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Wildfire Field Guide for the Oil and Gas Industry

A field guide for frontline operators to help prevent wildfires and reduce the impact on personnel safety, the environment, industry infrastructure, operations, and liability.

National Safety Association
for Canada's Energy Industry

Edition: #1
Release Date: November, 2012
Revised: November, 2024

Disclaimer

This document is intended to be flexible in application and provide guidance to users rather than act as a prescriptive solution. Recognizing that one solution is not appropriate for all users and situations, it presents generally accepted guidelines that apply to industry situations, as well as recommended practices that may suit a company's particular needs. While we believe that the information contained herein is reliable under the conditions and subject to the limitations set out, Energy Safety Canada does not guarantee its accuracy. The use of this document or any information contained will be at the user's sole risk, regardless of any fault or negligence of Energy Safety Canada and the participating industry associations.

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Safety Doesn't Clock In And It Doesn't Punch Out It's 24/7

ENERGY SAFETY CANADA

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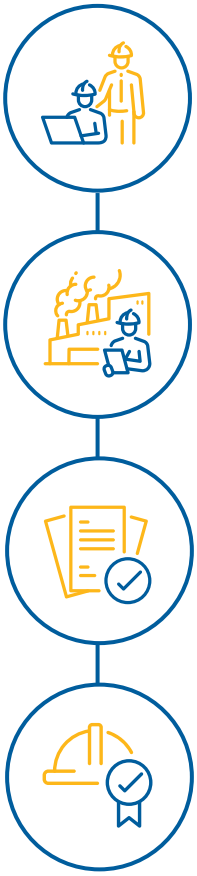

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Preface

Purpose

The Wildfire Field Guide for Oil and Gas Industry is a site-orientated wildfire risk assessment tool.

The goal is to address a company's wildfire protection needs through a proactive FireSmart™ process.

Key objectives include:

- Increased safety for personnel
- Increased environmental stewardship and overall corporate responsibility
- Reduced risk to industry infrastructure from wildfires
- Reduced production disruptions
- Reduced liability from wildfires.

Who

This Field Guide has been customized to provide a generic application for field operators throughout Alberta, British Columbia, Saskatchewan and the Northwest Territories. Based on the generic application, legislative requirements should be referenced and incorporated within the specified planning area.

How to Use this Guideline

This Field Guide includes various wildfire risk factors that, when assessed, can help the user determine the appropriate mitigation strategies required to help prevent wildfires and reduce the impact of catastrophic wildfires on safety, environment, infrastructure, operations and liability.

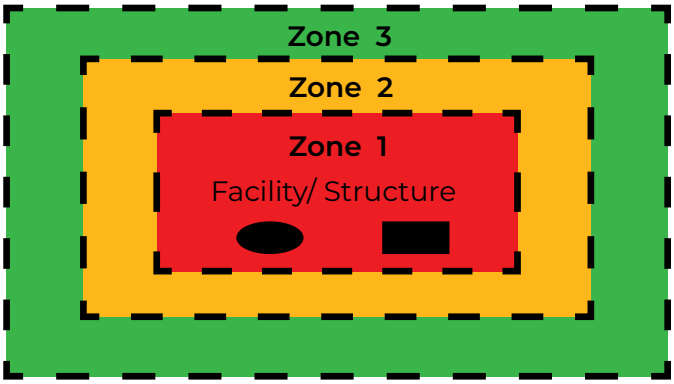
The wildfire risk factors within each wildfire risk assessment table are used to calculate a low, moderate or high rating.

Table Of Contents

1.0 WILDFIRE RISK ASSESSMENT PROCESS

A wildfire can ignite on an oil and gas disposition and quickly spread to adjacent land resource values (liability), or it can ignite on adjacent lands and rapidly spread onto an oil and gas disposition, affecting personnel safety and operations (threat). This Field Guide identifies a spatial scale to effectively assess these two types of wildfire risks (see Figure 1).

Figure 1: FireSmart™ industrial zones, 1, 2 and 3. Defensible space distances may vary depending on fuel types, fire intensity and topography.



FireSmart™ Industrial Zone 1 (priority 1) focuses on a 0– to 10-metre radius around each structure on an individual oil and gas disposition. Key assessment components critical to wildfire mitigation are:

- Structures and ignition potential (materials, ember transport, radiant heat)
- Flammable material storage units (i.e. hydrocarbon storage tanks)
- On-site vegetation

FireSmart™ Industrial Zone 2 (priority 2) focuses on a 10- to 30-metre radius around structure(s) on an individual oil and gas disposition. Key assessment components critical to wildfire mitigation are:

- Structures and ignition potential (location in relation to forest vegetation)
- Slope

FireSmart™ Industrial Zone 3 (priority 3) focuses on the landscape 30+ metres surrounding multiple oil and gas dispositions and land use activities. Key assessment components critical to wildfire mitigation are:

- Flaring
- Vegetation flammability
- Wildfire preparedness (personnel safety and wildfire evacuation)
- Equipment operations
- Debris disposal
- ATV / OHV operations

Use the following wildfire risk assessment tables to determine the risk ratings within FireSmart™ Industrial Zones 1, 2 and / or 3.

