
Saskatchewan Upstream Flaring and Incineration Requirements

Directive S-20

June 2022

Revision 2.0

Governing Legislation:

Act: *The Oil and Gas Conservation Act*

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

Order: 120/22

Record of Change

Revision	Date	Description
0.0	July 1, 2011	Original
1.0	November 2015	Update to facilitate implementation of IRIS in 2015
1.1	December 2019	Update to include recent contact information
2.0	June 2022	Updates to align with Directive PNG036

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1. Introduction

This Directive provides upstream oil and gas flaring and incineration performance, equipment spacing and set-back distance specifications of the Saskatchewan Ministry of Energy and Resources (ER).

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

1.1 Applicable Wells and Facilities

The standards specified in this Directive apply to flare and incinerator systems associated with wells and facilities licensed or approved under *The Oil and Gas Conservation Act* (OGCA) and/or *The Oil and Gas Conservation Regulations, 2012* (OGCR).

Flares or incinerators installed at wells or facilities licensed on or after July 1, 2012 must meet the requirements of this Directive, as amended from time to time. Flares or incinerators installed at wells or facilities licensed prior to July 1, 2012, must upgrade to this Directive, if:

- The flaring or incinerator system is being upgraded as a part of the normal upgrade process of the well or facility;
- The facility licence undergoes an amendment;
- A single well battery is upgraded to a multi-well battery;
- Gas sent to the flare or incinerator has hydrogen sulphide (H₂S) equal to or greater than 10 mol/kmol; or
- Instructed to do so by ER.

Portable flares or incinerators used during drilling, servicing, turn-around or tests and located and used on the sites for less than one year are exempt from the requirements of this Directive, except for applicable equipment spacing. At any time, ER may require the licensee to shut-down portable flares and incinerators if in the opinion of ER environmental or public safety concerns are present.

2. Governing Legislation

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

- The OGCA
- The OGCR
- Associated Directives
 - *Directive S-01: Saskatchewan Upstream Petroleum Industry Storage Standards* (Directive S-01)
 - *Directive PNG001: Facility Licence Requirements*
 - *Directive PNG036: Venting and Flaring Requirements* (Directive PNG036)

3. Definitions

0.01 mol/kmol: Means 0.1 per cent or 10 parts per million (ppm).

10 mol/kmol: Means 1 per cent or 10,000 ppm.

Acid gas: Means gas that is separated in the treating of solution or non-associated gas that contains H₂S, total reduced sulphur compounds, and/or carbon dioxide (CO₂).

Associated gas: Means gas that is produced from an oil reservoir. This may apply to gas produced from a gas cap or in conjunction with oil.

Edge of the lease: Means:

- perimeter fence;
- at the lease berm;
- at the edge of the lease; or
- whichever is the lesser of the three.

Flame type equipment: Means open flame equipment, other heating device or electrical device that has open ignition and/or it could potentially cause a fire or explosion. For the purpose of equipment spacing, flame type equipment includes, but is not limited to: steam boilers, dehydrators, generators, heaters, treaters, diesel engines without automatic air shut offs and heated water tanks on a skid.

Non-associated gas: Gas produced from a gas pool (i.e., not associated with oil or bitumen reservoirs or with production).

Non-routine flaring, incinerating: Intermittent and infrequent events such as planned maintenance, process upsets, and emergencies that result in flaring or incinerating.

Licensee: Means licensee of the well or facility.

Produced products: Means upstream oil and gas products (unrefined), byproducts, wastes and materials contaminated with produced products. They include, but are not limited to, crude oil, condensate, drilling fluids, drilling waste, frac fluids, frac sands, liquid petroleum gas, oily byproduct, produced water, produced sand and any other material contaminated with produced products.

Process equipment: Means any non-flame type equipment used in the upstream petroleum recovery or treatment process such as amine tank, pop tank, scrubber, sweetener and separator. Process equipment generally does not have a permanent footing.

Routine flaring, incinerating Applies to continuous flaring, venting, and incinerating.

Separator: Means an apparatus for separating liquid and gas at the surface as they are produced from a well.

Sour gas: Means natural gas, including solution gas, containing H₂S.

Storage: Means holding of material produced, generated and used by the upstream petroleum industry for a period of time until the products, byproducts or wastes are transported, treated or disposed.

Specified: Means written or verbal requirements provided by appropriately authorized or delegated person.

Sulphur emissions: For the purposes of this Directive, includes all air emissions of sulphur-containing compounds, including SO₂, H₂S, and total reduced sulphur compounds (e.g., mercaptans). Sulphur emissions from flare stacks are expected to be primarily in the form of SO₂, with minor amounts of other compounds.

Tank: Means a device designed to contain materials produced, generated and used by the upstream petroleum industry which is constructed of impervious materials that provides structural support.

