Directive 084

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Requirements for Hydrocarbon Emission Controls and Gas Conservation in the Peace River Area

The Alberta Energy Regulator has approved this directive on September 11, 2018.

<original signed by>

Jim Ellis
President and Chief Executive Officer

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1 Introduction

1.1 Purpose of This Directive

This directive sets out the Alberta Energy Regulator's (AER) requirements for addressing odours and emissions generated by heavy oil and bitumen operations in the Peace River area of Alberta.

For the Peace River area, these requirements are intended to

- reduce hydrocarbon emissions that contribute to odours and
- increase the conservation of gas resources.

This directive includes requirements to

- eliminate routine venting;
- prevent nonroutine venting;
- reduce nonroutine flaring;
- conserve at least 95 per cent of all solution gas;
- reduce fugitive emissions;
- minimize odours from truck-loading, truck-unloading, tank-cleaning, and tank-desanding activities; and
- participate in a regional ambient air monitoring program.

This directive applies to all AER-regulated wells and facilities associated with heavy oil and bitumen operations in the Peace River area regardless of whether the facility is exempt from *Directive 056: Energy Development Applications and Schedules* licensing requirements. Where a conflict arises between the requirements in this directive and any other AER directive, the requirements in this directive prevail unless otherwise directed by the AER. Licensees are advised that requirements in other AER directives, such as *Directive 060: Upstream Petroleum Industry Flaring, Incinerating, and Venting*, continue to apply to heavy oil and bitumen operations in the Peace River area.

Facilities in this area may also operate under an *Environmental Protection and Enhancement Act* (*EPEA*) approval, and the requirements in this document are in addition to, and separate from, *EPEA* approval requirements. Licensees must meet all applicable requirements, and the AER may provide direction as needed.

The Peace River area, as defined in this directive, comprises the Three Creeks, Reno, Seal Lake, and Walrus areas (see figure 1). Where heavy oil and bitumen wells and facilities are built in close proximity to these defined areas, the AER may direct companies to comply with all or a part of these requirements.

This directive does not apply to AER-approved waste disposal facilities located in the Peace River area. Approval holders for these facilities must comply with the applicable odour and emission requirements in *Directive 060* and *Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry*.

Questions on how to use this directive should be directed to Directive084@aer.ca.

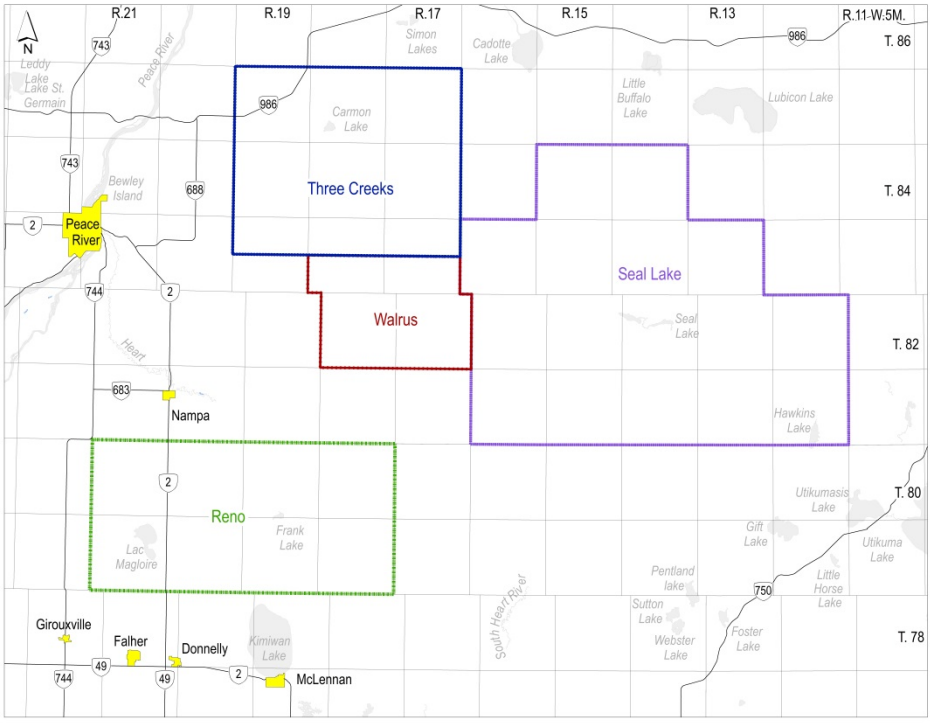

Figure 1. Map of the Peace River area as defined in this directive

1.2 What's New

The monthly leak and annual survey report forms (formerly appendices 2 and 3), and all references to them, have been deleted because the subject information will now be submitted through the designated information submission system. Section 6.2.6.1, "Monthly Leak Report," and appendix 2, "Annual FEMP Analysis Report," now provide a list of the details required for each report.

