Non-routine” abandonments are those identified as having particular risks and will require an application to ER for review and approval before they commence. The amended Directive outlines scenarios that may constitute non-routine abandonments and ER may prescribe specific abandonment requirements for a non-routine abandonment.

Miscellaneous Items of Note

- Well abandonment requirements no longer depend on whether the well is in-pool or out-of-pool;
- Four abandonment method options are available for lower-risk routine abandonments, including the mechanical bridge plug abandonment method;
- Prescribed abandonment methods for certain higher-risk routine abandonments (e.g. “critical sour” wells); and
- An option for a “project abandonment” non-routine abandonment application to facilitate the abandonment of a group of wells using a particular abandonment method.

Review of Amended Directive

ER is seeking written comments on the amended Directive, a draft of which is attached to this notice as Appendix A. Please direct any comments or questions on the amended Directive to:

er.servicedesk@gov.sk.ca

Attn: Ken Kowal, Director, Field Operations
Petroleum and Natural Gas Division

The deadline for submitting written comments is **April 16, 2019**.

Well Abandonment Requirements

Directive PNG015

March 2019

Revision 2.0

Governing Legislation:

Act: *The Oil and Gas Conservation Act*

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

Order:

Record of Change

Revision	Date	Description
0.0	September, 2015	Initial draft
1.0	November, 2015	Live version, updated wording to provide clarity, added Directive number
2.0	March, 2019	Updated to replace <i>The Oil and Gas Conservation Regulations, 2012</i> as the primary regulation for abandonment requirements for oil and gas wells. Introduces concept of “routine” and “non-routine” well abandonments.

DRAFT

Contents

1.	Introduction	5
1.1	24-Hour Ministry Emergency Support Contact Number	5
2.	Governing Legislation.....	5
2.1	Notice to Operators	5
3.	Definitions	6
4.	Abandoning a Well.....	7
4.1	Routine Well Abandonment	7
4.2	Non-Routine Well Abandonment	7
4.3	Project Abandonments	8
5.	Requirements for Routine Well Abandonments	8
5.1	Notification of a Routine Well Abandonment	8
5.2	Routine Well Abandonment Methods.....	8
5.2.1	Bridge Plug Abandonment Requirements for Non-Horizontal Wells	8
5.2.2	Cement Plug Abandonment Requirements for Non-Horizontal Wells	9
5.2.3	Bridge Plug Abandonment Requirements for Horizontal Wells	9
5.2.4	Cement Retainer Squeeze Abandonment Requirements for Non-Horizontal Wells.....	10
5.2.5	Cased Wells with No Perforations	10
5.2.6	Critical Sour Wells or Wells with a Hydrogen Sulfide (H ₂ S) Concentration ≥15 per cent ...	10
5.2.7	Wells in EOR (non-thermal) or Secondary Recovery Projects (Including Waterfloods)	11
5.2.8	Routine Abandonment that Becomes Non-Routine or Modifications to Approvals	11
6.	Requirements for Non-Routine Well Abandonments	11
6.1	Application for a Non-Routine Well Abandonment.....	11
6.2	Common Non-Routine Well Abandonment Scenarios	11
6.2.1	Wells in Sensitive Surface Locations	12
6.2.2	Wells in a Thermal EOR Project.....	12
6.2.3	Commingled or Multi-Zone Well Completions	13
6.2.4	Wells with a Wellbore Integrity Issue	13
6.2.5	Wells and Fresh Water-Bearing Formations.....	13
6.2.6	Drilled and Abandoned Wells or Dry Hole Abandonments	13

6.2.7 Abandonment of a Well (open hole/dry hole) that Penetrates the Prairie Evaporite Formation..... 14

6.2.8 Directionally Drilled or Horizontal Wells in Field Office Areas 1, 2 or 3 14

7. Records and IRIS Reporting for Routine and Non-Routine Well Abandonments..... 15

8. Cutting and Capping..... 15

8.1 Downhole Abandonment and Cut and Cap 15

8.2 Wedding Cake Cut and Capping Requirements 16

8.3 Vented Cap Requirements 16

9. Long Term Monitoring Requirements for Abandoned Wells 16

9.1 Wells requiring SCVF or GM Remedial Work..... 16

9.2 Special monitoring requirements 16

Appendix 1: Field Office Locations and Areas..... 17

DRAFT

1. Introduction

This Directive outlines the requirements for well abandonments in the province of Saskatchewan. The purpose of this Directive is to provide:

- the details of these well abandonment requirements;
- information on submitting an application to the Saskatchewan Ministry of Energy and Resources (ER) for a well abandonment; and
- instructions on obtaining ER approval to conduct abandonment operations.