Treater: Means an apparatus for separating oil, gas and water at the surface as they are produced from a well.

Upstream: For the purpose of this Directive, upstream means activities associated with wells and facilities licensed or approved under the OGCA and/or the OGCR.

4. General Requirements

The use of flare pits and earthen pits as storage receptacles in the production operation of wells and facilities are strictly prohibited in Saskatchewan. Flare pits may be used during the drilling of a well, if approved. For questions regarding flare pits, contact the respective ER Field Office.

Flare, incinerators, and other gas combustion systems, including those using sour gas as a fuel for production or process equipment, must be designed, maintained, and operated so that emissions do not exceed the air quality standards specified in Directive PNG036.

The licensee shall install a vapour recovery unit to prevent the emission of volatile gases from storage devices and associated processing equipment at a facility or well site when H₂S is equal to or greater than 10 mol/kmol as measured at the source of emission or 0.01 mol/kmol as measured at the edge of the lease. Other methods to control sour gas emissions at a licensed facility or well site may be approved by ER upon request.

ER may require the licensee to modify or replace existing flares or incinerators, if in the opinion of ER, the operation is resulting in off-lease odours, associated complaints or continuous or frequent visible black smoke.

Equipment and controls design information, operating limits and procedures, or any other information about the flare or incinerator system must be provided to ER upon request.

5. Flaring and Incineration Performance Requirements

This Directive identifies ER requirements and is not a substitute for comprehensive engineering design codes and guidelines.

Licensees must ensure that a professional engineer, certified technician, certified engineering technologist or registered engineering technologist is responsible for the design or review of the flare or incinerator systems, including separation, related piping, and controls, and for the specification of safe operating procedures.

Licensees must also ensure that the flare and incinerator system is operated within the operational range and type of service specified by the designing or reviewing engineer, technician, or technologist. If this equipment is used for emergency shutdowns, this must be considered in the design.

If a licensee is using a flare or incinerator that has not previously been field tested, the licensee must be able to provide actual monitoring data to show that performance specifications can be met. Field testing of newly designed equipment is not allowed unless there are acceptable and backup combustion systems to ensure that any sweet, sour, or acid gas is properly combusted.

ANSI/API Standard 521: Pressure-Relieving and Depressuring Systems and *API Standard 537: Flare Details for Petroleum, Petrochemical, and Natural Gas Industries*, as well as applicable fire safety codes, electrical codes, CSA standards, and mechanical engineering standards, are all recommended references for the design of gas combustion systems.

5.1 Heating Value and Exit Velocity for Flares

The combined net or lower heating value of gas, including make-up fuel gas, directed to a flare must not be less than 20 mega joules per cubic metre (MJ/m³), except as noted below:

- If existing flare stacks have an established history of stable operation and compliance with air quality standards specified in Directive PNG036, licensees are allowed to maintain the current heating value provided it is not less than 12 MJ/m³. Licensees are expected to support claims that existing flare stacks have operated satisfactorily over time.
 - If flare stacks have a history of flame failure, odour complaints, and/or exceedances of air quality standards specified in Directive PNG036, licensees must operate with a combined flare gas heating value of not less than 20 MJ/m³.
- The combined net or lower heating value of acid gas plus make-up fuel gas directed to existing or new flares must not be less than 12 MJ/m³ under any circumstance.
- Sour gas plant emergency systems must be configured to ensure that the flared gas heating value is not less than 12 MJ/m³ and the air quality standards specified in Directive 36 are met.
 - ER recommends that 20 MJ/m³ heating value be maintained for non-routine flaring but recognizes that short duration emergency flaring with a gas heating value of less than 20 MJ/m³ may occasionally occur.

If a flare requires fuel make-up, it must be designed and specified by a qualified technical professional. Equipment controls must be installed and operating procedures must be

documented to ensure minimum fuel gas make-up during routine and non-routine operating conditions. Facilities must be operated in compliance with specified minimum fuel gas make-up requirements.

The flare system must have sufficient exit velocity and/or be equipped with wind guards to prevent wind from extinguishing the flame. The flare tip diameter must be properly sized for the anticipated flaring rates.

5.2 Minimum Residence Time and Exit Temperature for Incinerators

Incinerators must provide a minimum residence time of 0.5 seconds at maximum flow rate or greater as required for complete combustion of heavier gases.

- Incinerators must be operated without visible flame.
- If the gas contains less than 10 mol/kmol of H₂S as measured at the source and the unsupplemented heating value of the gas is 20 MJ/m³ or greater, no minimum residence time is required.

Incinerators must operate with a minimum exit temperature of 600°C.