The **Wildfire Risk Assessment Worksheet** can be used as a summary form in the field for completion, submission, or incorporation into

FireSmart™ plans. Review wildfire mitigation tips for each section and implement strategies to help reduce wildfire risk and liability.

Larger sites may require more than one assessment (or FireSmart™ prescriptions) to address complex issues or if the area has a high degree of variance. Completion of the assessment should be done in the planning and design phase of all new facility construction but may also need to be completed or reviewed for existing facilities as well.

It is recommended that sites conduct a full wildfire risk assessment every 5 years and that the assessment is reviewed at least annually.

2.0 Structures and Ignition Potential

Use the following table to assess the structural flammability (rooftops, building exterior, eaves, etc.) within **FireSmart™ Industrial Zone 1 (0 - 10 metres)**. Circle the points below for each row of risk factors #1 - 5 and combine the score at the bottom to determine a low, moderate or high rating for the structural assessment.

Table A: Structural Assessment			
1. Roofing Material	Metal, tile, asphalt or non-combustible material 0		Wood 20
2. Building Exterior	Non-combustible concrete or metal siding 0		Wood or vinyl siding 10
3. Eves, vents and openings	No eaves, vents are screened and opening is turned down 0		Open eaves, unscreened vents can trap embers 5
4. Loading docks / decks based enclosed	None or fire-resistant material sheathed in 0	Combustible material sheathed in 2	Combustible material not sheathed in 5
5. Location of petroleum products and combustibles	None or > 10 metres from structures 0	3 – 10 metres from structure 5	< 3 metres from structure 10
Combined Points 1 – 5	**Low: 0 – 2**	**Moderate: 3 – 20**	**High: 21+**

Use the following table to assess the flammable storage materials typically within **FireSmart™ Industrial Zone 1 (0 - 10 metres**). Circle the points below for each row of risk factors #1 - 4 and combine the score at the bottom to determine a low, moderate or high risk rating for the flammable storage material assessment.

Table B: Flammable Storage Material Assessment			
1. Hydrocarbon Storage onsite	Absent 0		Present 10
2. Tank tops	Top cone shaped, vents turned down, will not trap embers at vents and openings 0		Flat top, vents open, can trap embers at vents and openings 20
3. Distance from forest vegetation	Structure within 20 to 30 metres of the forest 0	Structure within 10 to 20 metres of forest 10	Structure within 10 metres of forest 20
4. Propane tanks	Vegetation within 10 to 20 metres of tank 0	Vegetation within 3 to 10 metres of tank 10	Vegetation within 3 metres of tank 20
Combined Points: 1 – 4	**Low: 0 – 10**	**Moderate: 11 – 19**	**High: 20+**

Use the following table to assess on-site vegetation. (Note: Grass / Shrubs and trees inside fence line) within **FireSmart™ Industrial Zone 1 (0 - 10 metres) and FireSmart™ Industrial Zone 2 (10 - 30 metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the on-site vegetation assessment.

Table C: On-Site Vegetation On The Disposition			
1. Site Vegetation	None or > 10 metres from structures 0	3 to 10 metres from structure 5	< 3 metres from structure 10
Total Points	**Low: 0**	**Moderate: 5**	**High: 10**

Use the following table to assess the location of structures in relation to forest vegetation within **FireSmart™ Industrial Zone 1 (0 - 10 metre)** and **FireSmart™ Industrial Zone 2 (10 - 30 metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the location of structures on the disposition assessment.

Table D: Location Of Structures On Disposition Assessment			
1. Distance from Forest Vegetation	Structure within 20 to 30 metres of forest 0	Structure within 10 to 20 metres of forest 10	Structure within 10 metres of forest 20
Total Points	**Low: 0**	**Moderate: 10**	**High: 20**

Use the following table to assess the location of structures in relation to forest vegetation within **FireSmart™ Industrial Zone 1 (0 - 10 metre radius) and FireSmart™ Industrial Zone 2 (10 - 30 metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the slope assessment.

Table E: Slope Assessment			
1. Slope Impact	Structures greater than 100 metres from crest of slope 0	Structures less that 100 metres from crest of slope 5	
2. Position of disposition and structures on the slope	Base of slope (areas of development on flat ground or valley bottoms, extending as high as one-third of the way up the slope) 0	Mid-slope (areas of development on slopes with forested areas or grasslands below, extending as high as midway up the slope) 5	Upper slope (areas of development located on the top half or crest of slopes with forested areas or grasslands below them) 10
Total Points	**Low: 0**	**Moderate: 10**	**High: 15**

2.1 Wildfire Mitigation for Airborne Wildfire Embers

The most likely wildfire threat to Oil and Gas facilities or structures 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 could impact facilities.

- Reduce the potential for a structure ignition from airborne embers by equipping all flammable structures with roof sprinkler systems.
- Keep disposition area free of spilled flammable petroleum products or accumulations of combustible products.
- Ensure tank tops are cone shaped and designed so embers will not land around tank openings or vents. Use of floating top storage tanks should be minimized.