No well in the province of Saskatchewan may remain unplugged or uncased after it is no longer used for the purpose for which it was drilled or converted. If a well is no longer used for the purpose for which it was drilled or converted, it is the responsibility of the licensee to abandon the well in accordance with the requirements of this Directive.

The well abandonment requirements in this Directive are meant to ensure that when a well is abandoned, formation fluids will not contaminate other geological formations, fresh water or the surface environment and atmosphere.

Questions concerning the requirements set out in this Directive should be directed to the ER Service Desk at 1-855-219-9373 or email at ER.servicedesk@gov.sk.ca.

1.1 24-Hour Ministry Emergency Support Contact Number

For urgent inquiries relating to well abandonment operations, operators may contact ER through its 24-hour Ministry Emergency Support Contact Number at 1-844-764-3637.

2. Governing Legislation

The requirements outlined in this Directive are authorized under and supported by:

- *The Oil and Gas Conservation Act (OGCA)*;
- *The Oil and Gas Conservation Regulations, 2012 (OGCR)*;
- Associated Directives and Guidelines
 - *Directive PNG002: Coal Mine Area Instruction*
 - *Directive PNG005: Casing and Cementing Requirements*
 - *Directive PNG006: Horizontal Oil Well Requirements*
 - *Directive PNG013: Well Data Submission Requirements*
 - *Guideline PNG024: Reclassification and Recompletion*
 - *Guideline PNG026: Gas Migration*

It is the responsibility of all operators to ensure compliance with the requirements set out in this Directive for well abandonment.

2.1 Notice to Operators

This Directive supersedes and replaces the following parts of the OGCR dealing with well abandonments: clause 27(1)(c) and sections 44, 45, 46 and 47.

3. Definitions

Acknowledgement of Reclamation: As defined in the OGCR.

Adequate Stratigraphic Isolation: Means a combination of cementing and casing conditions that prevent communication between stratigraphic units and/or fresh water-bearing formations through pathways that did not previously exist.

Application: Means an application to the Minister through the Integrated Resource Information System (IRIS).

Completion: As defined in the OGCR.

Cut and Cap: Refers to the cutting off of the surface and production casing stubs a minimum of one metre (1 m) below ground level, and the capping of a well in accordance with this Directive.

Downhole Abandonment: when all wellbores and completions are permanently plugged in accordance with this Directive.

Fish-in-the-hole: Means anything left in the wellbore, including but not limited to tools, drill pipe and drill collar.

Fresh Water: As defined in the OGCR.

Gas Migration (GM): Refers to situations where gas from stratigraphic units penetrated by the well is present at surface in soils around the outermost string of well casing.

Gas Well: As defined in the OGCR.

Indian Reserve: for the purposes of this Directive, means an Indian reserve as represented by the Indian reserve geospatial feature layer within the Saskatchewan Mining and Petroleum GeoAtlas online mapping application and downloadable as a dataset for use in Geographical Information Systems (GIS) from Information Services Corporation (ISC) Saskatchewan.

Multi-Zone Well Completion: Means a well that is equipped to produce oil and/or gas separately from more than one pool.

Occupied Dwelling: As defined in the OGCR.

Oil Well: As defined in the OGCR.

Operator: As defined in the OGCR.

Public Facility: As defined in the OGCR.

Surface Casing Vent Flow (SCVF): Refers to the surface release of fluids and/or gas in any combination or volume between the production casing and surface casing.

Urban Municipality: for the purposes of this Directive, means an urban municipality as represented by the urban municipality geospatial feature layer within the Saskatchewan Mining and Petroleum GeoAtlas online mapping application and downloadable as a dataset for use in GIS from ISC.