The PeaceRiverRecommendations@aer.ca inbox will no longer receive submissions because this information must now be submitted through the designated information submission system.

The PeaceRiverRecommendations@aer.ca inbox will no longer receive questions; all questions should be directed to the Directive084@aer.ca inbox.

1.3 AER Requirements

AER requirements are those rules that a responsible duty holder as specified in legislation (e.g., licensee, operator, company, applicant, approval holder, or permit holder) is required to follow. The term "must" indicates a requirement, while terms such as "should," "recommends," and "expects" indicate a recommended practice.

In this directive, "licensee" means the holder of a licence under the *Oil and Gas Conservation Act*, or, where the context so requires, the operator of a facility where a licence or approval is not required under the *Oil and Gas Conservation Act*, or the holder of an approval under the *Oil Sands Conservation Act*.

Each AER requirement is numbered.

Information on compliance and enforcement can be found on the AER website.

2 General Requirements

1) Upon request by the AER, a licensee must produce those documents, records, or plans required to be completed by this directive and any additional documentation needed by the AER to assess compliance with the regulatory requirements in this directive.

Emissions outside the lease boundary must not exceed the objectives described in the *Alberta Ambient Air Quality Objectives and Guidelines* (AAAQO).

3 Routine and Nonroutine Venting

3.1 Objective

To eliminate routine venting and to prevent nonroutine venting of solution gas.

3.2 Requirements

2) Unless otherwise directed by the AER, licensees must capture and flare, incinerate, or conserve all solution gas.

3) Licensees must implement suitable and functional controls to prevent nonroutine venting.

4 Limitations on Nonroutine Flaring

4.1 Objective

Reduce nonroutine flaring.

4.2 Requirements

4) Starting March 1, 2019, a licensee's nonroutine flaring volumes must not exceed 3.0 per cent of its total gas production volumes in any calendar year. Fuel gas used for pilots or flare system purge is excluded from this calculation.

$$Per\ cent\ nonroutine\ flaring = \frac{Total\ annual\ gas\ nonroutinely\ flared\ from\ all\ facilities}{Total\ annual\ gas\ production\ from\ all\ facilities} \times 100$$

5) The licensee must comply with the records (logs) requirements in section 10.1 of *Directive 060* with the exception that records must be retained for at least 24 months.

5 Gas Conservation

5.1 Objective

Increase the conservation of solution gas.

5.2 Requirements

6) Unless otherwise set out in a gas conservation plan that has been accepted by the AER prior to the issuance of this directive, all licensees of existing heavy oil and bitumen wells and facilities must achieve a cumulative gas conservation rate of at least 95.0 per cent.[1] A licensee's gas conservation rate is calculated on a calendar-year basis as follows:

$$\begin{aligned}&Per\ cent\ gas\ conservation\ rate\\&= \frac{Total\ gas\ production\ from\ all\ facilities - Total\ gas\ routinely\ flared\ from\ all\ facilities}{Total\ gas\ production\ from\ all\ facilities} \times 100\end{aligned}$$

7) Notwithstanding requirement 6), licensees without existing heavy oil or bitumen wells or facilities in the Peace River area must meet the 95.0 per cent gas conservation rate for their first oil battery within 12 months of the on-production date of the battery unless otherwise directed by the AER.

6 Fugitive Emissions

6.1 Objective

Reduce fugitive emissions.

The requirements in this section apply once a site begins meeting requirement 2.

6.2 Requirements

6.2.1 Fugitive Emissions Management Program

8) A licensee must develop, document, and implement a fugitive emissions management program (FEMP). This program must outline the procedures and plans that will be used to meet the requirements set out in this directive. The basic elements of this program and references to the respective sections of the directive that set out the requirements for these elements are shown in figure 2. Licensees must make their FEMPs available to the AER upon request.

[1] The gas conservation rate in this section does not include nonroutine volumes. Requirements related to nonroutine venting and nonroutine flaring are found in sections 3 and 4 of this directive.