- Remove vegetation around tanks.
- To prevent the entry of airborne embers, screen all eaves and vents with corrosion resistant non-combustible 3 millimetres wire mesh and turn the vent openings downward.
- Construct all new structures on the disposition with metal roofs and siding. The base of the structure must be closed in with metal, concrete or earth fill to prevent embers from getting under the structure.
- Avoid use of combustible materials such as wood, particularly in the case of stairs or walkways which are in close proximity or touching structures

2.2 Wildfire Mitigation for Radiant Heat

Structures adjacent to forest vegetation can be subjected to very high temperatures during a wildfire. The wildfire can damage or ignite structures adjacent to wildland fuels and fire can subsequently spread from structure to structure.

- Ensure there is a **minimum** of 20 metres between the structures with metal cladding and the flammable forest vegetation with a tree height greater than 20 metres. If structures have construction material comprised of combustible material, ensure there is a **minimum** of 30 metres between forest and structures.
- In grass vegetation, ensure a **minimum** mowed zone of 20 metres between structures and grass vegetation. If structures are constructed with combustible material, ensure there is a **minimum** of 30 metres. Alternatively, convert zones (depending on construction material) to bare mineral soil.
- Ensure propane tanks have a **minimum** of 3 metres of vegetation free space around the tank (or if grass vegetation, a 3-metre mowed zone).
- Structures should be located at the bottom of the slope or on the top of the slope with a **minimum** of a 100-metre set-back from the edge of the upper slope to reduce the radiant heat associated with a fire spreading upslope.
- Consult with wildfire behaviour specialists when recommending safe distances for occupied facilities including camps.

3.0 Flaring

Use the following table to assess wildfire ignition potential from flaring typically within **FireSmart™ Industrial Zone 3 (30-metre radius around each flaring facility)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the flaring assessment.

Table F: Flaring Assessment

1. Flare stack / flare pit / flare tank	Area around flare stack is free of tress and woody debris for 30 metres. Remove and clear to bare mineral soil. Yes = 0 or No = 10	Cleared, bare mineral soil surface extends at least 8 metres around flare pit / flare tank. Yes = 0 or No = 10	**Total points** **Low: 0** **Moderate: 10** **High: 20**

3.1 Wildfire Mitigation For Flaring

- Maintain a clear bare mineral soil surface extending at least 8 metres around the flare pit or flare tank.
- An area around the flare stack is free of all combustible debris (trees, shrubs, dead and down debris) and cleared down to bare mineral soil surface within 30 metres.
- The flare pit is constructed to restrict flare materials from discharging beyond the pit and the discharge tip of the flare line is directed into the flare pit at an angle of not less than thirty (30°) degrees below horizontal.
- Operators should perform regular maintenance of flare stacks and pipes to reduce buildup of carbon.
- Inspect and maintain the ignition devices to ensure operation is within appropriate parameters.
- Perform regular maintenance of any associated fluid tanks at the base of flare stacks to prevent burping.
- Inspect flare devices on a regular basis to ensure vegetation control and the devices are being maintained.
- Use flare ignition devices (i.e. flare gun or flare pen) only in the event of an emergency.
- Advise the local fire authority at least one hour prior to ignition of the flare for those operations with intermittent flaring for testing or maintenance procedures. This is to prevent costly and unnecessary fire agency dispatches.
- Advise the local Fire Authority as soon as is practical given the situation for those operations where unexpected or emergency flaring is necessary.
- Prior to routine flaring, obtain fire weather and danger rating information to ensure the fire danger rating and ignition potential is not high or extreme (Appendix 3).
- Do not conduct flaring during periods of high or extreme fire hazard during the spring and fall when there is an abundance of cured grass.

- If flaring is necessary, complete flaring operations during the evening or early morning when the vegetation ignition risk is at the lowest due to higher relative humidity and lower temperatures.

4.0 Powerlines

If the disposition holder is the owner of the powerline, use the following table to assess wildfire ignition potential from powerlines within **FireSmart™ Industrial Zone 3 (30+ metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the powerline assessment.

If the disposition holder is not the owner of the powerline, follow up by contacting the local utility company to address risk of ignition (based on assessment) and potential operational impacts.

Table G: Powerline Assessment

1. Powerlines	If owner, has a powerline hazard assessment been completed?	Do you have a back up power supply in case power is cut off?	Is there adequate distance between the powerline and the adjacent trees (a distance greater than the fall arch of the tree)?	Has there been adequate removal of all hazard trees?	Has the surface vegetation been maintained to avoid wicking?	Total points
	Yes = 0 or No = 5	Yes = 0 or No = 5	Yes = 0 or No = 5	Yes = 0 or No = 5	Yes = 0 or No = 5	Low: 0 Moderate: 10 High: 20

4.1 Wildfire Mitigation for Powerlines

- If the powerline is not owned by the disposition holder, **contact the local utility company to establish maintenance schedules and responsibilities** to address risks of ignition on powerline right of ways and potential operational or safety impacts.
- If the powerline is owned by the disposition holder, complete a powerline hazard assessment plan.
- One of the most important parts of a powerline assessment is what impact (short- or long-term) would it have on a disposition holder's operations if the power line was cut off by burnt poles and a broken line. Ensure

a backup power supply is in place in case a wildfire interrupts the main electrical supply

- When practical, the power line should be located between the pipeline and the access road; if this is not possible it should be located on the opposite side of the access road and / or pipeline in relation to prevailing winds. This reduces the likelihood of a tree striking the power line if it should blow down.
- Hazard trees are removed when new power line corridors are constructed and ongoing maintenance should be completed every five years at a minimum to identify and remove new hazard trees.
- Maintain surface vegetation along powerline right of ways.