Water Body: As defined in the OGCR.

Wellbore Abandonment: when a wellbore is permanently plugged to prevent migration of fluids within the stratigraphic units and the wellbore. “Wellbore abandonment” is only relevant in relation to multi-bore horizontal wells. If the wellbore abandonment results in all wellbores being abandoned, then the operation is a downhole abandonment.

4. Abandoning a Well

This Directive contemplates two main types of well abandonments: routine and non-routine. Routine well abandonments do not require prior ER review or approval and may commence upon notification to ER. The purpose of a notification is to obtain an authorization from IRIS to be used for reporting downhole abandonment of the wellbore to ER.

Non-routine abandonments are those identified as involving particular risks relating to downhole and/or surface considerations and require ER review and approval prior to commencing abandonment operations. The licensee must determine in advance whether the planned well abandonment operation will require a notification for a routine abandonment or an application for non-routine abandonment.

If abandonment of a well fails to meet the requirements of this Directive, does not result in adequate stratigraphic isolation, or allows the release to the surface environment and atmosphere, the Minister may require the operator to remedy the default or defect within the period specified by the Minister.

4.1 Routine Well Abandonment

A planned well abandonment operation is routine if the well completion is an oil well or a gas well other than those deemed as non-routine pursuant to subsection 4.2.

4.2 Non-Routine Well Abandonment

A planned well abandonment operation is non-routine if the well completion is:

- is not an oil well or a gas well;
- is an oil well or a gas well that:
 - is located in a sensitive surface location (clause 6.2.1);
 - is or was previously part of a thermal enhanced oil recovery (EOR) project (clause 6.2.2);
 - is a commingled or a multi-zone well (clause 6.2.3);
 - has a wellbore integrity issue; (clause 6.2.4);
 - does not have adequate cement coverage of all fresh water-bearing formations (clause 6.2.5); or
- an abandoned dry hole addressed in clauses 6.2.6, 6.2.7 and 6.2.8.

On all non-routine abandonments, ER may prescribe well-specific abandonment requirements.

4.3 Project Abandonments

There may be instances where an operator may want to abandon multiple wells using a particular method in a project abandonment. In these situations, operators may make a non-routine well abandonment application including a plan outlining the proposed abandonment methodology for the group of wells. If approved by ER, the operator may proceed to abandon the group of wells on the basis of the authorized project abandonment.

5. Requirements for Routine Well Abandonments

5.1 Notification of a Routine Well Abandonment

A routine well abandonment does not require ER approval prior to the commencement of abandonment operations. However, notification to ER of a routine well abandonment is required through IRIS before any abandonment operation may begin.

5.2 Routine Well Abandonment Methods

Routine well abandonments may be conducted using any of the methods outlined below. Using any other method changes the abandonment type to non-routine and A non-routine well abandonment application is therefore required pursuant to section 6.

5.2.1 Bridge Plug Abandonment Requirements for Non-Horizontal Wells

Bridge plug abandonments must be conducted as follows:

1. The permanent mechanical bridge plug must be set within 15 meters measured depth of the highest contact interval or the open hole.
2. Test the bridge plug by pressure-testing the plug and production casing to 7 MPa for at least 10 minutes.
3. Setting a cement plug 8 vertical metres in length on top of the bridge plug.
4. Fill the casing to the surface with fresh water.

If test in item 2 above fails, contact ER in accordance with section 1.1 above and an application for ER review may be required to be submitted.

5.2.2 Cement Plug Abandonment Requirements for Non-Horizontal Wells

Cement plug abandonments must be conducted as follows:

1. The cement plug must be set by displacement to extend:
 - a. from 15 vertical meters below the perforations or plug back total depth to at least 15 vertical metres above the perforations; or
 - b. in the case of an open hole completion, from the bottom of the hole to at least 15 vertical metres above the casing shoe.
2. Confirm that the cement has reached sufficient compressive strength by:
 - a. probing for the plug after sufficient waiting time for full curing of the cement and ensuring that the plug is able to withstand a minimum force of 1800 decanewtons or string weight, whichever is less or;
 - b. e-line logging the plug with a method that does not disturb the unset cement plug.
3. Test the plug for proper shut-off by pressure-testing the plug and production casing to 7 MPa for at least 10 minutes.
4. Fill the casing to the surface with fresh water.