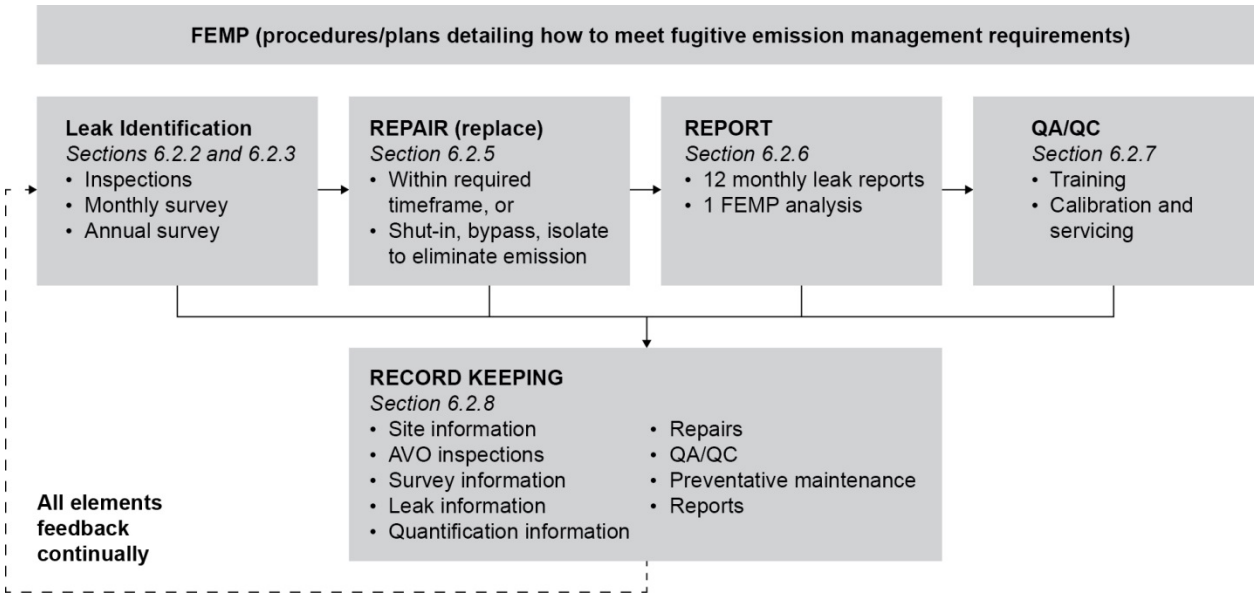

Figure 2. Elements of a fugitive emissions management program

6.2.2 Inspections and Surveys

9) A licensee must develop, document, and implement plans to accurately identify leaking components.

10) The licensee must include in its FEMP a detailed description of how inspections and surveys are conducted, including, for example, the distance from the base of a tank when a hydrocarbon leak-imaging infrared camera is being used.

6.2.2.1 Unscheduled Inspections

11) A licensee must immediately conduct an inspection

a) upon becoming aware of a possible leak,

b) in response to an odour complaint, or

c) as directed by the AER.

It is recommended that when licensees become aware that a pressure-relief device has been activated, the component be checked to ensure that the component has reseated properly. Licensees should develop and implement measures to detect when pressure-relief devices have been activated where these situations are not apparent.

It is recommended that licensees inspect for leaks following any maintenance or servicing activities that could have introduced a leak.

6.2.2.2 Weekly Audio/Visual/Olfactory Inspections

12) A licensee must conduct weekly audio/visual/olfactory (AVO) inspections. The AVO inspections must be conducted inside and outside of each active process building, around all process units, and along all aboveground piping. AVO inspections should check for

    a) stains, wet areas, or dripping around thief hatches, pressure vacuum valves, and gauge board assemblies on storage tanks;

    b) frosting or sweating of valves and pressure-relief devices connected to vent lines;

    c) visible vapour or steam plumes from components;

    d) normally closed valves connected to vents or open-ended lines that are not fully closed during normal operations;

    e) components that have been temporarily removed for inspection, maintenance, or other purposes and have not been put back in place afterward;

    f) unlit pilots on fired equipment (e.g., tank heaters and line heaters) and unlit flares;

    g) odours inside buildings and downwind of piping, process equipment, and storage tanks;

    h) sounds indicative of a leak; and

    i) other reasonable indications of a leak.

Acceptable proof of the AVO inspections can take the form of an addition to existing operator check sheets or preventive maintenance forms that show when an AVO inspection was done.

6.2.2.3 Monthly Surveys

13) A licensee must conduct a monthly survey of targeted components, and there must be a minimum of seven days between monthly surveys.

14) Mandatory targeted components are those components that must always be checked and cannot be removed from the targeted component list. Monthly surveys must include the following mandatory targeted components:

    a) tank-top components (e.g., thief hatches, pressure vacuum relief valves, and gauge board assemblies),

    b) flare ignitor or pilot (ensure it is lit), and

    c) compressor seals.