5.0 Vegetation Flammability

Using the following table, assess the vegetation flammability component within **FireSmart™ Industrial Zone 3**. Refer to Appendix 2 for vegetation fuel type descriptions and photos. Circle the points below for risk factors #1 - 3 for each of the 4 quadrants and combine the score at the bottom to determine a low, moderate or high risk rating for the vegetation flammability assessment.

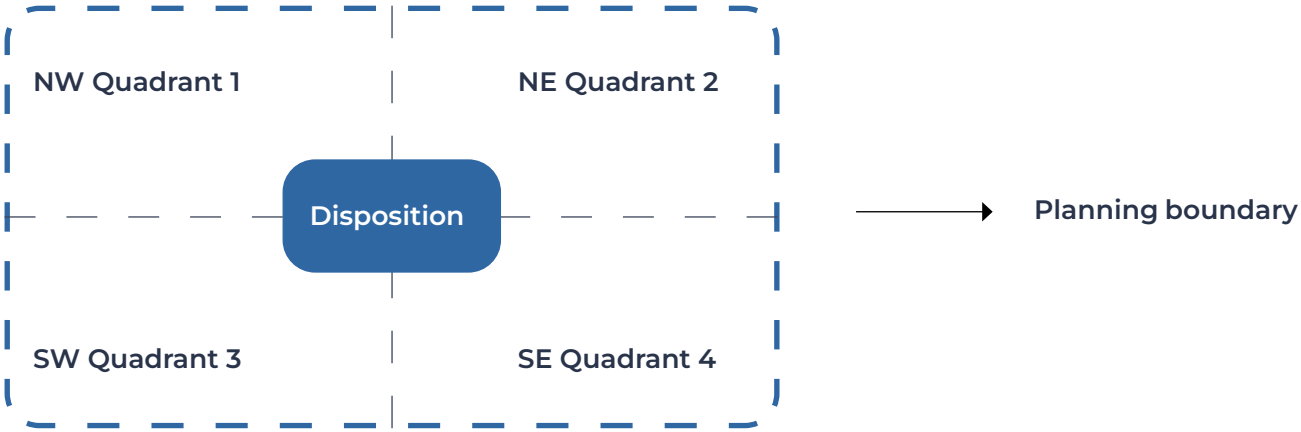
Note:

Break radius into 4 quadrants (Q1 – NW, Q2 – NE, Q3 – SW, Q4 – SE). Do this vegetation flammability assessment for each quadrant and total the quadrant values]. Q1 refers to a quadrant in terms of a 360-degree circle divided into 4 equal parts. Assign the predominant fuel type conditions that best describe the quadrant

Table H: Vegetation Flammability Assessment							
Fuel Types	Deciduous (leafed)		Mixed Wood (needle / leafed)			Coniferous (needled)	
	Young (0 – 70 years)	Old (70+ years)	< 30% Coniferous Composition	30 – 70% Coniferous Composition	> 70% Coniferous Composition	Trees well spaced / separated	Trees have no space / all touching
	3	10	5	10	15	10	20
Surface Vegetation	Grass (O1) or Shrubs		Adjacent logging debris from clearing			Forest Stand Dead and Down and Woody Material	
	Standing	Matted	Light	Moderate	Heavy	Scattered	Abundant
	5	10	5	10	25	10	20
Ladder Fuels	Absent 0		Scattered 5			Abundant 10	
Combined Points 1 – 3 (Quadrant 1)	**Low: 0 – 15**		**Moderate: 16 – 30**			**High: 31+**	
Combined Points 1 – 3 (Quadrant 2)	**Low: 0 – 15**		**Moderate: 16 – 30**			**High: 31+**	
Combined Points 1 – 3 (Quadrant 3)	**Low: 0 – 15**		**Moderate: 16 – 30**			**High: 31+**	
Combined Points 1 – 3 (Quadrant 4)	**Low: 0 – 15**		**Moderate: 16 – 30**			**High: 31+**	

Note:

Use the assessment table to get the value for each row and enter it into the respective quadrant then add up total in each quadrant and determine low, moderate or high-risk rating.



5.1 Wildfire Mitigation for Vegetation Flammability

Assessing vegetation flammability and additional wildfire behavior factors is a complex process. Field operations personnel should seek professional advice from a wildfire behavior specialist if there is a moderate or high rating and prior to implementing any vegetation / fuel modification.

- Any vegetation management treatment outside the approved disposition requires authorization and approvals.
- Maintain FireSmart™ Industrial Zone 1 and 2 as grass mowed down to 10 cm or less.
- If values at risk warrant (i.e. large number of personnel, facility type and contents, location, etc.) maintain FireSmart™ Industrial Zone 1 and 2 as a vegetation-free area where all woody debris are totally disposed of and the site is maintained as bare mineral soil or gravel;
- If values at risk don't warrant a vegetation-free area, then implement vegetation reduction.

