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OF PETROLEUM PRODUCERS

Canada's Oil and Natural Gas Producers

GUIDE

Emergency Preparedness Guide for Hazards Associated with Wildfires

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Overview

This guide is designed to give field personnel the basic information to prepare for, recognize, assess and respond appropriately to the threat from wildfires and smoke.

The guide is not intended as a replacement for site-specific emergency plans, nor is it a blueprint for developing such plans. It is not intended to provide direction for emergency evacuation and worker safety provisions.

All emergency wildfire situations are unique therefore this guide should only be used as reference. Wildfire behaviour experts may be consulted during the development of emergency response plans for wildfire and smoke hazards.

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1 Introduction

A large portion of the upstream oil and gas industry operates in forested areas where the threat from wildfire and smoke from wildfires are significant.

Wildfires can cause harm to people, personnel entrapment, damage to facilities and negatively impact operations.

Smoke from wildfires is a threat to the health and safety of personnel by reducing visibility and air quality.

New hazards may be created by the fire and remain present in the environment long after a wildfire event.

This guide highlights effective and reasonable measures to identify and prepare for the risks from wildfire and smoke.

The intended audience for the guide includes any worker in the upstream oil and gas industry working in forested areas, or involved in the development of emergency preparedness planning and business continuity planning for wildfires.

2 Using this Guide

This guide is designed to provide a broad introduction to the dangers posed by wildfires and smoke.

Emergency response planning is a legislated requirement for the oil and gas industry. The incorporation of wildfire risk in emergency response planning is critical, and should include training, site orientation and the development of a communication plan.

The guide does not supersede the authority of government officials. Always obey and follow orders from government officials in emergency situations and use the resources provided in this guide to stay in close contact with authorities.

The guide is divided into two key parts:

[Section 3](#) describes the risk from wildfire smoke, how to assess it and how to respond to smoke incidents.

[Section 4](#) describes how to understand and prepare for the hazards associated with wildfires.

This guide should be used in conjunction with The Field Guide for the Upstream Oil and Gas Industry FireSmart®. FireSmart® is a site-specific guide and wildfire risk assessment tool for field operators to help prevent wildfire and reduce the impact of catastrophic wildfire on industry infrastructure, operations, personnel safety, liability and the environment. Implementing FireSmart strategies can be the best way to reduce the risk to facilities or operations against injury, damage, and/or production loss.

Additional material on how to prepare for a wildfire and how to respond to a wildfire are listed in Appendix A. The information in Appendix A is provided only as an introduction to these topics. Appendix B provides links and references to additional material.

For more information on FireSmart®, visit www.enform.ca/firesmart.

The reader is also directed to the CAPP Best Management Practices: [Wildfire Prevention](#) for further information.

3 Smoke: Hazards and Assessment

Smoke from wildfires can pose a serious health risk to upstream oil and gas personnel. The purpose of this section is to help field workers recognize and assess the risk posed by smoke and respond appropriately and effectively.

This section includes

- a basic description of the risks posed by wildfire smoke ([Section 3.1](#)),
- a basic description of wildfire smoke ([Section 3.2](#)),
- a description of the health effects caused by smoke ([Section 3.3](#)),
- practical methods to assess the risk from smoke ([Section 3.4](#)) and
- a list of suggested responses to different levels of smoke ([Section 3.5](#)).

Note: The suggested responses are intended to highlight areas of particular concern and offer guidance to minimize risk to health and safety. They are not a replacement for government or company directives.

3.1 Risk from Smoke

An active wildfire front is often seen as the main risk to health and safety from a wildfire. Yet the smoke from a wildfire also poses a serious health and safety risk, and can lead to widespread evacuations and harm. During past wildfire incidents, heavy smoke from wildfires has forced the evacuation of nonessential employees and contractors.

The health effects of smoke can range from eye and respiratory tract irritation to more serious problems such as reduced lung function, bronchitis, exacerbation of asthma, and premature death (see [Section 3.3](#) for the health effects of smoke).

The effects of smoke can be far more widespread than the fire itself. Dangerous concentrations of smoke can drift over vast areas.

In addition to the health risk, wildfire smoke can severely reduce visibility, hamper operations and increase the risk of incidents.

3.2 Characteristics of Smoke

3.2.1 Smoke Composition

Smoke from wildfires is a mixture of gases and fine particles from burning trees and other plant materials.¹ The composition of smoke will vary depending on fuel type and conditions. Smoke is made up primarily of carbon dioxide, water vapour, carbon monoxide, particulate matter, hydrocarbons and other organics, nitrogen oxides and trace minerals.

In general, particulate matter (PM) is the major pollutant of concern from wildfire smoke. Particulate is a general term for a mixture of solid particles and liquid droplets suspended in the air. The particulates formed in wildfires tend to be very small (less than 2.5 microns in diameter) and are excellent at scattering light, which reduces visibility. These small particulates are often referred to as PM_{2.5}.

Wildfires also produce carbon monoxide. This colourless odourless gas is a product of incomplete combustion. It is produced in the largest amounts during the smouldering stages of a fire.

Hazardous chemical pollutants are also present in smoke in far less concentrations than particulates and carbon monoxide. The most common are acrolein, benzene and formaldehyde.

3.2.2 Smoke Behaviour

Smoke from wildfire behaves erratically. Sometimes wind may blow the smoke clear. At other times, the wind may fan the flame and blow more smoke in.