- For combustion of gases with less than 10 mol/kmol of H₂S as measured at the source and an unsupplemented heating value of 20 MJ/m³ or greater, no minimum exit temperature or temperature monitoring is required.
- For combustion of gases with greater than 10 mol/kmol of H₂S, the facility must be designed to automatically shut down if the exit temperature of the incinerator drops below either 600°C or the required temperature to meet the air quality standards specified in Directive PNG036, whichever is higher.
 - For combustion of gases with greater than 50 mol/kmol of H₂S, the incinerator must also be equipped with process temperature control and recording.
 - All violations, together with measures taken to prevent recurrence, must be immediately reported by the licensee to the appropriate ER Field Office.

Any enclosed combustion technology not meeting the above requirements (minimum exit temperature and minimum residence time) must submit third-party verified conversion efficiency test results to ER for approval.

Test programs and submissions must be provided by a qualified person and must include:

- Inlet gas parameters, including flow rates and composition;
- Stack gas exit parameters, including temperature and composition;
- Material and energy balance calculations;
- A mass-weighted conversion efficiency value representative of the exit conditions;
- Discussion of the variation of measured and calculated results, depending on sampling location across the stack;
- Discussion of extending test results to other inlet conditions, including discussion of inlet limitations for H₂S concentration and inlet gas flow rate;
- Temperature monitoring and reporting; and
- Any other information required by ER.

Licensees using incinerators must be able to provide details about the conversion efficiency of the equipment. Any of the following are considered acceptable evidence of compliance with this requirement:

- Conversion efficiency for incinerator is 99 per cent or greater, based on one of the following:
 - the manufacturer's third-party-verified conversion efficiency test results, provided that the tests were conducted under conditions representative of the facility design, or
 - actual field measurements of conversion efficiency from the operating facilities following start-up.
- Any other evidence acceptable to ER

If conversion efficiency is less than 99 per cent, the incinerator will be considered to operate as a flare and must meet all requirements for flares, including stack height.

5.3 Smoke Emissions

Routine gas combustion must not result in continuous or repeat black smoke emissions over a consecutive period of six minutes. Any smoke emissions that may result in public concern must immediately be reported to the appropriate ER Field Office.

5.4 Ignition

Flares and incinerators must have reliable systems to ensure continuous ignition of any gas that may discharge to the device.

- At all wells and facilities (excluding gas plants) where the gas contains more than 10 mol/kmol of H₂S, a pilot or automatic ignition device must be installed on flares and incinerators for continuous (e.g., sour water or condensate tank flash-gas) and intermittent (e.g., emergency depressuring) sources.
- At gas plants where gas contains more than 0.01 mol/kmol of H₂S, pilots and automatic ignition must be installed on flares and incinerators.
- If repeat failures have occurred or off-lease odours or other impacts have resulted from failure to ensure ignition of sour gas, regardless of H₂S content, ER may require installation of:
 - both pilots and automatic ignition, and/or
 - flame failure detection and alarms.

Manual flare and incinerator ignition subject to good fire safety practices will be accepted for non-routine purposes where:

- no continuous gas flow exists, and
- no automatic relieving systems are connected to the stack.

5.5 Stack Design

Flares and incinerators must meet or exceed all the applicable stack design requirements listed below:

- Flare and incinerator stacks must be designed so that the maximum radiant heat intensity at ground level does not exceed 4.73 kilowatts per square metre (kW/m²).

- Ground-level radiant heat determinations for flares can be based on calculation procedures outlined in ANSI/API Standard 521, or any other method acceptable to ER. Incinerators must be operated without visible flame. Exceptions to this requirement will be considered by ER upon request, provided an equivalent level of safety can be ensured.
 - In such cases licensees must restrict access to the area where the radiant heat intensity could be exceeded and must ensure that this area is free of combustible materials and vegetation. Access restrictions must include appropriate warning signs and the area must be clearly marked.
 - Appropriate procedures must be in place when it is necessary to work within the area where the radiant heat intensity could be exceeded.
- Flares and incinerators located within a distance of 5 times the height of any neighbouring buildings (on-site and off-site) must have a height of at least 2.5 times the height of the highest building. Where this is not possible, stack height may be based upon calculated radiant heat and proper dispersion, not on distance to buildings, after consultation with ER.
 - The foregoing does not apply to devices for destruction of trace vent gases, such as those emitted from gas dehydrators.
- Flare stacks for acid or sour gas containing more than 10 mol/kmol of H₂S must have a minimum height of 12 m above ground level.
- Flare stacks and incinerators must have sufficient height to provide adequate plume dispersion to comply with air quality standards specified in Directive PNG036 for sulphur dioxide (SO₂).
 - Proper stack heights must be used to minimize fuel consumption. If the use of supplemental fuel gas is proposed, all other options must be investigated first. Fuel gas usage and amounts must be justified.
- Interconnecting lines to the flare or incinerator must be secured to prevent whipping or flailing.