6.0 Wildfire Preparedness

A company subject matter expert may be required to assist with this assessment. Otherwise obtaining a copy of the company's Emergency Response Plan or "Pre-Fire Plan" may be an alternative option to completing the assessment. Use the following table to assess personnel safety within **FireSmart™ Industrial Zone 1 - 3 (30+ metres)**. A site with personnel working a daily work shift of 4 hours or more is considered occupied. Circle the points below for risk factor #1 to determine a low, moderate or high-risk rating for the personnel safety assessment.

Table I: Personnel Safety Assessment						
1. On-site personnel	Number of personnel on the daily work shift: 0 – 5 0	Number of personnel on the daily work shift: 6 - 25 5	Number of personnel on the daily work shift: 26 – 50 10	Number of personnel on the daily work shift: 51 - 100 15	Number of personnel on the daily work shift: > 100 20	**Total Points** **Low: 0 – 5** **Moderate: 10 - 15** **High: 20**

Use the following table to assess wildfire evacuation routes / plans within **FireSmart™ Industrial Zone 1 (0 - 10 metre radius around each structure)** and **FireSmart™ Industrial Zone 2**. Circle the points below for risk factors #1 - 2 and combine the score at the bottom to determine a low, moderate or high risk rating for the evacuation routes and plans assessment.

Table J: Evacuation Routes and Plans Assessment				
1. Employee Safety	Evacuation route (road access) identified? One or more two-way routes / access = 0 No two-way routes / access = 10 Isolated access (remote site with no road access) = 15	Temporary Safety areas identified? Yes = 0 or No = 5	Helicopter landing area identified? Yes = 0 or No = 5	
2. Wildfire evacuation plans	Wildfire evacuation plans in place? Yes = 0 or No = 5	Employees briefed on Wildfire Evacuation plans? Yes = 0 or No = 5		
Total Points	**Low: 0 – 5**	**Moderate: 10 -15**	**High: 20 - 25**	

Use the following table to assess water supply within **FireSmart™ Industrial Zone 1 - 3 (0 - 10 metre radius around each structure)** and **FireSmart™ Industrial Zone 2**. Circle the points below for risk factors #1 - 2 and combine the score at the bottom to determine a low, moderate or high risk rating for the road access and water source assessment.

Table K: Road Access and Water Source Assessment

1. Infrastructure Access Roads	Access to facility; road surface width		Access to area through vegetation				Site ring road	
	>6.1 m	< 6.1 M	Deciduous (leafy)	Grass	Mixed wood (needled / leafed)	Coniferous (needled)	Yes	No
	0	5	1	5	5	5	0	5
2. Water Supply	Hydrant Service		Pits, tanks, natural source				Alternative water supply available	
	Yes		With pump and hoses		Not with pump and hoses		Yes	No
	0		0		5		10	20
Combined Points: 1 - 2	**Low: 0 – 10**		**Moderate: 11 - 20**				**High: 20+**	

6.1 Wildfire Mitigation for a Wildfire Emergency Event

If required you should consult a fire behavior specialist or subject matter expert to confirm your wildfire emergency preparedness is adequate.

Personnel Safety

- Determine the minimum number of personnel required to operate during a wildfire event
- Ensure evacuation alerts are issued during a wildfire event and wildfire emergency evacuation procedures are followed.

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 the expected number of personnel.

- Alternative safety area(s) should be identified to account for smoke drift or other factors that may compromise the primary area.
- The temporary safe areas should be gravel, mineral soil or frequently mowed grass.
- If practical the site should have a water source.
- Ideally, the site should have alternate access routes and / or have a helicopter landing area.
- The site should have a GPS location that is documented in the Emergency Response Plan.
- The site should have adequate space for the personnel, vehicles and equipment that would normally be expected to utilize the safe area including helicopters.

Water supply

- Have an adequate water supply for the purpose of firefighting.
- Identify natural water sources such as streams and small lakes in the immediate area.
- Ensure access to natural water sources for tanker trucks and / or portable pump setups are developed and identified.
- If natural water sources are not available, consider developing a water storage facility on the site. Non-draining borrow pits or tanks may be used for storing large volumes of water.
- Identify the availability of large water tankers in the region.
- Consider the use of agricultural or industrial water delivery systems to move water long distances for the protection of facilities.
- 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.

Access roads / 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 sites 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.
- A roadway curvature radius should be at least 30 metres, measured from the centerline. This is a standard for Fire Department access.
- Road gradient should not exceed 10 percent.
- 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 traveled way.
- Bridges should be designed and built with an all-weather surface capable of supporting heavy pieces of equipment traveling across the bridge. Weight limits should be clearly posted at the approaches to each bridge.

Figure 1: example of access route that may act as evacuation route

7.0 Using Fire Safely

Use the following table to assess wildfire ignition potential from operations within **FireSmart™ Industrial Zone 3 (30+ metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the using fire safely assessment. If this section does not apply to the disposition, then use an N/A (not applicable).