Since smoke concentrations change constantly, vigilance, caution and a variety of information sources are recommended during smoke events (see [Section 3.4, Monitoring for Smoke](#)).

Large vertical smoke columns can create their own updrafts and downdrafts which can cause sudden changes to the local weather including shifting winds or erratic winds, and in some cases can produce their own lightning.

¹ www.deq.mt.gov/FireUpdates/docs/WildfireSmokeGuide.pdf

3.3 Health Effects of Smoke Exposure

Smoke can hurt your eyes, irritate your respiratory system, and worsen chronic heart and lung diseases.²

Some of the common symptoms include

- coughing,
- scratchy throat,
- irritated sinuses,
- shortness of breath,
- chest pain,
- headaches,
- stinging eyes,
- runny nose and
- asthma exacerbations.

People who have heart disease might experience

- chest pain,
- rapid heartbeat,
- shortness of breath or
- fatigue.

Smoke may worsen symptoms for people who have pre-existing respiratory conditions such as respiratory allergies, asthma and chronic obstructive pulmonary disease in the following ways:

- inability to breathe normally
- cough with or without mucus
- chest discomfort
- wheezing and shortness of breath

When smoke levels are elevated even healthy people may experience some of these symptoms.

3.3.1 People at Heightened Risk

Wildfire smoke affects people differently. People at increased risk for adverse health effects include

- people with existing respiratory conditions such as lung cancer, asthma or chronic obstructive pulmonary disease (COPD), including chronic bronchitis and emphysema,
- people with existing cardiovascular conditions including angina, previous heart attack, congestive heart failure or irregular heartbeat,
- infants and young children may be more at risk because they have elevated metabolic rates and immature immune systems,

² emergency.cdc.gov/disasters/wildfires/facts.asp

- the elderly tend to be more at risk because respiratory, cardiovascular and immune systems are not as strong as they may have been,
- pregnant mothers and fetus' may be harmed by wildfire smoke because it contains many of the same compounds as cigarette smoke,
- diabetics are at risk because they may have underlying conditions such as cardiovascular disease,
- smokers are at risk because they may have compromised lung function and
- anyone whose outdoor activity results in deep rapid breaths (e.g., runners, labourers)

Risks increase when smoke becomes heavier (it contains more particulates) and as the length of time a person is exposed increases.

3.3.2 Particulate Exposure from Smoke

The principle health threat from wildfire smoke is caused by exposure to particles suspended in the air (particulates). Particle pollution may contain substances like carbon, sulphur and nitrogen compounds, metals and organic chemicals.

Unlike many other sources, the particles from wildfires tend to be very small (PM_{2.5}). These small particles can lodge deep in the lungs and are very slow to clear.

For people with pre-existing respiratory and cardiovascular disease, exposure to particulates can cause persistent cough, phlegm, wheezing, and difficulty breathing. There is also the risk of aggravating pre-existing conditions.

In healthy individuals, exposure can cause respiratory symptoms, temporary reductions in lung function, and pulmonary inflammation.

Particulate exposure can also affect the immune response, reducing the body's ability to remove foreign materials from the lungs, like pollen and bacteria.³

3.3.3 Carbon Monoxide Exposure

Carbon monoxide is a tasteless, colourless, odourless gas produced by the incomplete combustion of carbon-based fuels.

Carbon monoxide exposure may happen to anyone close to a fire, especially if it is smouldering. Symptoms of carbon monoxide exposure include headache, weakness, dizziness, confusion and visual impairment. Prolonged or heavy exposure may result in a coma or death.

3.3.4 Chemical Exposure from Smoke

The smoke from wildfires contains a variety of chemicals, many of them hazardous.

Chemicals like formaldehyde and acrolein can irritate eyes and the respiratory system, and may trigger asthma.

³ www.deq.mt.gov/FireUpdates/docs/WildfireSmokeGuide.pdf

Wildfire smoke may also carry carcinogens such as polycyclic aromatic hydrocarbons and benzene.

Smoke concentrations will increase significantly in low lying areas such as valley bottoms where there is poor mixing of air or during an inversion.

3.4 Monitoring for Smoke

There are a variety of ways to monitor for smoke.

During high-risk situations, use as many monitoring methods as possible. Since smoke behaves erratically, the effectiveness of a single monitoring method may change abruptly.

3.4.1 Local Air Quality Reports and Air Quality Indexes

Many jurisdictions in Canada provide estimates of air quality over the Internet using the Air Quality Health Index (AQHI) forecasting system. Using a scale from 1 to 10 categorized as low, moderate, high, and very high health risk, AQHI represents the forecast of the maximum level of outdoor air pollution within the next 12-hour period. AQHI is based on a mixture of pollutants including PM_{2.5}. The current AQHI ratings for different locations in Canada are published at www.airhealth.ca. While useful, AQHI ratings for many regions of Canada are not yet available.

In western Canada, the BlueSky Western Canada Smoke Forecasting System provides detailed smoke forecasts from BC to Manitoba during the fire season. BlueSky produces a new 60-hour model forecast of hourly ground level PM_{2.5} values, twice daily (early morning and mid-afternoon). This is a valuable resource, and should be used (www.bcairquality.ca/bluesky/west/) though it must be kept in mind that it is a modelled forecast and may not perfectly predict the time or location of PM_{2.5} events nor properly capture rapidly changing local conditions.