5.6 Liquid Separation

Entrained liquids in a flare or incinerator stream may reduce combustion efficiency and contribute to increased emissions of total reduced sulphur compounds, hydrocarbons, and products of incomplete combustion. Proper gas-liquid separation facilities adequate to protect the pipeline system or gas combustion system must be used.

The terms knockout, knockout drum, scrubber, and separator are used interchangeably. The requirements apply to all these devices.

- Design information on flare and incinerator system liquid separation equipment must be submitted to ER upon request.
- Liquid separation equipment must be provided in both temporary (including well test) and permanent flare and incinerator systems to prevent the carryover of liquid hydrocarbons, water, or other liquids.
- Flare and incinerator separators must be designed in accordance with good engineering practice to remove droplets of 300 to 600 micron diameter and larger (refer to ANSI/API Standard 521). Designs must be based on the lowest density hydrocarbon liquids that could be released to the flare or incinerator system.

- The flare and incinerator separators or knockout drums must be designed to have sufficient holding capacity for liquid that may accumulate, as a result of upstream operations, such as hydrocarbon carryover, liquid slugs, and line condensation.
- Flare and incinerator separators in facilities must be equipped with high-level alarms that can be responded to by the licensee prior to liquid carryover, in addition to liquid level indication.
- High-level alarms and facility shutdowns must be installed on all flare and incinerator separators where liquid streams are directed to the separator for storage or where free liquids are contained in continuously combusted streams.
- Flare and incinerator separator high-level alarms must be connected to facility alarm panels and/or semi-attended facility alarm call-out systems if the facilities are so equipped.
- Well test vessels receiving production from oil wells must be equipped with a high-level shutdown, unless attended 24-hours a day and procedures for monitoring liquid levels are in place.
- Flare and incinerator separators or knockout drums used for liquid storage must be designed, installed, and spaced in accordance with Directive S-01.

5.7 Exceptions to Separator Requirements

ER does not require independent flare or incinerator separators in situations where the only vessels connected to the flare or incinerator are production separators equipped with a high-level shutdown (HLS) or equivalent devices or with a system that prevents liquids from entering the flare or incinerator.

The following limitations apply to this exception:

- The HLS must be configured to shut down and block in, but not depressure, the battery. The HLS trip level must be set so that adequate vapour-liquid separation is not impaired at maximum liquid level and vapour flow rates.
- If liquid carryover involving spills occurs around the flare or incinerator or if black smoke is formed, licensees must install adequately sized flare or incinerator separators.

5.8 Backflash Control

Inadequately purged flare or incinerator systems may have sufficient oxygen present to support combustion. Backflash may occur when the linear velocity of the combustible mixture of gas and air in the system is lower than the flame velocity.

- Licensees must take precaution to prevent backflash using appropriate engineering and operating practices, such as:
 - installation of flame arresters between the point of combustion and the flare or incinerator separator, or
 - provision of sufficient flare header sweep gas velocities (i.e., purge or blanket gas) to prevent oxygen intrusion into the flare or incinerator system.
- Check valves are not an acceptable form of backflash control.
- Safe work procedures must be in place to ensure complete purging of oxygen from flare or incinerator systems prior to ignition.

5.9 Flare and Incinerator Equipment Spacing and Set-back Distances

Flares and incinerators must be located, as measured from the base of the stack, at least:

- 50 metres (m) away from wells, not including water disposal wells or water injection wells where there is no risk of flammable vapours;
- 50 m away from storage tanks containing flammable liquids or flammable vapours;
- 25 m away from any oil and gas processing equipment;
- 75 m away from surface improvements; and
- 100 m away from an occupied dwelling;

In the case of a flare stack installed before January, 1, 2008, at a well or facility site, clauses 51(4)(c) and 51(7)(b) of the OGCR may apply. If the flare stack was relocated at the well or facility site on or after January 1, 2008, the licensee must adhere to current equipment spacing and set-back distances for a flare.

Refer to Directive S-01 for other factors that may increase the setback distance from an occupied dwelling.

5.10 Fire Bans

Licensees must maintain areas surrounding flares and incinerators to minimize fire hazards. Information on fire bans can be obtained from Saskatchewan Public Safety Agency at www.saskpublicsafety.ca.

6. ER Field Office Contacts

Flaring and incineration inquiries, notifications, or complaints may be directed to the applicable ER Field Office listed below:

Estevan	General Inquiry	(306) 637-4541
Kindersley	General Inquiry	(306) 463-5400
Lloydminster	General Inquiry	(306) 825-6434
Swift Current	General Inquiry	(306) 778-8252