Table L: Using Fire Safely Assessment

1. Smoking, cooking and warming fires; refuse burning	Is the site appropriate for using fire?	If using fire, is there suppression equipment on hand to avoid escape and for proper extinguishment?	If using fire, has it been properly extinguished before leaving the site?	Are you avoiding using fire during high and extreme fire danger?	Total Points
	Yes = 0 or No = 5	Yes = 0 or No = 5	Yes = 0 or No = 5	Yes = 0 or No = 5	Low: 0 – 5 Moderate: 10 - 15 High: 15-20

7.1 Wildfire Mitigation for Smoking

- Smokers' materials such as cigarettes should be "field stripped" by the user to ensure that all material is extinguished before disposal on bare mineral soil. The material shall be broken up and spread before discarding or placed in a metal or glass receptacle.
- Matches must be cold to the touch before disposal. The safest method of lighting tobacco materials is with a childproof lighter.
- Smoking in forest areas during periods of high or extreme fire danger conditions should be prohibited.

7.2 Wildfire Mitigation for Cooking and Warming Fires

When using an outdoor campfire for cooking or warming purposes during a fire season, take the following precautions:

- Open fires should be prohibited during periods of high or extreme fire danger conditions;
- Consider the use of alternative methods for cooking and warming;
- Set the fire on a flat rock, gravel bar, sand or bare mineral soil at a spot relatively clear of vegetation and located near water;
- Clear the site of all debris down to mineral soil to a radius of at least 1 metre from the edge of the fire;
- Keep the fire under control and attended to at all times;
- Extinguish the fire before leaving the site.
  - » Let the fire burn down.
  - » Once the fire has burned down, spread out the remains evenly within the pit and slowly add water or loose dirt (or sand) and stir.
  - » Continue adding water or dirt and stir until the fire is extinguished.

7.3 Wildfire Mitigation for Refuse Burning

When using incinerators:

- Burning of non-industrial wastes shall be carried out in a fully enclosed incinerator constructed of incombustible material and the draft and smoke vents thereof covered with a heavy gauge metal screen of a mesh size not greater than 6 millimetres.
- During the fire season, ensure the mesh on top of the incinerator is free of any carbon or other foreign matter that can turn into a glowing ember, become dislodged and spread to surrounding flammable forest vegetation during high winds.
- An incinerator area shall be located over bare rock, gravel, sand, mineral soil or concrete at least 30 metres from a stand of trees or shrubs and the ground surrounding it outward from its base to a distance of at least 3 metres shall be clean mineral soil or be covered by any of the aforesaid materials.

- During periods of high and extreme fire danger and during high winds when the ignition probability in a forest area is high, consider using the incinerator during the late evening when the relative humidity is higher than 45 percent and the wind speed is less than 15 km per hour.

8.0 Equipment Operation

Use the following table to assess wildfire ignition potential from equipment operations within **FireSmart™ Industrial Zone 3 (30+ metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the equipment operation assessment.

Table M: Equipment Operations Assessment

1. Heavy equipment, light equipment and welding equipment	Is equipment parked on bare mineral soil or other non-flammable area? Yes = 0 or No = 5	Is there adequate suppression equipment supplied with the operational equipment during the fire season? Yes = 0 or No = 5	Are internal combustion engines equipped with spark arresters and mufflers in good working condition? Yes = 0 or No = 5	Has the equipment exhaust systems been cleaned on a regular basis? Yes = 0 or No = 5	Are you operating equipment during low to moderate fire danger? Yes = 0 or No = 5	Total Points **Low: 0** **Moderate: 5 - 10** **High: 15-25**

8.1 Wildfire Mitigation for Heavy Equipment

- To prevent wildfire ignition by heavy equipment, establish a policy that requires all operators to clean flammable material from their equipment's exhaust systems on a regular basis.
- While cleaning the engines, park the equipment on bare mineral soil if possible or spray the area with water then drive the equipment over the wet areas and clean them.
- Ensure that equipment with diesel engines that idle for long periods of time are throttled up and placed under load to expel any carbon build up over a safe zone of mineral soil or other non flammable material.
- Heavy equipment should carry a backpack water container (full of water) complete with hand pump, dry chemical extinguisher, shovel, axe or Pulaski during the fire season.

8.2 Wildfire Mitigation for Light Equipment

- To prevent wildfire ignition by light equipment, establish a policy that requires all operators to clean their equipment's exhaust systems on a regular basis.
- Ensure all internal combustion engines are equipped with spark arresters or mufflers in good working condition.
- When using a power saw:
  - » Refrain from starting a power saw within 3 metres of the gasoline supply;
  - » Refrain from placing a running or hot power saw engine on any flammable matter;
  - » Have an approved fire extinguisher on site.
- Ensure vehicles with catalytic converters are not parked in tall dry grassy areas.
- Evaluate the risks of mowing, mulching or using graders during periods of high and extreme fire danger periods when the grass is cured, the forest fine fuels are dry and the relative humidity is below 30 percent.
- Allow small engines to cool down before refuelling.
- If it is essential that these operations are conducted during high and extreme fire danger periods with high probability of wildfire ignitions then a water tanker complete with crew, hose and pump should accompany the operation to patrol behind the operation to detect and extinguish any fires that maybe ignited.