Communications with specific government departments should be established in advance to ensure that timely information on smoke is received.

News reports on the radio, TV and the Internet are another source of current information on air quality. In high-risk situations government officials will use these outlets to transmit the latest information.

All the sources above can provide useful forewarning of a threat from smoke. They should be used extensively, but must be considered in the context of site-specific conditions.

3.4.2 Estimating Air Quality

In areas without continuous particulate matter (PM) monitoring (Air Quality Health Index), particle levels can be estimated using a visibility index. This is particularly effective during wildfires, when timely information is critical. Even in areas with continuous particulate monitoring, the visibility method is a quick and effective means of assessing air quality because smoke concentrations can change quickly and vary over short distances.

To estimate particulate matter concentrations that are potentially harmful using a visibility assessment use the following procedure:

- 1) Face away from the sun.
- 2) Look for landmarks at known distances.
- 3) Determine the visibility range – the limit of which is the point where even high-contrast objects, like a mountain or a dark building, totally disappear.
- 4) Estimate visibility in kilometres.
- 5) Use the table below to identify the suggested health message and appropriate action, based on the air-quality category.

Table 1: Estimating air quality using visibility

*Adapted from Wildfire Smoke: a guide for public health officials:
www.arb.ca.gov/smp/progdev/pubeduc/wfgv8.pdf*

Visibility in km	Air Quality Category	Equivalent approx. PM2.5 1-3 hour average in µg/m ³ *
15 km and up	Good	0-40
5-14 km	Moderate/Unhealthy for Sensitive Groups	41-175
2.5-4 km	Unhealthy	176-300
1.5-2 km	Very Unhealthy	301-500
Less than 1 km	Hazardous	over 500

**The concentration of an air pollutant (e.g. Particulates less than 2.5 microns in diameter — PM2.5) is given in micrograms (one-millionth of a gram) per cubic meter air or µg/m³.*

The visibility index may be unreliable at times when specific landmarks at known distances are unavailable or when visibility is poor e.g., at dawn or dusk and at night. The above index also only applies to the particulate matter (PM) levels in dry air conditions. This method of estimation is not accurate during high humidity conditions.

3.4.3 Measuring Particulate Levels Using Instruments

There are a variety of instruments available to measure particulates. Select a device that is appropriate to your operation.

3.4.4 Measuring Carbon Monoxide Levels

Carbon monoxide is generally less of a threat to health and safety during a wildfire than particulates. However, carbon monoxide can pose a serious threat when sheltering in enclosed spaces with little or no access to fresh air. Because carbon monoxide has no colour, odour or taste, it can be dangerous to oil and gas workers and emergency responders near a wildfire. Carbon monoxide poisoning can occur after exposure to very high concentrations or after exposure to lower concentrations for a prolonged period. The threat of carbon monoxide poisoning drops off rapidly the further you are away from the fire.

Having a carbon monoxide detector onsite will warn workers of dangerous levels of carbon monoxide.

Carbon monoxide detectors should be used when fires are close to a site and when sheltering inside clean air shelters if the time spent indoors exceeds one hour.

3.5 Response to Wildfire Smoke

The table below provides suggested actions in response to varying levels of particulate matter.

Table 2: Recommended action in response to varying levels of particulates

*Adapted from Wildfire Smoke: a guide for public health officials:
www.arb.ca.gov/smp/progdev/pubeduc/wfgv8.pdf*

Air Quality Category	Health Messages for At-Risk Personnel	Health Messages for All Other Personnel	Recommended Actions
Good Visibility: 15 km and up 1-3 hour average PM2.5 0-40 µg/m3	Continue with usual outdoor activities.	Ideal air quality for outdoor activities.	Be aware of forecast (current, daily, tomorrow).
Moderate/ Unhealthy for Sensitive Groups Visibility: 5-14 km 1-3 hour average PM2.5 41-175 µg/m3	Reduce or reschedule prolonged strenuous activities and limit time spent outdoors.	Be aware of health effects of smoke and related symptom.	Advise workers about: health effects of smoke, related symptoms, and ways to reduce exposure. If the smoke event is projected to be prolonged, evaluate and notify possible cleaner air shelter sites and prepare evacuation plans for at-risk populations.
Unhealthy Visibility: 2.5-4 km 1-3 hour average PM2.5 176-300 µg/m3	Avoid prolonged strenuous activities and stay indoors if possible.	Reduce or reschedule prolonged strenuous activities outdoors, especially if you experience symptom.	Consider cancelling non-essential outdoor activities. Restrict or eliminate access to the site by other visitors, Consider the distribution and use of respirators and masks.
Very Unhealthy Visibility: 1.5 -2 km 1-3 hour average PM2.5 301-500 µg/m3	Avoid all strenuous activities and stay indoors if possible.	Avoid prolonged strenuous activities and stay indoors if possible.	Consider having at-risk personnel go to designated air shelters. Make preparations and take precautions against the threat from a wildfire, including the risk from fire (see Appendix A). Consider the distribution and use of respirators and masks.
Hazardous Visibility: < 1 km 1-3 hour average PM2.5 >500 µg/m3	Avoid all strenuous activities and stay indoors.	Avoid all strenuous activities and stay indoors.	Restrict activities to the essentials. If smoke event is projected to be prolonged, consider evacuation of at-risk personnel. Make preparations and take precautions against the threat from a wildfire, including the threat from fire (see Appendix A). Consider the distribution and use of respirators and masks.