If test in item 3 above fails, contact ER in accordance with section 1.1 above and an application for ER review may be required to be submitted.

5.2.3 Bridge Plug Abandonment Requirements for Horizontal Wells

Bridge plug abandonments for horizontal wells must be conducted as follows:

1. The permanent mechanical bridge plug must be set as close to the perforations or liner hanger as possible and below the top of the producing stratigraphic unit. If no liner is present then plug must be set just above the intermediate casing point.
2. Test the plug for proper shut-off by pressure-testing the plug and production casing to 7 MPa for at least 10 minutes.
3. Set a cement plug from above the bridge plug to a minimum of 65 degrees from vertical within the build section of the horizontal. If the cement top does not extend to a minimum of 15 vertical meters above the producing stratigraphic unit, then the cement plug shall be extended to meet this coverage.
4. Fill the casing to the surface with fresh water.

If the liner top extends beyond the top of the producing stratigraphic unit, the application should be submitted for non-routine review. Also, if test in item 2 above fails, contact ER in accordance with section 1.1 above and an application for ER review may be required to be submitted.

5.2.4 Cement Retainer Squeeze Abandonment Requirements for Non-Horizontal Wells

Cement retainer squeeze abandonment for non-horizontal wells must be conducted as follows:

1. Set a positive action cement retainer within 15 meters measured depth of the highest contact interval or open hole. Then test the retainer and casing for proper shut-off by pressure-testing the wellbore to 7 MPa for at least 10 minutes;
2. Squeeze cement into the fluid bearing formation until a satisfactory pressure is obtained indicating proper shut-off. Then place an 8 vertical metre cement plug on top of the cement retainer; and
3. Fill the casing to the surface with fresh water.

If test in item 1 above fails, contact ER in accordance with section 1.1 above and an application for ER review may be required to be submitted.

5.2.5 Cased Wells with No Perforations

Wells that are drilled and cased with no completion activity are routine well abandonments. An operator must complete the following steps:

1. Fill the casing to the surface with fresh water;
2. Pressure test to 7 MPa for at least 10 minutes.

If test in item 2 above fails, contact ER in accordance with section 1.1 above and an application for ER review may be required to be submitted.

5.2.6 Critical Sour Wells or Wells with a Hydrogen Sulfide (H₂S) Concentration ≥15 per cent

Wells that are critical sour or that encounter fluids containing H₂S in a concentration of 15 per cent or greater must follow the cement retainer squeeze abandonment requirements outlined in clause 5.2.4 above. If a cement retainer squeeze is not possible, then a cement bond log must be run to ensure adequate stratigraphic isolation and a bridge plug with 30 vertical meters of cement on top of the bridge plug must be used. If the operator is unable to establish and demonstrate adequate stratigraphic isolation, then a non-routine well abandonment application must be made in accordance with section 6.

Determining if a well is critical sour for abandonment purposes depends on two main factors:

- The distance of the well from an urban municipality, occupied dwelling or public facility; and
- The well's maximum potential H₂S release rate.

A critical sour well is one that meets any of the following criteria:

- Maximum potential H₂S release rate >2.0 m³/s;
- Maximum potential H₂S release rate >0.3 m³/s but <2.0 m³/s and the well is located within 5.0 km of an urban municipality, occupied dwelling or public facility;

- Maximum potential H₂S release rate >0.1 m³/s but <0.3 m³/s and the well is located within 1.5 km of an urban municipality, occupied dwelling or public facility;
- Maximum potential H₂S release rate >0.01 m³/s but <0.1 m³/s and the well is located within 500 m of an urban municipality, occupied dwelling or public facility;

To determine if the abandonment requirements of this section apply, operators must calculate the maximum potential H₂S release rate of their well(s) to be abandoned. It is recommended that operators consult with the CAPP document [H₂S Release Rate Assessment and Audit Forms](#) for assistance in calculating the well's maximum potential H₂S release rate.