8.3 Wildfire Mitigation for Welding

- Establish a policy that requires employees and contractors operating in wildland areas to conduct welding operations on bare mineral soil if possible. As an alternative, during high fire hazard periods, the work area where welding is to take place should be wet down with water or foam additives. Water is not very effective in fibrous soils during high and extreme build up indices (BUI).
- Another option is to use a non-flammable shield around the area where welding will take place to confine and prevent the sparks from spreading in all directions.
- If it is essential that if these operations are undertaken during high and extreme fire danger periods with very high probability of wildfire ignitions then a water tanker complete with crew, hose and pump should accompany the welding operation to patrol, detect and extinguish any fires that maybe ignited.
- Wildfire foam or wetting agent additives should be considered for use when welding on pipelines during high and extreme ignition potential periods to reduce amount of water required and to ensure the water penetrates into the organic layers. Properly mixed foam will increase the effectiveness of water by 3-5 times, depending on the foam and equipment used. Foam solutions act as a fire suppressant rather than a fire retardant. A suppressant extinguishes the flaming and glowing phases of combustion when applied directly to forest vegetation.

9.0 Using an all-Terrain Vehicle or off Highway Vehicle (ATV / OHV) on the Job

Using the following table, assess ATV / OHV operations within **FireSmart™ Industrial Zone 3 (30+ metres)**. Circle the points below for risk factor #1 to determine a low, moderate or high risk rating for the ATV / OHV operations assessment. If an ATV / OHV is not used for operations, then this section may not be applicable (N/A).

Table N: ATV / OHV Operations

1. ATV / OHV Activity	Is an ATV / OHV being used for operations?	Is there a spark arrestor on the ATV / OHV?	Is the ATV / OHV being parked on a bare mineral soil / gravel or other non-combustible surface area?	Are you checking the ATV / PHV for burning material around exhaust, manifold or engine after each use to prevent the risk of starting an ATV- / OHV-caused wildfire?	Total Points
	Yes = 0 or No = 5	Yes = 0 or No = 5	Yes = 0 or No = 10	Yes = 0 or No = 10	Low: 0 Moderate: 5 - 10 High: 15-30

9.1 Wildfire Mitigation for ATV / Ohv Use

- **Remember that a spark arrester is required on the ATV / OHV.**
- Ensure that the spark arrester and muffler are in good working condition. Any alteration to the factory components can increase the chance of starting a wildfire which can lead to prosecution.
- Stop and remove any vegetation that may have built up on a regular basis (particularly in the spring or when travelling in tall grass or muskeg):
  - Around the exhaust
  - On the engine and manifold
- Consideration should be given to restrict or limit the use of ATVs / OHVs during prolonged periods of extreme fire danger, particularly in the spring of the year.
- Always carry a small fire extinguisher and collapsible shovel to put out small fires.
- Wash the ATV / OHV regularly. **Do not** wash the ATV / OHV in a stream, creek or lake.

10.0 Debris Disposal

Use the following table to assess woody debris piles that will be disposed of through burning typically within **FireSmart™ Industrial Zone 3 (30+metres)**. Circle the points below for risk factors #1 - 2 and combine the score at the bottom to determine a low, moderate or high risk rating for the debris disposal assessment. If this section does not apply to the disposition, then use an N/A (not applicable).

Table O: Debris Disposal Assessment

1. Disposal of woody debris piles through burning	Woody debris piled on organic or mineral soils (holdover potential)		Winter burning: assessing risk for holdover fires using Fire Weather Index for the fall season	
	Mineral Soils	Organic Soils	Drought Code < 300 (low, moderate, high) *Refer to website below	Drought Code > 300 (very high or extreme) *refer to website below
	0	10	0	10
2. Disposal of woody debris piles through burning	Woody debris piles burning inspected for extinguishment (if burned over the winter, inspected prior to the upcoming fire season)			
	Extinguished	IR Scanned	Manual Check	Not Inspected
	0	3	5	20
Combined Points: 1 - 2	**Low: 0 – 5**	**Moderate: 6 – 15**		**High: 16+**

*If alternative disposal options are feasible (mulching), avoid burning as this is one of the primary causes of industrial wildfires.

Refer to the Canadian Wildfire Information System website to determine daily Fire Weather Index (FWI) fire danger ratings Fire Weather Index (FWI) fire danger ratings or contact the local Fire Center for the current drought code rating (value).

10.1 Wildfire Mitigation for Burning Debris Piles

Site clearing and debris disposal includes timber salvage, mulching and burning. If alternative disposal options are feasible, such as mulching, avoid burning as this is one of the primary causes of industrial wildfires. Mulching can be utilized on standing vegetation, woody debris windrows or piles.

- If the risk of hold over fires is high, consider mulching.
- Mulching / chipping should be considered in areas where smoke dispersal is a problem and may affect populated areas.

