

Notice of Proposed New Directive & Amended Guideline
Directive PNG026: Gas Migration and Surface Casing Vent Flow
Guideline PNG026: Gas Migration and Surface Casing Vent Flow
Testing Procedures

Background

The Ministry of Energy and Resources (ER) is consulting the oil and gas industry on a new directive and on proposed changes to an existing guideline to provide clearer expectations and instructions for industry's management of surface casing vent flow and gas migration (SCVF/GM).

The Process

ER is holding industry consultations on the new directive and the amended guideline from June 17 to July 8, 2022. Once this consultation period has concluded, ER will review consultation feedback in preparation of a final draft of the new directive and the amended guideline. The new directive and the amended guideline are expected to come into effect in the summer to early fall 2022.

Summary of Proposed Changes

The new SCVF/GM directive specifies when testing and reporting are required, outlines the qualifications for personnel conducting the tests and describes how to communicate the test results to ER. The information provided in the new directive will aid industry in complying with all of ER's requirements related to SCVF/GM testing and reporting. Changes to the existing guideline will provide clearer expectations for acceptable testing methods and ER's reporting requirements. The guideline will also promote better testing results by proposing minimum SCVF/GM testing procedures.

The new directive features new requirements for operators to perform an SCVF test on all new wells just after drilling and to use qualified third-party professionals to do SCVF/GM testing for an abandonment, a repair or if requested to do so by ER. The requirement to conduct an SCVF test for every new well drilled, instead of testing only those wells where industry has identified a problem, stems from ER's desire to ensure that all wells are adequately scrutinized for possible gas leaks. Through the test, ER will be alerted sooner if a well has a problem that needs to be tracked because the problem could become worse later in the life of the well. This work can be conducted by the operator and does not have to be certified by an independent, qualified third-party professional.

Review of Draft Directive

ER is seeking written comments on the new directive and the amended guideline, which are attached to this notice as Schedules “A” and “B”, respectively. Please direct any comments or questions about the proposed amendments to:

ER Service Desk at er.servicedesk@gov.sk.ca

Attn: Ken Kowal

Energy Regulation Division

The deadline for submitting written comments is **July 8, 2022**.

SCHEDULE A

Gas Migration and Surface Casing Vent Flow

Directive PNG026

June 2022

Revision 1.0

Governing Legislation:

Act: *The Oil and Gas Conservation Act*

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

Directives: *Directive PNG005: Casing and Cementing Requirements*
Directive PNG013: Well Data Submission Requirements
Directive PNG015: Well Abandonment Requirements

Order: N/A

Record of Change

Revision	Date	Description
0.0		Initial draft
1.0	June, 2022	Based on Guideline PNG026 (established in November 2015) but reintroduced as a directive. Expanded to include testing and measurement methods for surface casing vent flow and gas migration, and features clarification-related updates for existing gas migration testing and measurement processes.

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1. Introduction

This Directive establishes the requirements for

- reporting gas migration (GM) and surface casing vent flow (SCVF),
- measuring GM/SCVF, and
- documenting and submitting the GM/SCVF measurement to the Ministry of Energy and Resources (ER).

This Directive supports regulatory requirements administered by ER for GM/SCVF to be addressed in the context of well completion, production, abandonment, and post-abandonment situations. For reference, these regulatory requirements are found in the following ER directives:

- *Directive PNG005: Casing and Cementing Requirements* (Directive PNG005)
- *Directive PNG013: Well Data Submission Requirements* (Directive PNG013)
- *Directive PNG015: Well Abandonment Requirements* (Directive PNG015)

Questions on this Directive can be directed to the ER Service Desk at 1-855-219-9373 or ER.servicedesk@gov.sk.ca.

2. Governing Legislation

This Directive is authorized under and supplemented by:

- *The Oil and Gas Conservation Act* (OGCA);
- *The Oil and Gas Conservation Regulations, 2012* (OGCR);
- *Guideline PNG026: Gas Migration and Surface Casing Vent Flow* (Guideline PNG026).

3. Definitions

AOR means the acknowledgment of reclamation issued by the minister pursuant to subsection 56(6) of the OGCA.