To determine the proximity of a critical sour well to an urban municipality, ER recommends that operators use the Mining and Petroleum GeoAtlas online mapping application, available: <https://gisappl.saskatchewan.ca/Html5Ext/index.html?viewer=GeoAtlas>.

5.2.7 Wells in EOR (non-thermal) or Secondary Recovery Projects (Including Waterfloods)

For wells in EOR (non-thermal) or secondary recovery projects (including waterfloods) that have adequate stratigraphic isolation, abandonments must be conducted using the requirements outlined in clause 5.2.6 above.

5.2.8 Routine Abandonment that Becomes Non-Routine or Modifications to Approvals

If a routine well abandonment becomes a non-routine well abandonment as defined by this Directive at any point before or during the abandonment operation, the licensee must stop work, contact ER in accordance with subsection 1.1 above and notify ER of the change in well conditions or event that caused the abandonment to become non-routine. A new application may be required at the discretion of ER with reference to the original routine well abandonment submission clearly indicated in the new application.

6. Requirements for Non-Routine Well Abandonments

6.1 Application for a Non-Routine Well Abandonment

A non-routine well abandonment application must be submitted through IRIS and must be reviewed and approved by ER before any abandonment operation may begin. Once ER has reviewed the application, a decision will be communicated to the applicant.

6.2 Common Non-Routine Well Abandonment Scenarios

Non-routine well abandonments will be evaluated on a case-by-case basis. The following is a list of common types of non-routine well abandonments, though it is not exhaustive. If there are any concerns or questions with a planned abandonment operation, contact ER in accordance with section 1 above before commencing the abandonment operation.

6.2.1 Wells in Sensitive Surface Locations

Wells located in sensitive surface locations are considered to be non-routine abandonments, including wells within:

- an urban municipality or Indian reserve;
- an industrial site such as an oil refinery, upgrader or downstream processing facility;
- surface excavations or gravel pits;
- an existing mine site or in coal mining areas;
- a water body;
- an irrigation canal;
- actively migrating sand dunes in the Great Sand Hills area; and
- potentially unstable river banks.

To determine if a well is within an urban municipality or Indian reserve, ER recommends that operators use the Mining and Petroleum GeoAtlas online mapping application, available: <https://gisappl.saskatchewan.ca/Html5Ext/index.html?viewer=GeoAtlas>. Alternatively, geospatial data representing urban municipalities and Indian reserves are downloadable from ISC as a dataset for use in GIS applications.

To determine if a well is within the Great Sand Hills area, ER recommends that operators use the HABISask online mapping application, available: <https://gisappl.saskatchewan.ca/html5ext/?viewer=habisask>. Please note that other ministries of the Government of Saskatchewan may also have regulatory requirements relating to well abandonment operations in this area.

6.2.2 Wells in a Thermal EOR Project

Wells that are currently or were previously part of a thermal EOR project are considered non-routine and will require an approved IRIS submission and proposed program of operations approved by ER prior to starting abandonment operations. The EOR project area is defined by the drainage area of all the wells associated with an EOR project plus a 200 metre buffer zone.

There are no designated thermal areas in Saskatchewan that have been identified or declared outside of existing thermal EOR project boundaries plus a 200 metre buffer zone. For this reason, any wells that may have thermal potential, but are not part of an existing EOR project are subject to the routine abandonment guidelines, unless there are some other conditions present that would qualify the proposed abandonment to be non-routine.

If future thermal EOR activity expands into an area that contains wells that have been abandoned to a standard that does not allow for thermal EOR activity, it will be the responsibility of the licensee developing the EOR project to re-license and re-enter any previously abandoned wells and perform the necessary remedial work. These wells will be identified and re-entry work determined as part of the EOR approval process.

6.2.3 Commingled or Multi-Zone Well Completions

Commingled or multi-zone well completion abandonments are considered non-routine abandonments and must be approved by ER prior to commencing abandonment operations.