15) A licensee must add a component to its list of targeted components for individual sites

    a) when directed by the AER,

    b) if a component has led to a public odour complaint, or

    c) if a component has been found to be leaking two or more times in the preceding three consecutive months.

16) A licensee must add a component to its list of targeted components for all its sites

    a) when directed by the AER, or

    b) where a component at multiple sites exhibits either high leak volumes or high leak frequency.

Components added to a list of targeted components by the licensee can be removed on a per-site basis if one of the following conditions is met:

- the component has been replaced or
- the component has gone three consecutive monthly surveys without leaking.

6.2.2.4 Annual Surveys

17) An independent third-party survey of all site components must be conducted annually to verify the effectiveness of a licensee's FEMP.

18) There must be a minimum of seven days between an annual and a monthly survey. There must be a minimum of six months between annual surveys.

6.2.3 Leak Detection Equipment

19) A licensee must use reliable and appropriate leak detection techniques or equipment when conducting inspections and surveys and when confirming that a component is no longer leaking.

For monthly and annual surveys, the following applies:

Hydrocarbon leak-imaging infrared cameras must be designed to detect a methane leak rate of approximately 1.0 gram per hour.

When using hydrocarbon leak-imaging infrared cameras, the licensee should

- be within 6 metres for all components (tank tops can be viewed at further distances but should be at the minimum distance required to view tank-top components, usually not greater than 30 metres from the base of the tank);
- inspect components perpendicular to the wind direction;

- use an appropriate lens to monitor tank-top components (a fixed lens of 70 millimetres or more should be used on tank tops when viewing from distances approaching 30 metres);
- view at multiple angles; and
- account for interference from sunlight, precipitation, wind, and ambient temperatures.

20) Organic vapour analyzers, if used, must be able to detect hydrocarbon gases at a concentration of 500 ppm when used in accordance with the United States Environmental Protection Agency's (EPA) Method 21.

21) Other techniques or equipment that provide an equivalent leak detection capability are permissible, but a licensee must demonstrate equivalence to the AER's satisfaction on request.

If more than one technique is used, it will be considered a leak if any method determines it is a leak.

6.2.4 Quantification of Leak Rates

22) A licensee must quantify leak rates if

    a) a leak is not repaired or leaking component is not replaced within 24 hours or

    b) a leak is detected during the annual survey.

23) The single point measurement uncertainty must not be greater than 25 per cent. Leak-rate measurement methods may include flow capture and metering systems (e.g., calibrated bags, turbine meters, ultrasonic gas flow meters, diaphragm meters, rotameters, and optical flow meters), velocity traverses, tracer tests, or remote sensing techniques. The methods used to quantify leaks must be documented and provided to the AER on request.

24) A licensee may only use engineering estimates of leak rates for sources of leaks that have demonstrable safety issues or technical challenges (e.g., tank-top fittings), unless otherwise specified by the AER. The basis of all estimates must be documented.

6.2.5 Repairs

25) A licensee must start addressing the leak (e.g., repair, shut-in, bypass, isolate, or eliminate) immediately upon detection.

26) A leak must be repaired immediately if the source of a leak is a failed pilot or ignitor on a flare stack or the leak is the source of an offensive off-lease odour.[2]

[2] As defined in section 8.2 of *Directive 060*.

27) For any equipment that is in service, the leak must be repaired or the leaking component replaced

    a) within 24 hours of identification, if

        i) the leak rate is greater than 0.20 cubic metres per hour;

        ii) the leak is causing, or has the potential to cause, off-lease odours, regardless of the leak rate; or

        iii) the leak rate is not quantified.

    b) within 120 hours of identification, if

        i) the leak rate is less than or equal to 0.20 cubic metres per hour (rate must be confirmed by quantification within 24 hours) and

        ii) the leak is not causing, or does not have the potential to cause, off-lease odours.

28) If a central processing facility of a thermal operation requires shutting down to repair a leak, the licensee can submit a written request, along with justification, to the local AER field centre for an extension to the deadline to complete repairs. If an extension is granted, the leak must be quantified with the total monthly volume reported in the comment section of the monthly leak reports until the leak has been repaired.

29) Within 24 hours of a leaking component having been repaired and put back into service, a licensee must confirm that the component is no longer leaking.

30) If a leak is not immediately repaired, a licensee must have a method to clearly identify the leak for subsequent repair and repair confirmation. The licensee's identification method must be documented and provided to the AER on request. The AER recommends that a licensee use physical tagging to identify leaks for repair and that the tags be removed once the integrity of the repair has been confirmed.