Gas Migration (GM) is when gas from stratigraphic units contacted within the well is present at surface in soils around the outermost string of well casing.

IRIS means the Integrated Resource Information System.

Minister means the elected representative responsible for the Ministry of Energy and Resources.

Qualified third party professional means a person who is objective, free from influence, operates at arm's length from the licensee, and who holds a recognized degree or certificate and has professional standing with the appropriate body to practice in Saskatchewan. A qualified person will have the necessary training, expertise, and technical knowledge of the subject matter to ensure BA adherence to the requirements of this directive. The qualified person must be a licensed and/or certified member in good standing with one of the following:

- *The Association of Professional Engineers and Geoscientists;*
- *The Saskatchewan Institute of Agrologists;*
- *The Alberta Society of Professional Biologists;*
- *Technology Professionals of Saskatchewan;* or
- Designated by the Minister.

Serious vent flow is defined as

- a stabilized shut-in pressure exceeding 11 kPa/m multiplied by the surface casing setting depth in metres,
- a flow containing hydrogen sulphide, hydrocarbon liquid, drilling mud, water, or other contaminants,
- an SCVF resulting in a fire, compromises public safety, or creates an environmental hazard, or
- determined by the appropriate field office.

Surface Casing Vent Flow (SCVF) means the movement of fluids and/or gas in any combination or volume between the production casing and the surface casing.

4. Gas Migration and Notification Requirements

The occurrence of GM is possible at any point in the life of a well, including after abandonment.

Pursuant to Directive PNG005 and the OGCR, the minister may order that GM related to well completion or production operations be rectified to the minister's satisfaction, which may include GM testing.

Directive PNG015 requires the licensee to conduct a GM test prior to cutting and capping a well to determine if gas is present at the surface in soils around the outermost string of the well casing.

GM remediation cannot proceed until the appropriate field office approves the remediation plan. If GM is evident on a well site subject to an acknowledgement of reclamation (AOR), the minister, under the powers of the OGCR, may order the licensee to immediately remedy the situation.

If GM is found at any time during the life of the well, the discovery shall be immediately communicated to the appropriate ER Field Office for review. ER will then require one of the following:

- remediate known GM prior to well completion;
- remediate GM prior to or during production; or
- remediate GM prior to cut and cap operations.

The licensee must immediately contact the appropriate field office if the severity of the GM increases at any time.

4.1 Wells to be Abandoned

As required by Directive PNG015, all wells must be tested for GM prior to cut and cap operations. Licensees must submit a copy of the test results to ER via IRIS. Cut and cap operations must not be conducted until GM to the surface around a wellbore has been mitigated to ER's satisfaction. A final test confirming that no GM is present shall be conducted no more than one year prior to the date of cut and cap.

4.2 Dry Hole Abandonments

If gas is found inside and/or outside the surface casing after the abandonment plugs are run, the licensee must immediately notify the appropriate field office to determine the process to re-enter the well and re-abandon.

A final test confirming that no GM is present must be conducted no more than one year prior to the date of cut and cap. The licensee must submit a copy of the test results to ER via IRIS.

4.3 Previously Abandoned Wells

Pursuant to the OGCR, the issuance of an AOR does not relieve an operator of their environmental liability associated with the well site. The minister will require an operator to re-licence and re-enter the well to conduct tests, logs, or analyses of the well and take remedial measures if it appears that gas has not been effectively shut off in a wellbore.

The licensee must immediately notify the appropriate field office if gas is found migrating to the surface around a previously abandoned wellbore. The licensee must

- obtain a licence to re-enter the well,
- receive a repair authorization from ER prior to conducting any work, and
- remediate the well and site to ER's satisfaction.

5. Surface Casing Vent Flow

The occurrence of SCVF is possible at any point in the life of a well, including after abandonment.

Pursuant to Directive PNG005 and the OGCR, the minister may order that SCVF relating to well completion or production operations be rectified to the minister's satisfaction, which would include verification with an SCVF test.