6.2.4 Wells with a Wellbore Integrity Issue

Wells that have a wellbore integrity issue are considered non-routine abandonments and require ER approval of the planned abandonment program prior to commencing abandonment operations. Examples of the more commonly encountered wellbore integrity issues include:

- wells with known SCVF or soil gas migration;
- wells with a fish-in-the-hole, production casing leaks, production casing patch, collapsed casing, hole in the casing;
- wells drilled without a surface casing string;
- abandoned wells that require additional remedial work;
- horizontal wells that are completed in more than one formation;
- wells with known inadequate stratigraphic isolation;
- wells with a prior commitment to address a temporary stratigraphic abandonment method previously approved by ER;
- wells that do not have adequately placed thermal cement within a designated thermal EOR project;
- areas known to have primary casing cementing issues;
- areas with highly corrosive formation fluids; or
- areas with a high frequency of casing failures.

6.2.5 Wells and Fresh Water-Bearing Formations

A company must be able to validate that adequate cement coverage exists over all fresh water-bearing formations to ensure adequate stratigraphic isolation. If information is not available or the cement is inadequate a non-routine abandonment application must be submitted and approved by ER prior to starting abandonment operations.

For assistance in determining the base of groundwater protection for a particular area of Saskatchewan, please visit the following page of the Saskatchewan Water Security Agency website (<https://www.wsask.ca/Water-Info/Ground-Water/Mapping/>) for information on available groundwater mapping resources.

6.2.6 Drilled and Abandoned Wells or Dry Hole Abandonments

All drilled and abandoned wells or dry hole abandonments are considered to be non-routine well abandonments. In an emergency or after-hours situation where a rush approval is required, contact ER in accordance with subsection 1.1 above.

A dry hole in which only the surface casing has been set must be abandoned by:

1. Isolating each porous zone with a 15 metre plug or by a cement plug across the porous zone extending 15 metres above and 15 metres below the porous zone;

2. Placing a cement plug of a minimum length of 30 metres across the surface casing shoe (at least 15 meters above and 15 meters below surface casing shoe);
3. Filling the interval between the cement plugs with an approved, heavy, mud-laden fluid;
4. Placing cement in the hole by:
 - a. pumping through tubing;
 - b. pump and plug; or
 - c. any other method that has been approved by ER;
5. Ensuring that all cement plugs have hardened sufficiently so that they withstand a force of 1800 decanewtons when probed. An alternative to this may involve e-line logging the cement plug with a method that does not disturb the unset cement plug;
6. Resetting a cement plug if it fails to withstand the required force or if e-line logging determines the cement plug is not set at the correct depth; and
7. Resetting a cement plug if it is found to be displaced to a distance that renders it inadequate for the purpose of sealing off or isolating the porous or water-bearing stratum for which it was set.

6.2.7 Abandonment of a Well (open hole/dry hole) that Penetrates the Prairie Evaporite Formation

A well drilled less than or up to 30 metres below the Prairie Evaporite must be abandoned by:

1. Setting a continuous brine saturated cement plug from the bottom of the well to 150 metres above the top of the Prairie Evaporite; and
2. Ensuring the cement plug has hardened sufficiently so that it withstands a force of 1800 decanewtons when probed. An alternative to this may involve e-line logging the cement plug with a method that does not disturb the unset cement plug.

A well drilled deeper than 30 metres below the Prairie Evaporite must be abandoned by:

1. Setting a cement plug not less than 30 metres immediately below the bottom of the Prairie Evaporite;
2. Directly on top of the cement plug referred to in step #1 above, setting a second cement plug made of sufficient brine saturated cement to ensure a continuous plug extending 150 metres above the top of the Prairie Evaporite; and
3. After they are set, ensuring that each cement plug has hardened sufficiently so that it withstands a force of 1800 decanewtons when probed. An alternative to this may involve e-line logging the cement plugs with a method that does not disturb the unset cement plugs.

The remainder of the open hole must be abandoned in accordance with clause 6.2.6 above. For isopach maps of the various members of the Prairie Evaporite, please visit the following link:

<http://www.publications.gov.sk.ca/details.cfm?p=89792>. These maps may also be viewed through the Mining and Petroleum GeoAtlas online mapping application, available: <https://gisappl.saskatchewan.ca/Html5Ext/index.html?viewer=GeoAtlas>.