3.5.1 Sheltering In Place

Staying indoors is an effective response to smoke from wildfires and provides the best protection in tightly closed, air-conditioned buildings.

In non-air conditioned or very leaky buildings, staying inside with doors and windows closed may offer little protection. It also poses the risk of heat stress during hot weather. When air quality improves, even temporarily, “air out” your accommodations to reduce indoor air pollution.

Effective clean air shelters should be identified before an event occurs. The information below provides information on equipment that can be used to either improve the indoor air quality of a shelter or help identify candidate buildings for shelters.

Air conditioners

Air conditioners reduce the amount of outside particulate simply by eliminating the need to open doors and windows for ventilation. Some air conditioners can be fitted with High Efficiency Particulate Arrestance (HEPA) filters (rated at PM2.5), which can capture most of the tiny particles associated with smoke and can further reduce the amount of outside air pollution that gets indoors. Replace filters after a smoke event. Stock sufficient filters in air shelters and replace filters as needed.

Air cleaners

Air cleaners are expensive but can be effective at reducing indoor particulate levels. Most are not effective at removing gases and odours. The two basic types of air cleaners for particle removal are mechanical cleaners and electronic air cleaners.

Air cleaner effectiveness is usually reported in terms of efficiency but airflow should also be considered. These two factors together are measured as the Clean Air Delivery Rate (CADR). This is a better measure of how a device will actually perform.

Devices that remove gases and odours are relatively costly, both to purchase and maintain. The filtering medium can quickly become overloaded and may need to be replaced often.

Humidifiers

Humidifiers are not technically air cleaners and will not significantly reduce the amount of particulate in the air during a smoke event. Neither will they remove gases like carbon monoxide. However, humidifiers and dehumidifiers (depending on the environment) may slightly reduce pollutants through condensation, absorption and other mechanisms. The greater benefit of running a humidifier in an arid environment during a smoke event would be to reduce stress on the respiratory system, by keeping the mucus membranes moist.

Ozone Generators

Some devices, known as ozone generators, personal ozone devices, “energized oxygen” generators, and “pure air” generators, are sold as air cleaners. However, they are not recommended.

3.5.2 Sheltering in Vehicles

Sheltering in vehicles can provide limited protection during a smoke event. For best results, keep windows closed and recirculate the inside air.

3.5.3 Reducing Activity Levels

Minimizing outdoor physical activity reduces exposure to harmful air pollutants. Because particulate matter is inhaled more deeply into the lungs during exercise, minimizing such exposure is important to decreasing the risk of harmful respiratory effects.

3.5.4 Reducing Other Sources of Air Pollution

Many indoor sources of air pollution can emit large amounts of the same pollutants present in wildfire smoke. These include cigarette smoke, gas, propane, and wood-burning stoves and furnaces. Activities such as cooking, burning candles and incense, and vacuuming can greatly increase the particulate levels in a building.

Reducing indoor air emissions during smoke events may reduce indoor particulate levels. These reductions can help compensate for the increased loading from the outdoor air.

3.5.5 Using Masks and Respirators

To provide protection during a smoke event, respirators must be able to filter tiny particles (around 0.1 to 0.3 microns) and must fit properly, providing an airtight seal around the wearer’s face. N95 or P100 filtration is recommended.

Certain masks designed to filter out larger particles offer little protection (e.g., paper dust masks). The same is true for bandanas (wet or dry), tissues held over the mouth and nose, and surgical masks, which are designed to filter air coming out of the wearer’s mouth and do not provide a tight seal.

Workers and the respirators they use must be fit tested. It is difficult to get a good seal on individuals with beards. In order for a respirator to be effective the wearer must be clean shaven where the mask seals to the face. For outdoor workers, or workers who cannot avoid exposure, respirators (as long as they fit properly) offer protection.

In Canada, CSA Z94.4 establishes the requirements for the selection, use and care of respirators. Some Canadian jurisdictions have adopted the updated standard CSA Z94.4-11. Please refer to the regulatory requirements in your area. A good source of information on respirators is the Centers for Disease Control (CDC) Respirator Fact Sheet available at www.cdc.gov/niosh/docs/2003-144/.

3.5.6 Off-site Clean Air Sanctuaries

During severe smoke events, clean-air sanctuaries or shelters can provide a place for workers to get out of the smoke. These can be located in large commercial buildings, educational facilities, hospitals, shopping malls or any place with effective air conditioning and particle filtration.

3.5.7 Operational Shutdowns

Curtailing outside activities can reduce exposure to smoke by encouraging people to stay inside and reducing physical activity. Restrictions on industrial emissions may also be warranted depending upon the local air pollution situation and the emission characteristics of particular industries.

Partially shutting down selected operations rather than a complete shutdown can minimize the economic impact of a smoke event, while making it considerably easier to conduct an evacuation and complete shutdown if required. Operations that take a long time to shutdown, or are particularly vulnerable should be among the first candidates for shutdown.

3.5.8 Evacuation

Evacuations of at-risk and non-essential personnel should be considered when smoke levels become unhealthy.

In a smoke event reduced operations can usually be maintained with a smaller workforce operating with strict safety precautions.

4 Emergency Preparedness for Wildfire

The purpose of this section is to be able to support the development of emergency response protocols in order to reduce the impacts to workers and operations from emergency wildfires. Operations may be able to develop a degree of resilience to some of the risks from wildfire emergencies through the planning process. There are a range of scenarios that should be considered.