An SCVF test is required to be conducted on every well after drilling, prior to well completion. The information collected from this test will help to identify if the well has integrity issues immediately after drilling has been completed. The test conducted here does not require the use of a qualified third-party professional but must be conducted as per Guideline PNG026. The licensee must submit the results of an SCVF test through IRIS within 90 days of the end of drilling date.

Prior to abandonment and pursuant to Directive PNG015, the licensee must conduct an SCVF test to determine if gas, liquid, or any combination of substances are escaping from the surface casing vent.

The licensee must immediately report the discovery of SCVF to the appropriate field office if SCVF is found at any time during the life of the well. The field office will review the severity of the SCVF.

6. GM/SCVF Testing Methods

Guideline PNG026 details the minimum test procedures, appropriate testing equipment, and test locations for measuring GM/SCVF. Licensees are to follow this Guideline when measuring GM and SCVF.

For the purposes of this Directive, all GM and SCVF measurement tests for an abandonment, a repair associated with a GM or SCVF, or if requested by ER, shall be conducted by a qualified third-party professional.

7. Documentation and Submission

The results from GM/SCVF tests must be recorded on the most current version of the *Gas Migration and Surface Casing Vent Flow* form. The licensee must attach the form to the well in IRIS and within the timeframe indicated in Directive PNG013, or as required by the appropriate field office.

The current version of this form is available on the Publications Center Saskatchewan website at: <https://publications.saskatchewan.ca/#/home>.

ER will conduct audits to confirm the accuracy of submitted data.

SCHEDULE B

Gas Migration and Surface Casing Vent Flow Testing Procedures

Guideline PNG026

June 2022

Revision 2.0

Governing Legislation:

Act: *The Oil and Gas Conservation Act*

Directive: *Directive PNG026: Gas Migration and Surface Casing
Vent Flow*

Record of Change

Revision	Date	Description
0.0		Initial draft
1.0	November, 2015	Approved first version
2.0	June, 2022	Expanded to include testing and measurement methods for surface casing vent flow and gas migration, and features clarification-related updates for existing gas migration testing and measurement processes.

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1. Introduction

This Guideline provides detailed test procedures, requisite test equipment, and test locations for measuring gas migration (GM) and surface casing vent flow (SCVF). This Guideline supports *Directive PNG026: Gas Migration and Surface Casing Vent Flow* (Directive PNG026) and intends to help operators comply with the requirements of Directive PNG026.

The appearance of the words “must” or “should” in this guideline indicate that a method must be followed in the described manner to produce the proper result.

Questions on this guideline can be directed to the Ministry of Energy and Resources (ER) Service Desk at 1-855-219-9373 or ER.servicedesk@gov.sk.ca.

2. Qualification Requirements and Certifications

As required by Directive PNG026, a qualified third-party professional must certify all GM and SCVF measurement tests for an abandonment or repair associated with GM or an SCVF, or as required by the Ministry of Energy and Resources (ER).

Evidence of certification must be included with the completed *Gas Migration and Surface Casing Vent Flow* form, which is attached to the appropriate well and submitted through the Integrated Resource Information System (IRIS).

3. Gas Migration Testing

3.1 General Requirements

ER recognizes that conditions vary greatly throughout Saskatchewan and licensees are encouraged to use their professional judgment when determining the appropriate testing methodology and procedure.

The test procedures outlined in this guideline are minimum recommended standards, and any deviations from these guidelines must be reviewed and approved by the appropriate field office prior to conducting the testing. All documentation must accompany a submission in IRIS.

3.2 Gas Migration Testing Conditions

GM testing must be conducted when:

- the soil is in a frost-free and dry condition. Saturated soil, such as immediately following rainfall or other condition, that may suppress gas migration must be avoided; and
- environmental conditions will provide a relevant and reliable reading.

Regardless of sampling method and instrumentation used, ER will not accept the test if the soil conditions are not frost-free and dry.

3.3 Testing Grid Expansion and Contaminated Soil Remediation

GM is present when the measured methane level is above the normal background level. If GM is detected, expanding the test grid will ensure that the entire GM-affected area is determined.