6.2.8 Directionally Drilled or Horizontal Wells in Field Office Areas 1, 2 or 3

All directionally drilled or horizontal wells in Field Office Areas 1, 2 or 3 (see Appendix 1) must have a cemented-in casing string instead of open-hole abandonment plugs unless otherwise approved by ER.

7. Records and IRIS Reporting for Routine and Non-Routine Well Abandonments

Daily Tour reports must be maintained for all well abandonment operations and must comply with the requirements specified in *Directive PNG013: Well Data Submission Requirements*. Tour reports must be compiled into a single PDF file and submitted into IRIS following abandonment operations. The Tour reports must contain detailed records of:

- the setting depth of any bridge plugs, retainers, packers, patches or other subsurface tools;
- the cement squeeze reports and charted squeeze pressures obtained for any retainer cement squeeze conducted as part of the abandonment including cement type, class and any additives used;
- the volume and linear depth of cement used in the abandonment including cement type, class and any additives used;
- the initial and final pressure and duration of any pressure tests conducted;
- the type of fluid used during the pressure testing and end-resulting fluid used to fill the wellbore;
- casing issues encountered while abandoning the well;
- defined data on SCVF and/or GM, including identification of sources and other information relating to non-routine abandonment (if applicable); and
- the depth the well casings were cut and the method used to cap the casing string(s).

At any point in time prior to, during or following a well abandonment, ER may conduct an audit of the well file to ensure the well abandonment was performed in accordance with this Directive. Failure to wait for non-routine well abandonment application approval to conduct the abandonment, failure to conduct the well abandonment in accordance with this Directive, or failure to properly report the well abandonment activities could result in re-entry of the well and performing the necessary work to bring the abandonment activities into compliance with this Directive, or confirm missing abandonment records.

8. Cutting and Capping

8.1 Downhole Abandonment and Cut and Cap

The downhole abandonment and cut and cap must be done when the intent is to fully abandon the well. For completion abandonment where the intention is not to downhole abandon, an application to reclassify or recomplate the well in order to apply for the plug back operation must be made. See *Guideline PNG024: Reclassification and Recompletion* for additional details.

The activity of downhole abandonment and cut and cap may be reported in IRIS at separate times, but the application and plan for both operations must be submitted at the same time for non-routine applications.

Upon completion of the downhole abandonment operation, an operator must complete and submit an abandonment report through IRIS.

Cut and cap operations must be finalized within one year of the completion of the downhole abandonment operation unless otherwise approved by ER.

Upon completion of cut and cap operations, the operator must submit the cut and cap details and any required attachments through IRIS at the time they report cut and cap.

8.2 Wedding Cake Cut and Capping Requirements

Wedding cake cut and cap operations are to be carried out by:

1. Cutting off the surface casing a minimum of one metre below ground level and cutting off the production string one metre below ground level;
2. Welding a steel plate in order to completely close off the annulus between the surface casing and the production casing; and
3. Welding a steel plate in order to completely close off the end of the production casing and attaching at a minimum the well license number to the plate.

8.3 Vented Cap Requirements

Wells that qualify for routine approval may use the vented cap method of cutting and capping in place of the wedding cake method. Vented caps must show well licence and well location.

Please note that a vented cap must be used on wells abandoned within 2,000 meters of an urban municipality, except where the well is located within a water body.

9. Long Term Monitoring Requirements for Abandoned Wells

9.1 Wells requiring SCVF or GM Remedial Work

Prior to conducting a cut and cap, a successful test of the surface casing vent and soil gas migration survey must be filed in IRIS. Following the cut and cap, the well site must be monitored for signs of vegetation loss or other signs of wellbore problems until an acknowledgement of reclamation is issued. If there are problems, the licensee must investigate to determine if evidence of gas migration exists.

9.2 Special monitoring requirements

ER may impose additional long-term monitoring requirements for both routine and non-routine abandoned wells where it determines that these actions are necessary to ensure long-term success of the abandonment.

Appendix 1: Field Office Locations and Areas