Field workers need to be equipped with tools and information to help them identify and monitor the risk posed by an approaching wildfire so that they can respond appropriately and effectively.

This section includes the following:

- a description of the various tools available to help you understand a wildfire situation ([Section 4.1](#))
- a description of the various operational issues that will affect the preparedness of an operation/facility ([Section 4.2](#))
- some of the potential hazards that may be present after a wildfire ([Section 4.5](#))

One of the greatest risks to oil and gas facilities from an advancing fire front will come from airborne embers that can travel long distances on wind currents. The accumulation of embers near vent openings or under eaves, stairs and other areas may cause a fire that will impact an oil and gas structure.

It is recommended prior to the development of emergency planning and response, a company should work through a wildfire risk assessment for their operation to determine the likelihood of being impacted by wildfires. This will help in development of emergency response plans relevant for wildfire and the operations. Where companies wish to reduce the risk to their operations, the FireSmart Guidebook® for the Upstream Oil and Gas Industry provides guidance for undertaking a wildfire risk assessment and recommendations for reducing potential impacts.

4.1 Understanding a Wildfire Situation

Understanding the local fire environment, daily weather conditions, current fire situation and preparing facilities and workers for wildfire emergencies can greatly reduce the potential impacts from wildfire.

This section covers the type of information available for emergency decision making prior to and during emergency wildfires.

4.1.1 Fire Danger Ratings

The Fire Danger Rating system provides a simple and effective tool for assessing the burning conditions in your area.

Provincial authorities issue regional fire danger ratings after considering current weather and fuel conditions. Ratings are accessible on the Internet, on the wildfire information page of your local authority.

The danger ratings are assessed at four different levels:

- **Low:** Fires may start easily and spread quickly, but there will be minimal involvement of deeper fuel layers or larger fuels.
- **Moderate:** Forest fuels are drying and there is an increased risk of surface fires starting. Carry out any forest activities with caution.
- **High:** Forest fuels are very dry and the fire risk is serious. New fires may start easily, burn vigorously, and challenge fire suppression efforts. Extreme caution must be used in any forest activities. Open burning and industrial activities may be restricted.
- **Extreme:** Extremely dry forest fuels and the fire risk is very serious. New fires will start easily, spread rapidly, and challenge fire suppression efforts. General forest activities may be restricted, including open burning, industrial activities and campfires.

The readiness level at a facility should be influenced by the daily fire danger rating, wildfire situation or other wildfire information.

Always be mindful of the risk level in your area, and prepare accordingly. During extreme conditions wildfires can travel dozens of kilometers in a single day. Understanding the likelihood and probable locations of where the threat may originate is crucial to applying the correct mitigation measures.

4.1.2 Using Current Wildfire Situation Updates and Information

Early detection of wildfires and ongoing monitoring of wildfires can significantly reduce risks to individuals and operations.

There are a number of resources available to monitor wildfires. These include local news channels, radio stations and websites, government sources including federal, provincial and local, communications with internal sources, or other sites in the area, alerts and government advisories, and social media sources.

Local Industry Liaison personnel, Information Officers or other government officials can provide your company with real time wildfire information including

- the number of wildfires in your area,
- the size and predicted spread of wildfires near your operation,
- the likelihood that you will be impacted by wildfire or smoke and estimate length of time you may be impacted and
- the imminent wildfire threat to personnel or operations.

In some jurisdictions these roles are established during the wildfire season with the purpose of providing stakeholders with a one window point of obtaining real time updates on wildfires. Some wildfire agencies also distribute local information to stakeholders with wildfire status and updates specifically designed for their use. Establishing these contacts prior to a wildfire emergency is recommended.

Information critical to the safety of workers and risk to the operations should be shared with supervisors and managers as well as contractors working in the area.

4.1.3 Additional Sources of Wildfire Information

Utilize relevant provincial or federal emergency response information sources. Some sources of information are listed in Appendix B.

4.1.4 Establishing Communication Systems

It is important that operators make informed decisions during a current wildfire event. Conditions can change rapidly and unexpectedly, so established communication systems are important.

During a current wildfire situation, employees require clear lines of communication from their employer through their supervisor.

In a wildfire situation rely on information from your supervisor and direction from government officials and emergency response teams. Listen to the radio, check the Internet, call people you know in the area, and talk to supervisors to make sure you are aware of the latest official information and instructions.

It is recommended that company contact personnel are identified and the flow of communications during emergencies is clearly established prior to an incident to ensure information is passed seamlessly through all areas of the company.

4.2 Preparedness During a Wildfire Event

The ability of operators to respond during a wildfire event will significantly affect the assessment of risk from the fire. Many of these factors are under control of the operator.

Key considerations include the following:

- the establishment of trigger points ([Section 4.2.1](#))
- the availability of secure routes for evacuation ([Section 4.2.2](#))
- the capacity to transport all personnel ([Section 4.2.3](#))
- the availability of shelter in place plans and locations ([Section 4.2.4](#))
- collaborative relationships and partnerships ([Section 4.2.5](#))
- the capacity to respond co-operatively and effectively with neighbouring facilities, residents and emergency response teams
- the capacity to operate facilities safely and effectively in an emergency
- the presence of an evacuation plan and established emergency procedures
- the presence of known check in points and procedures
- the availability of trained first responders
- the availability of adequate protection equipment
- water availability
- recovery considerations following a wildfire or wildfire smoke event

4.2.1 Establishment of Trigger Points

Emergency response planning should include consideration of trigger points to help an operation decide when to change or modify their operations. A trigger point is defined as a point of reference from which predetermined actions take place.