If contaminated soils are suspected to be causing elevated gas migration readings, retesting is required after contaminated soils have been remediated. The entire grid must be retested after remediation.

Other methane sources such as biogenic methane and petroleum hydrocarbon (PHC) based soil contamination should be considered because they may affect test results.

3.4 Ground Penetration Test Method

This type of GM testing requires that holes are created in the soil to measure methane concentrations.

3.4.1 Ground Penetration Equipment

To perform ground penetration GM tests, a hole must be dug to a minimum depth of 50 centimetres (cm) below ground surface to a maximum of 64 millimetres (mm) in diameter. Equipment or material to seal the hole at surface must be utilized to ensure that soil gases do not escape when testing.

In addition, an instrument capable of measuring the methane concentration in the air must meet the following specifications:

- a measuring range of 0-100, 0-1000, 0-10 000 ppm;
- accuracy: +/- 10%;
- linearity: +/- 10%;
- sensitivity: 1 ppm;
- response time: <5 seconds; and
- calibration: adjustable zero and span with a maximum +/- 15% drift over 24 hours.

Calibrate equipment according to the manufacturer's standard operating procedures to ensure that a proper sample is obtained. Special consideration may be needed to ensure that the equipment is calibrated to methane and that the equipment is set to read methane.

3.4.2 Ground Penetration GM Procedure

The ground penetration test method must be conducted in accordance with the following procedure:

1. Determine if the location meets proper soil conditions as stated in subsection 3.2.
2. Perform instrument check.
3. Prepare a test hole of a **minimum of 50 cm** below ground surface and a maximum of 64 mm in diameter.

4. Isolate the hole from atmospheric contaminants.
5. Insert the measuring equipment probe a minimum of 30 cm into hole, maintaining a seal at surface to prevent atmospheric gas and soil gas from mixing.
6. The volume and rate of the sample will depend upon the instrumentation being used. Ensure that a sufficient sample is taken to purge lines and instrumentation for an accurate reading.
7. Take the reading according to manufacturer's standard operating procedure.
8. Record observations on the *Gas Migration and Surface Casing Vent Flow* form.
9. Readings of zero must be recorded as "0" on the form.
10. Purge instrument and lines to ensure no cross-contamination before proceeding to next sample location.
11. Expanding the test grid will help define the affected area if methane levels exceed background levels.
12. All test grid locations must be completed for all GM tests.

3.4.3 Test Point Locations

A minimum of three representative control samples to determine background ppm readings must be taken. These background samples should be taken at the lease edge or just beyond unless otherwise approved by the appropriate field office. More background samples may be needed based on the test results.

After background or control samples have been taken, test point locations should be as follows:

- Two test points within 30 cm of the wellbore on opposite sides;
- at 2 metre (m) intervals outward from the wellbore every 90° (across with the wellbore at center) to a distance of 6 m; and
- at any points within 75 m of wellbore where there is apparent vegetation stress.

3.5 Soil Surface Gas Detection Method

This type of GM testing involves measuring methane concentrations at the air-soil interface using infrared technology.

3.5.1 Soil Surface Gas Detection Equipment

To measure potential GM at the air-soil interface, an infrared instrument capable of measuring the methane concentration in the air must meet the following specifications:

- a measuring range of 0-100, 0-1000, 0-10 000 ppm,
- accuracy: +/- 10%,
- linearity: +/- 10%,
- sensitivity: 1 ppm,
- response time: <5 seconds, and
- calibration: adjustable zero and span with a maximum +/- 15% drift over 24 hours.

Calibrate equipment according to the manufacturer's standard operating procedures to ensure that a proper sample is obtained. Special consideration may be needed to ensure that the equipment is calibrated to methane and that the equipment is set to read methane.

3.5.2 Soil Surface Gas Detection Procedure

The soil surface gas detection test method must be conducted in accordance with the following procedure:

1. Determine if the location meets proper soil conditions as stated in section 3.2.
2. Perform instrument check.
3. Take the reading according to manufactures standard operating procedure.
4. Record observations on the *Gas Migration and Surface Casing Vent Flow* form.
5. Observed zero readings shall be recorded as "0" to demonstrate the reading was taken.
6. Follow the manufacturer's standard operating procedure before proceeding to next sample location.
7. If methane levels exceed background, expanding the test grid will help define the affected area.
8. All test grid locations must be completed for all GM tests.