6.2.6 Reporting

6.2.6.1 Monthly Leak Reports

31) A licensee must submit a monthly leak report that covers all of its sites and must

    a) include all leaks detected by monthly surveys and all other inspections;

    b) include the following details:

        i) reporting frequency,

        ii) the licensee details and contact information,

        iii) survey month,

iv) the licence numbers,

v) surface locations,

vi) whether monthly surveys were conducted at all sites and reasoning,

vii) component details,

viii) the dates the leak was addressed,

ix) whether the leak was addressed within the required timeframe, and

x) if the leak was not addressed within the required timeframe, an explanation for why;

c) be submitted to the AER through the designated information submission system;

d) be submitted by the 18th of the month (or next business day) following the month of the monthly inspection; and

e) be certified by management that the information they contain is true, accurate, and complete.

6.2.6.2 Annual FEMP Analysis Report

32) A licensee must submit one annual FEMP analysis report that covers all of its sites and that

a) contains the information listed in appendix 2 and

b) is submitted to the AER through the designated information submission system.

6.2.7 Quality-Assurance / Quality-Control Program

33) A licensee must have a quality-assurance / quality-control (QA/QC) program that includes the following elements:

6.2.7.1 Training

34) A licensee must develop and implement an effective training program on the procedures and the equipment necessary to complete monthly surveys.

To be considered effective, a licensee's training program should include training on

- the use, calibration, and maintenance of equipment used to detect leaks and to quantify leak rates;
- survey procedures and component identification; and
- desktop training, field training, and periodic refresher courses.

Periodic audits of survey work should be considered as a method of evaluating the effectiveness of the training program.

6.2.7.2 Calibration and Servicing Requirements

35) All equipment used to detect leaks and to quantify leak rates must be operated, serviced, and calibrated in accordance with manufacturer's specifications.

6.2.8 Record Keeping

36) A licensee must retain a complete record of all surveys, inspections, leak detection and quantification results and procedures, leak repairs, QA/QC programs, and reports. The information that a licensee must retain is contained in appendix 3.

37) A licensee's fugitive emissions records (see requirement 36) must be

a) retained for at least five years,

b) made available to the AER on request, and

c) accessible by the AER at the local field office or another nearby site.

7 Truck Loading and Unloading and Tank Cleaning and Desanding

7.1 Objective

Implement measures to minimize odours from truck-loading, truck-unloading, tank-cleaning, and tank-desanding activities.

Licensees must meet the requirements contained in section 7.2 as of September 1, 2018. The AER expects licensees to work towards meeting these requirements in the interim.

7.2 Requirements

38) The licensee must implement suitable and functional controls for emissions that have the potential to cause, or are causing, off-lease odours when

a) loading and unloading fluids by truck and

b) cleaning and desanding storage tanks.

Emission controls may include

- scrubbers,
- flares and incinerators,
- pressurized trucks, and
- operational procedures.

39) A licensee must develop, document, implement, and retain an emission controls program for truck loading, truck unloading, tank cleaning, and tank desanding that ensures that emission controls are suitable and functional.

This program should identify and describe

- compounds that have the potential to cause off-lease odours or AAAQO exceedances;
- methodologies and analyses used to determine the compounds with the potential to cause off-lease odours or AAAQO exceedances;
- effectiveness of emission controls design;
- criteria used to select suitable emission controls;
- maintenance and monitoring procedures of emission controls; and
- activities or actions taken to continuously improve the emission controls program.

40) The emission controls program for truck loading, truck unloading, tank cleaning, and tank desanding must be made available to the AER upon request.

8 Ambient Air Monitoring

8.1 Objective

Monitor air quality to generate accurate, timely, and transparent information about odours and emissions from heavy oil and bitumen operations.

8.2 Requirement

41) Unless otherwise directed by the AER, licensees must participate in a regional ambient air monitoring program operating in the Peace River area, such as the Peace River Area Monitoring Program or other successor program.

9 Annual Performance Report

9.1 Objective

Licensees report consistent and relevant information on progress related to meeting the regulatory outcomes specified in this directive.