It is important to consider factors specific to the operational environment when developing trigger points for wildfire response planning. These may include time to evacuate, distance of the operation from the fire or smoke, or physical features such as a river or road.

Wildfire evacuations could involve a few different scenarios and it is important to understand how your trigger points will relate to various threats.

Tactical evacuation: May occur when the emergency wildfire situation has escalated with little notice where authorities recommend an immediate evacuation due to an emerging wildfire threat.

Strategic evacuation: May occur when a wildfire threat is not imminent however is likely to impact the operation. Projected time of impact of a probable threat will be provided by provincial or municipal authorities. This may also occur when smoke from wildfire is affecting air quality of the operation where a full or limited evacuation is recommended.

Specialized resources and expertise should be utilised where internal expertise is limited. Operational personnel should be involved in developing these triggers,

and emergency response plans and associated trigger points should be communicated to workers.

4.2.2 Evacuation Planning

Emergency wildfires may cover large geographical areas. When planning for evacuation it is essential to understand which direction a wildfire threat may come from, considerations for size of potential wildfires and the rate at which wildfires may travel.

A wildfire situation may limit the usability of emergency evacuation routes. For example, the road out of an area may be blocked by fire, smoke or a vehicle. Smoke may prevent helicopters from landing, slow traffic down or the increased volume of traffic on a critical road may lead to congestion. Alternative evacuation routes should be considered.

Evacuation planning should be integrated with other operators working in the same area to ensure that emergency response measures are well coordinated. This will reduce the chance of incidents occurring as a result of the evacuation process and traffic congestion.

The following are some key considerations for access roads and evacuation routes:

- If there is potential for the main access to be cut off by a wildfire, alternative emergency evacuation routes (two-way access) should be identified and developed including potential helicopter landing pads for remote sites.
- Identify adjacent waterways that can be accessed by boat if applicable.
- Provide Wildfire and other Emergency Service personnel with the ability to open locked gates.
- The road should provide two-way access with a travel surface of not less than 6.1 metres wide.
- A roadway curvature radius should be at least 30 metres, measured from the centerline. This is a Fire Department standard.
- Road gradient should not exceed 10 per cent.
- Dead-end roadways that are more than 90 metres in length should be constructed with a turnaround at the terminus having no less than 18 metres turning radius or a hammerhead “T” alternate turnaround.
- All gates should be located at least 9 metres off the main roads and should not open outward. Gate openings should provide a clear opening of not less than 0.6 metres wider than the travelled way.
- Bridges should be designed and built with an all-weather surface capable of supporting heavy pieces of equipment travelling across the bridge. Weight limits should be clearly posted at the approaches to each bridge.
- Notice to Airmen (NOTAM) will be established around active wildfires and could affect aviation operations.

4.2.3 Transportation of Personnel

Ensure the capacity to transport all personnel is available. This capacity must take into account congestion during an emergency, and restricted access caused by the wildfire event.

It is important to identify workers who are at risk from wildfires and prioritize their evacuation. Those who are particularly vulnerable include:

- personnel in remote or difficult to access locations,
- personnel who are out of cellular phone range or difficult to contact,
- personnel at risk of losing their evacuation route,
- personnel with pre-existing medical conditions and
- personnel without access to first responders.

Procedures should be in place to account for other personnel including customers, visitors and contractors, to ensure their safety.

Ensure employees are trained and familiar with the emergency response plan, and prepare an emergency transportation plan for use during evacuations.

4.2.4 Shelter in Place and Mustering

Shelter in place and mustering procedures should be established as part of emergency response planning. This information should be included in documented emergency response plans, and communicated to workers. Considerations for planning have been included in Appendix A.

Recent research and formulae for building safety zones for fire fighters can also be used as a helpful guide to estimate the size of safety zones required to accommodate all personnel.

4.2.5 Collaborative Relationships and Partnerships

It is important to establish strong information sharing relationships with operators in the area and residents.

4.2.6 Hazards During Recovery of Operations

Hazards may arise following a wildfire event that should be considered during recovery process. Some of these may include

- deep burning ground fires,
- potential of flare ups,
- snag trees or trees and branches that have been “hung up”,
- hot ash pits,
- air borne dust and ash,
- reduced visibility and air quality in windy conditions,
- damage to infrastructure or systems and
- falling trees due to root-burnout.

Workers should be made aware of potential hazards following a wildfire event, and possible mitigation controls including inspections prior to resuming operations.

5 Conclusion

Working in a forested or grassland environment comes with some inherent risk including that from wildfire. There are some unique hazards associated with wildfires that should be considered when operators are developing emergency response plans. These hazards may present prior to, during or after a wildfire event.

Organizational emergency planning should identify the unique hazards associated with wildfires and smoke. An effective emergency response plan should minimize the hazardous impact and assist in developing operational resilience during wildfires.

Appendix A Wildfire Preparedness Considerations

A.1 Wildfire Precautions

The following list of precautions can be used to assist the facility operator to prepare for a wildfire. This is not a complete list and the reader is encouraged to use the FireSmart® Guide.