3.5.3 Test Point Locations

A minimum of three representative control samples to determine background ppm readings must be taken. These background samples should be taken at the lease edge or just beyond unless otherwise approved by the appropriate field office. More background samples may be needed based on the test results.

After background or control samples have been taken, test point locations should be as follows:

- within 30 cm of the wellbore, two test points on opposite sides;
- at 2 metre (m) intervals outward from the wellbore every 90° (across with the wellbore at center) to a distance of 6 m; and
- at any points within 75 m of wellbore where there is apparent vegetation stress.

4. Surface Casing Vent Flow Testing

The SCVF testing methods described in subsections 4.1, 4.2, and 4.3 may be done at any time after SCVF has been identified.

4.1 Bubble Test Method

Bubble tests may be used to determine if an SCVF is present. One end of a hose test apparatus is submerged in water while the other end is connected to the surface casing vent. Bubbles indicate the flow of gas from the vent.

4.1.1 Bubble Test Equipment

The bubble test requires:

- a container filled with approximately 500 milliliters to 1 litre of water,
- small hose fittings to connect to surface casing vent,
- a small hose (minimum 6 mm, maximum 12 mm inside diameter), and
- any other equipment required to direct gas flow from the vent downward into the water container.

4.1.2 Bubble Test Procedure

The bubble test method must be conducted in accordance with the following procedure:

1. Ensure that there are no leaks at fittings or welded connections.
2. Verify before starting the test that all valves in the vent line are open.
3. Connect the test fittings to the vent so that gas flow is directed into the container of water.
4. Immerse the hose a maximum of 2.5 cm (1 inch) below the water surface.
5. Observe for 10 minutes. Note any gas flow (i.e., bubbles) indicating a positive vent flow.
6. Record observations on the *Gas Migration and Surface Casing Vent Flow* form.
7. If there is a positive vent flow, determine the SCVF flow rate and stabilized shut-in surface casing pressure in accordance with subsections 4.3 and 4.4 respectively.

If any bubbles are present during the 10-minute SCVF test the well has SCVF and the licensee must immediately notify the appropriate ER Field Office.

4.2 Flow Rate Determination

Equipment selection should be appropriate for the SCVF flow rate and expected pressure range. A positive displacement meter is necessary to accurately measure low volumes. An orifice well tester with a proper orifice plate may provide satisfactory measurements with a 24-hour shut-in pressure of 200 kPa or greater that builds quickly.

The licensee must install and use the equipment according to the manufacturer's instructions. In addition,

- the pressure/volume range of the equipment must not be exceeded,
- the fittings, wellhead, etc. must not be leaking,
- casing vents must be left open when equipment is removed unless specifically directed by ER to close them, and
- the test must be a minimum 24 hours.

4.3 Maximum Shut-In Casing Pressure (Pressure Build-Up) Procedure

1. Install a pressure gauge with pressure chart recorder or digital data logger as well as a pressure relief valve on the vent.
2. Ensure that there are no gas leaks at fittings and welds.
3. Document results and notify appropriate field office as per Directive PNG026.
4. Remove equipment and leave surface casing vent open.

The build-up pressure should be continued until a stabilized pressure is obtained. The pressure is considered stabilized if the change in pressure:

- is less than 2 kPa/hour over a six-hour period, or
- can be reasonably estimated to not exceed the pressure limits for the pressure-relief valve, which must be set no higher than 11 kPa/m of surface casing depth.

4.3.1 Maximum Shut-In Casing Pressure (Pressure Build-Up) - Equipment

- Pressure gauge with pressure chart recorder or digital data logger; and
- Pressure-relief valve, which must have a set pressure no higher than 11kPa/m of surface casing depth.

5.0 More Information

Please contact the local field office for more guidance on testing methodologies and procedures.

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