9.2 Requirements

42) All Peace River area licensees must submit the following information about the previous calendar year to the AER by March 31, unless otherwise directed by the AER, through the designated information submission system:

a) Routine Venting

   i) Progress related to installing controls to meet requirement 2).

   ii) The types of controls installed in order to eliminate routine venting.

b) Nonroutine Venting

   i) Progress related to installing controls to meet requirement 3).

   ii) The types of control installed in order to prevent nonroutine venting.

c) Nonroutine Flaring

   i) Summary of the nonroutine flaring percentage (as calculated in section 4) at all facilities for the previous calendar year. The data should include a breakdown of nonroutine flaring at each facility and a cumulative total for the licensee's operations in the Peace River area.

d) Gas Conservation

   i) Progress related to meeting gas conservation requirements, including any challenges and successes related to conserving the gas.

e) Fugitive Emissions

   i) The annual FEMP analysis report (see section 6.2.6.2).

f) Truck Loading and Unloading, Tank Cleaning, and Tank Desanding

   i) Emission controls equipment installed and operating practices implemented to minimize odours from truck-loading, truck-unloading, tank-cleaning, and tank-desanding activities.

   ii) Identify any changes to the emission controls program from the previous year.

   iii) For 2017 and 2018, provide information on progress related to meeting these truck-loading, truck-unloading, tank-cleaning, and tank-desanding requirements.

9.3 Continuous Improvement

It is recommended that licensees continually improve their operations by evaluating their effectiveness in meeting the regulatory objectives of this directive. Licensees are encouraged to document the operational improvements they make and to present them as part of their annual performance report.

Appendix 1 Glossary

component A component is defined as a device that has the potential to leak. Components include the following: valves, connectors, compressor seals, pump seals, actuator seals, pressure-relief devices, flow meters, pressure regulators, sampling connections, instrument fittings, engine and compressor crankcase vents, sump and drain tank vents and covers, blowdown system vents and open-ended valves and lines, thief hatches, pressure vacuum relief valves, and gauge board assemblies.

conservation The recovery of solution gas for use as fuel for production facilities, sale, beneficial injection into an oil or gas pool, or other useful purposes (e.g., power generation).

control Equipment, mechanism, technique, procedure, or device used to guide performance or manage an activity or process.

control, functional A control that is useful, functioning, working, operating, in service, or otherwise performing for the appropriate amount of time to fulfil its purpose, task, or regulatory requirement.

control, suitable A control that is designed, constructed, maintained, and operated such that it effectively fulfils its function for an activity in relation to a specific AER requirement and meets all applicable regulatory standards or requirements (e.g., AER *Directive 060*, Canadian Standards Association, *Safety Codes Act*). In the case of emissions with the potential to cause off-lease odours, a suitable control is one that is able to safely manage odorous emissions at a well or facility so that they do not cause off-lease odours. In most cases, this would entail equipment designed to a point source control efficiency of at least 95 per cent for the odorous compounds it is meant to control. In the case of nonroutine venting, a suitable control is one that is able to safely manage product flow and pressures while preventing venting from a well or facility.

crude bitumen A naturally occurring viscous mixture, mainly of hydrocarbons and heavier than pentane, that may contain sulphur compounds and that, in its naturally occurring viscous state, will not flow to a well.

fugitive emission

A fugitive emission is defined as an unintentional release of hydrocarbons to the atmosphere. Fugitive emissions may result from equipment component leaks, wear and tear, improper assembly, inadequate material specifications, manufacturing defects, damage during use or installation, corrosion, and fouling.

Fugitive emission sources also include

- leakage into engineered vent systems,
- improper seating of pressure-relief devices and purge gas valves, and
- pneumatic devices that release hydrocarbon gas in excess of design parameters.

The following emission sources are not included as part of these requirements:

- area-based sources such as ponds or pits, and
- exhaust from burners, engines, flare stacks, combustors, or incinerators.

heavy oil

Crude oil with a density of 920 kg/m^3 or greater at 15°C.

leak

A leak is defined as a fugitive emission that results from the loss of hydrocarbon past a component at a rate in excess of a manufacturer's design specifications or health, safety, or environmental standards, whichever is more stringent, or as otherwise defined by the AER.

In the absence of quantifying the leak rate, in relation to the above, a component is leaking and in need of repair or replacement if

- the emissions can be seen or detected using a hydrocarbon leak-imaging infrared camera or
- the emissions produce a hydrocarbon screening value of 500 ppm or greater using an organic vapour analyzer in accordance with US EPA Method 21.

nonroutine venting and flaring

"Nonroutine" applies to intermittent and infrequent flaring, venting, and incineration that does not occur on a regular basis due to normal operation. There are two types of nonroutine flaring: planned flaring and unplanned flaring.

oil battery

A system or arrangement of tanks or other surface equipment or devices receiving the effluent of one or more wells for the purpose of separation and measurement prior to the delivery to market or other disposition.