- Determine the minimum number of personnel required to operate during a wildfire event, and plan accordingly.
- Have emergency contact information readily available and prominently displayed.
- Ensure that emergency contact information is shared with provincial emergency management agencies.
- Make sure all emergency equipment is maintained and spare batteries are available.
- Ensure there are multiple lines of communication to emergency information such as land lines, cell phones, two-way radios and radio receivers. Make sure they have spare batteries and are charged.
- Keep a sufficient supply of emergency safety equipment such as respirators. See 3.5.5 for more information on respirators.
- Keep an adequate number of appropriate fire extinguishers in strategic locations (such as near loading docks and waste collection areas) and maintain them properly.
- Maintain a water supply and equipment to control small fires in accordance to company policy and applicable regulations.
- If your water pump uses electrical power, consider a gasoline or diesel powered pump or generator in case electricity is cut off during a fire. Be aware of the risks of storing a large quantity of fuel. Use an appropriate storage facility that is protected against vehicle impacts and fire. See section A.2 below for more.
- Have appropriate tools, such as rakes, axes, saws, ladders, buckets and shovels, available to help control small fires while waiting for emergency personnel to arrive.
- Identify, mark and communicate the location of safe areas to personnel. See section A.2 for more information.
- Identify and monitor the condition and availability of roads and evacuation routes. See section 4.2.2 for more information.
- Consider providing basic wildfire suppression training to those who will be key in suppressing wildfires in your operation.
- Consider the use of wildfire suppression sprinkler systems (portable or permanent) for structural protection in conjunction with the local fire department or local emergency response agency. Prior to activating remote wildfire suppression sprinklers, ensure workers initiate the system from a safe location.
- Determine the minimum number of personnel required to operate and respond during a wildfire event, particularly during peak vacation periods e.g., statutory holidays, July and August.

Note: All plans to protect the health and safety of personnel should take into account sudden changes that may occur in emergency situations, such as low

visibility from smoke or the unexpected loss of an evacuation route, loss of communications, critical infrastructure and power outages.

A.2 Identification and Preparedness of Temporary Safe Areas

The following are some key considerations for temporary safe areas:

- Identify individuals that have smoke intolerances and ensure early priority evacuation arrangements.
- If using a temporary safety area(s), ensure adequate space is determined for number of personnel. If unsure, a wildfire behavior expert should be consulted when determining location and size of safe areas.
- Alternative safety area(s) should be identified to account for smoke drift that would compromise the primary area.
- The temporary safe areas should be gravel, mineral soil or frequently mowed grass (post green up).
- If practical the site should have a water source.
- Identify site marshals or managers who would be responsible for managing the safe area.
- Where at all possible, safe areas should be on flat ground and away from slopes.
- Ideally the site should have alternate access routes and/or have a helicopter landing area. If helispots are designated, ensure that the locations are clearly marked and appropriately marshalled so that the helicopter is able to land safely.
- Helipad or helispot locations should be provided to emergency management authorities and local rotary wing companies in advance.
- The site should have a GPS location that is documented in the Emergency Response Plan and the location information should be posted at the site.
- Sites should be clearly marked and areas where multiple access points exist, consider marking the direction of travel to get to the safe area as visibility may be reduced from smoke.
- The site should have adequate space for the personnel, vehicles and equipment that would normally be expected to utilize the safe area including helicopters.
- Provisions should be made for providing first aid and emergency medical services at these locations.
- Consider storing basic supplies such as potable water and other supplies at a safe area for use during an emergency.

Smoke is a serious threat during a wildfire. See Section 3.5 for more on identifying effective shelter areas for smoke events.

A.3 Initial Response to Wildfire

The response to wildfire will depend on the threat posed by the fire. Specific responses for a site are available in the site's emergency plans.

Once fire has been identified as a threat, preparations should commence including:

- Locate and contact all personnel including visitors and others.
- Restrict further access to the site.
- Ensure adequate supplies of food and water available.
- Review and improve the condition of sites (e.g., reduce flammable material).
- Check safety equipment.
- Check and test communications.
- Contact and inform officials and company officials.
- Establish and maintain clear lines of communication with the organization in charge of emergency operations.
- Review the emergency documentation.
- Check and record transportation resources.
- Enact emergency transportation plan.
- Communicate to all personnel the relevant emergency plans, safety sites, safety equipment locations and communication systems.

If the fire threat is severe or immediate, consider a partial shutdown or full shutdown and a complete evacuation. The emergency plan for a site should contain explicit and clear conditions for when these measures are necessary. When they are unavailable, and communications are down, field personnel must assess the risks using the indicators provided in Section 4.1. In this unlikely case, field personnel should err on the side of caution.

Partial shutdowns can be useful to reduce the risks involved with a complete evacuation while minimizing the economic impact of an evacuation. The process of evacuation can entail serious risks, particularly if poor visibility makes driving hazardous. In these situations, the risks posed by driving with reduced visibility need to be weighed against the potential benefits of evacuation.

When issuing an evacuation order, pay close attention to the destination. It must be considerably safer than the site. Pay particular attention to the potential for smoke to affect the evacuation centre (see Section 3 for more).