planned flaring	Flare events where the operator has control over when flaring will occur, how long it will occur, and the flow rates. Planned flaring results from the intentional depressurization of processing equipment or piping systems. Examples of planned flaring include pipeline blowdowns, equipment depressurization, start-ups, facility turnarounds, and well tests.
routine venting and flaring	"Routine" applies to continuous or intermittent flaring, venting, and incineration that occurs on a regular basis due to normal operation. Examples of routine flaring include the following: storage-tank vapour flaring; flash-tank vapour flaring; and solution gas flaring.
site	A single surface lease (pads counted as one lease) where gas is flared or vented.
solution gas	All gas that is separated from oil, condensate, or bitumen production. This gas includes casing gas (gas produced from well casing) and tank-top gas (gas given off from the heavy oil while in production tanks).
unplanned flaring	Emergency or upset operational activities closely associated with facility health and safety. Unplanned flare events are where the operator has no control of when flaring will occur. There are two types of unplanned flaring: upset flaring and emergency flaring.
venting	The intentional controlled release of uncombusted gas.

Appendix 2 Annual FEMP Analysis Report

The annual FEMP analysis report must contain the following sections and information:

1) Monthly Leak Reports Summary

This summary includes all leaks detected by monthly surveys and inspections. Inspections can include routine AVO inspections, inspections triggered by off-lease odour complaints, and AER inspections.

Include a summary table giving information by month and year of the following:

- Number of sites and number of sites with leaks detected
- Number of leaks of targeted components
- Number of leaks of nontargeted components
- Number of leaks identified through inspections
- Number of leaks not addressed within required timeframes
- Comments on repairs not completed within required timeframes

2) Annual Survey Report

The report must include the following information and be certified by management that the information it contains is true, accurate, and complete:

- Reporting frequency
- Licensee details and contact information
- Survey year
- Licence numbers
- Surface locations
- Whether annual surveys were conducted at all sites and, if not, an explanation why
- Component details
- Dates when the leak was addressed
- Whether the leak was addressed within the required timeframe and, if not, an explanation why

3) Annual Survey Data

This data is from all components and includes leak information from the annual survey.

- Number of leaks by component type

- Number of components (see below) by component type (estimate or actual)
- Leak frequency by component type
- Leak volumes for each component type together with method of quantification (e.g., high-flow sampler, flow meter, etc.)

4) Summary of Monthly Leaks from Record Keeping

This data is from all leaks reported throughout the year except the annual survey report.

- Number of leaks by component type
- Leak frequency by component type
- Number of leaks attributed to off-lease odours
- Number of leaks by leak identification method (e.g., AER inspection, licensee inspection, or survey)
- Number of leaks by component type that were not addressed within required timeframes
- Leak volumes by method of quantification (e.g., high-flow sampler, flow meter) for all leaks not addressed within 24 hours

5) Performance of Fugitive Emissions Management Program

   a) Discussion of trends shown in monthly reports

      i) Leaks increasing, decreasing, or remaining relatively unchanged

      ii) Leaks by component type as recorded in

         - monthly surveys
         - annual surveys

      iii) Differences observed between monthly and annual surveys

      iv) Was the targeted component list modified within the year? If so, what modifications were made and why?

   b) What changes will be made to routine AVO and other inspections?

   c) Rank-order sites according to the number of leaks detected and the numbers of repeat leaks. Discuss the results (e.g., why certain sites are higher than others)

6) Plans for Further Fugitive Emissions Reductions

   a) How will preventive maintenance programs be adjusted?

   b) What design changes will be made?

c) What are the plans to address sites that have greater leak numbers, greater leak volumes, or greater repeat leaks (see 5(b) above)?

d) Will the targeted component list be modified? If so, what modifications will be made and why?

Component Counting

Component inventories may be developed either by applying representative component schedules to each major process unit or equipment package, including the yard piping, or by an in-field inspection of individual process units and areas.

While component inventories may be derived from process diagrams, this method frequently underestimates component numbers due to the lack of detail on most process diagrams. This is especially true for fittings (e.g., connectors and valves less than two nominal pipe size) and any third-party packages (e.g., compressor units, heaters, and scrubbers).

When counting each component, it is important to also record the percentage of the time that it is out of service (i.e., there is zero gauge pressure on both sides of the component). This information can be used to adjust leak frequencies accordingly.

The following are recommended practices for compiling an inventory of components based on standard component classifications:

- **Compressor seals**: A reciprocating compressor is deemed to have one seal associated with each compressor cylinder regardless of whether it is a single or tandem seal. A centrifugal compressor has two seals if the shaft penetrates both ends of the compressor housing, or one seal if the shaft penetrates only one end of the housing. Other components on the compressor and on any associated cooler must be accounted for separately (e.g., valves, connectors, pressure-relief valves, open-ended valves and lines, and gas-operated instruments).
- **Connectors**: Each threaded, flanged, or mechanical connection, including tubing connections, is counted as a single connector. Welded or backwelded connections are not counted.

Some types of components may have more than one set of connections. For example, a union may have three sets of connecting surfaces (two end connections and a centre connection), a nipple or reducer may have two (one at each end), and tees may have three (one at each end). If all three connection points on a union are threaded, then a union would be classified as having three connectors. A union that has welded end connections would be counted as having only one connector.

- **Valves**: This category accounts for leakage from around the valve stem and from the valve body. The end connections and any leakage past the valve seat are counted separately (see

connectors and open-ended valves or lines).

- **Pressure-relief valve**: Generally, a pressure-relief valve that discharges directly to the atmosphere or through a vent system is counted. However, if the valve discharges to a control device (e.g., flare or thermal oxidizer), or has a rupture disk installed upstream along with a monitoring system to indicate when the rupture disk has failed, then the valve is not counted.

  The connection on the upstream side of the valve is counted as a separate component. The connection on the downstream side is also counted if the relief valve is connected to a control device.

- **Pressure regulators:** If the regulator discharges directly to the atmosphere or through a vent system, it is counted. However, if the regulator discharges to a control device (e.g., flare or thermal oxidizer), it is not counted. The connections upstream and downstream of the regulator are counted as separate components.
- **Open-ended valves or lines**: Each valve in hydrocarbon service that has hydrocarbon fluid on one side and is open to the atmosphere on the other (either directly or through a line) is counted as an open-ended valve or line. If the open side of the valve is fitted with a properly installed cap, plug, blind flange, or second closed block valve, or is connected to a control device, then it is no longer considered to be open-ended (i.e., there is zero leak potential).

  A drain valve that discharges into the top of an underground storage tank is considered an open-end line.

  The valve stem and body, and the connector on the process side of the valve are counted as separate components.
- **Sampling System:** The individual parts of a sampling system should be counted as separate components. Thus, an open-ended line that is used for routine sampling would be counted as both a sampling system and an open-ended line.

Appendix 3 Fugitive Emissions Record Keeping Information

For each site, a licensee must record the following information:

1) Site Information
    a) Licence number
    b) Site name (if applicable)
    c) Location by legal land description (LSD-SEC-TWP-RG-MER)
    d) Site type (e.g., thermal, cold heavy oil production)
    e) Number of production tanks
    f) Number of components by component type (estimated or actual; see “Component Counting” section in appendix 2)
2) AVO Inspections
    a) Date of inspection
3) Survey Information
    a) Name and contact information of person conducting survey
    b) Surveyor company name (if applicable)
    c) Date of surveys
    d) Duration of each survey
    e) Environmental conditions during survey (e.g., wind speed, ambient temperature)
    f) Targeted component list and tracking process
4) Leak Information
    a) Date and time the fugitive emission or odour was first detected
    b) Where the odour was detected (if applicable; i.e., on lease or off lease)
    c) How leak was detected (monthly or annual survey, public complaint, odour detected, AVO inspections, AER inspection)
    d) Date and time of leak detection
    e) Environmental conditions (e.g., wind speed, ambient temperature)
    f) Method of leak detection used (e.g., thermal camera)
    g) Location of leak

h) Component type (e.g., connector, block valve, control valve, thief hatch, PVRV, pressure-relief device, pump seal, compressor seal, regulator, pneumatic device, pilot/ignitor failure, flow meters, pressure regulators, sampling connections, instrument fittings, engine and compressor crankcase vents, sump and drain tank vents and covers, blowdown system vents and open-ended valves and lines, thief hatches and gauge board assemblies, etc.) and style (e.g., gate valve, ball valve)

i) Is it a mandatory targeted component (e.g., thief hatches/PVRVs, PSVs, gauge board assemblies, unlit flare stack, compressor seals)?

5) Quantification Information

a) Quantified emission rate (m^3/hr) from each leak if required under section 7

b) Method of quantification

6) Repair

a) Date and time leak addressed (repaired, shut-in, bypassed, isolated, or eliminated)

b) Was leak addressed within required timeframe?

c) Date and time of repair confirmation

d) Name and contact information of repair personnel

e) General comments on repairs completed outside of required timeframes.

7) QA/QC

a) Calibration details for all equipment used for leak detection and quantification

b) Details on QA/QC programs (e.g., training)

8) Preventive Maintenance Programs

a) Details on preventive maintenance programs

9) Reports

a) A copy of the current FEMP

b) Original third-party annual comprehensive survey reports

c) Monthly leak reports

d) Annual survey reports

e) Annual FEMP analysis reports