Appendix B Resources

The following resources are helpful:

B.1 Oil & Gas Industry

- CAPP Best Management Practices – Wildfire Prevention (www.capp.ca/getdoc.aspx?DocId=132380&DT=NTV)
- **FireSmart® Guidebook for the Oil and Gas Industry** (www.firesmartcanada.ca/resources-library/firesmart-guidebook-for-the-oil-and-gas-industry)

B.2 Alberta

- **Alberta Environment and Sustainable Resources Development (ESRD):** Provides wild fire information and provides links to sites that monitor the current forest fire situation and conditions in Alberta (wildfire.alberta.ca/)
- **Alberta Environment and Sustainable Resources Development (ESRD) Wildfire Info Facebook Page:** Provides wildfire information in an accessible format (www.facebook.com/AlbertaWildfireInfo).
- **Alberta Fire Bans:** Provides a single portal for information on all fire bans, fire restrictions and forest areas closures in Alberta (albertafirebans.ca).
- **Alberta Wildfire System and FireWeb** (wildfire.alberta.ca/fire-smart-industry/alberta-wildfire-system-fire-web.aspx)
FireWeb can be used to spatially view a variety of data including current wildfire information, historical fire data and the Wildfire Threat Assessment Model which assists users in better understanding, evaluating assessing wildfire threat around their values.
- **Alberta Forest Management Regulations Part I** (www.qp.alberta.ca/570.cfm?frm_isbn=9780779729159&search_by=link)
- **Alberta Forest and Prairie Protection Act** (www.qp.alberta.ca/574.cfm?page=F19.cfm&leg_type=Acts&isbncln=9780779726554&display=html)
- **Alberta Forest Protection Regulations Part II** (www.qp.alberta.ca/574.cfm?page=1972_310.cfm&leg_type=Regs&isbncln=9780779728282&display=html)

- **Alberta Wildfire app**
Through the use of links and GPS (Global Positioning System) the app is able to give people the most up to date and detailed information on wildfires in Alberta (itunes.apple.com/ca/app/alberta-wildfire/id626977403?mt=8 for Android
play.google.com/store/apps/details?id=ca.ab.gov.ABWildfire&hl=en).
- **Government of Alberta – Alberta Sustainable Resource Development**
(esrd.alberta.ca/)

B.3 British Columbia

- **British Columbia – Ministry of Forests and Range**
(bcwildfire.ca/)
- **Emergency Management BC**
(embc.gov.bc.ca/em/hazard_preparedness/Wildfire_Information.html):
Provides wild fire information and provides links to sites that monitor the current forest fire situation and conditions in British Columbia.

B.4 Northwest Territories

- **nwtfire.com**
(www.nwtfire.com/cms/)

B.5 Saskatchewan

- **Government of Saskatchewan – Environment – Wildfire Management**
(www.environment.gov.sk.ca/fire)

B.6 Additional Resources

- **Active Fire Mapping Program**
The Active Fire Mapping Program is an operational, satellite-based fire detection and monitoring program managed by the USDA Forest Service Remote Sensing Applications Center (RSAC) located in Salt Lake City, Utah. The Active Fire Mapping program provides near real-time detection and characterization of wildfire conditions in a geospatial context for the continental United States, Alaska, Hawaii and Canada. Detectable fire activity across all administrative ownerships in the United States and Canada are mapped and characterized by the program
(activefiremaps.fs.fed.us/?extent=canada).
- **Fire Danger Class**
(wildfire.alberta.ca/fire-danger-forecasts/default.aspx)

- **MODIS**
(modis.gsfc.nasa.gov/) In remote areas MODIS can be a useful tool for monitoring large wildfires.
- **Prometheus Wildfire Growth Model**
(firegrowthmodel.ca/) Prometheus can be used to determine potential risk to an operation through wildfire simulations.
- **Smoke Exposure from Wildland Fires: Interim Guidelines for Protecting Community Health and Wellbeing**
(www.gov.mb.ca/health/publichealth/wildlandfiresmokeexposure.pdf)
- **The Canadian Interagency Forest Fire Centre (CIFFC)**
(www.cifffc.ca): Provides operational wildland fire-control services, as well as management and information services to member agencies. In addition to coordinating services for all of the provinces, territories and the federal fire management agencies, CIFFC often coordinates the sharing of resources with the United States and other countries.
Its **FireWire** online fire-data service is free and constantly updated
(www.cifffc.ca/index.php?option=com_content&task=view&id=25&Itemid=27).
- **The Canadian Wildland Fire Information System (CWFIS)**
The Government of Canada website is a computer-based tool that monitors fire danger conditions across Canada. It creates daily fire weather and fire behaviour maps year-round and hot-spot maps throughout the forest fire season, generally between May and September. It also uses satellites to detect fires (cwfis.cfs.nrcan.gc.ca/home).
- **Understanding fire weather**
(wildfire.alberta.ca/fire-weather/understanding-fire-weather.aspx)
- **Wildland firefighter safety zones: a review of past science and summary of future needs)**
(www.fs.fed.us/rm/pubs_other/rmrs_2014_butler_b001.pdf)
- **CAPP Guide: Emergency Response Planning: Shelter-In-Place Instructions**
(www.capp.ca/getdoc.aspx?DocId=103587&DT=NTV)
- **Canadian Smoke Newsletter 2014 ed. Wildfire Smoke from Start to Finish**
(www.iawfonline.org/CSN_2014.pdf)

- **Incident Command System (ICS)**
ICS Canada (www.icscanada.ca/)
Training in Alberta
(extranet.gov.ab.ca/srd/HTC/Programs/CategoryGroupOutline.aspx?groupId=30)