- Mulching versus burning should be considered in highly erodible soils and permafrost areas.
- When possible, allow woody debris piles to cure for one season before burning.
- A fire permit is required depending on the time of year. Review pertinent legislation and acquire a fire permit from the responsible agency.
- During the wildfire season, burning should not be considered when the forecasted Fire Danger Class Fine Fuel Moisture Content (FFMC) is greater than 89 and the Initial Spread Index (ISI) is greater than 10.
- During winter burning, when the fall (October closing) Fire Danger Class Drought Codes (DCs) are greater than 450, there is a higher risk of holdover fires in fibrous soils.
- Windrows of debris should not be more than 60 metres in length with a minimum of 8 metre breaks between the ends of each windrow. Round piles and windrows should be at least 15 metres from the adjacent forest.
- Debris should be piled in a manner that allows for clean, efficient burning of all material. Avoid mixing soil into the woody debris.
- Ensure sufficient firefighting resources are on-site as specified in provincial legislation.
- If burning during snow-free conditions, ensure that a constant fire watch is maintained.
- Burning sites on bare mineral soil or shallow organic soils will prevent hold-over fire in deep organic layers.
- Burning can produce smoke that will reduce visibility on roadways causing a safety concern. This may require traffic control or signage on roadways.
- Consider the use of burn sleds for more efficient and safer burning.
- Ensure that all burning material is extinguished by spreading the debris and mixing with water / snow to ensure no residual fire is remaining.

Note:

The Company may be responsible for all fire suppression and rehabilitation costs if their fire escapes control. Many wildfires occur as a result of holder fires caused by improper extinguishment of burning debris. If the fire escapes control, report the fire immediately by calling 9-1-1 or the "Report a Wildfire" contact number.

Alberta	British Columbia	Saskatchewan	Northwest Territories
Report a wildfire 310-FIRE (310-3473) General inquiries 1-877-944-0313	Report a wildfire 1-800-663-5555 (or just 5555) General inquiries 1-888-336-7378	Report a wildfire 1-800-667-9660 General inquiries 1-800-667-9660	Report a wildfire 1-877-NWT-FIRE or 1-877-698-3473 General inquiries 1-867-767-9055

11.0 SUMMARY

Industrial activity ranks as the third highest of all human-caused wildfires. A historical review of industry related wildfires has identified the most common wildfire ignition risks and liabilities.

Increasing awareness of wildfire prevention best management practices and implementing wildfire mitigation strategies will help to reduce wildfire risks, liability and impacts.

The Field Guide is a site-specific wildfire risk assessment tool to help prevent wildfires and reduce the impact of catastrophic wildfire. Based on the risk ratings of each assessment component, wildfire mitigation strategies can be implemented accordingly. However, it is recommended that a FireSmart™ plan be developed if there are several high to extreme risk factors in conjunction with a large personnel capacity.

By adopting and implementing the principles in this field guide, the oil and gas industry will enhance personnel safety, environmental stewardship and contribute to preventing wildfires.

Based on the generic application for field operators throughout Alberta, British Columbia, Saskatchewan and the Northwest Territories, legislative requirements should be referenced and incorporated within the specified planning area.

12.0 Wildfire Risk Assessment Worksheet

Wildfire Field Risk Assessment for the Oil and Gas Industry

Appendix 1: Local Contact Information

Fill in the table with a list of applicable local key contacts.

Alberta	British Columbia	Saskatchewan	Northwest Territories
Report a wildfire 310-FIRE (310-3473) General inquiries 1-877-944-0313	Report a wildfire 1-800-663-5555 (or just 5555) General inquiries 1-888-336-7378	Report a wildfire 1-800-667-9660 General inquiries 1-800-667-9660	Report a wildfire 1-877-NWT-FIRE or 1-877-698-3473 General inquiries 1-867-767-9055

Appendix 2: Forest Fuel Types and Descriptions

Forest Floor and Organic Layer	Surface and Ladder Fuelsa	Stand Structure and Composition	Photo
Coniferous Fuel Type C-1 (Spruce-Lichen Woodland)			
Continuous reindeer lichen; organic layer absent or shallow, uncompacted.	Very sparse herb / shrub cover and down woody fuels; tree crowns extend to ground.	Open black spruce with dense clumps; assoc. sp. jack pine, white birch; well-drained upland sites.	
Coniferous Fuel Type C-2 (Boreal Spruce)			
Continuous feather moss and / or Cladonia; deep, compacted organic layer.	Continuous shrub (e.g., Labrador tea); low to moderate down woody fuels; tree crowns extend nearly to ground; arboreal lichens, flaky bark.	Moderately well-stocked black spruce stands on both upland and lowland sites; Sphagnum bogs excluded.	
Coniferous Fuel Type C-3 (Mature Jack or Lodgepole Pine)			
Continuous feather moss; moderately deep, compacted organic layer.	Sparse conifer understory may be present; sparse down woody fuels; tree crowns separated from ground.	Fully stocked jack or lodgepole pine stands; mature.	

Coniferous Fuel Type C-4 (Immature Jack or Lodgepole Pine)			
Continuous needle litter; moderately compacted organic layer.	Moderate shrub / herb cover; continuous vertical crown fuel continuity; heavy standing dead and down, dead woody fuel.	Dense jack or lodgepole pine stands; immature.	
Coniferous Fuel Type C-5 (Red and White Pine)			
Continuous needle litter; moderately shallow organic layer.	Moderate herb and shrub (e.g. hazel); moderate dense understory (e.g. red maple, balsam fir); tree crowns separated from ground.	Moderately well-stocked red and white pine stands; mature; assoc. sp. white spruce, white birch, and aspen.	
Coniferous Fuel Type C-6 (Conifer Plantation)			
Continuous needle litter; moderately shallow organic layer.	Absent herb / shrub cover; absent understory; tree crowns separated from ground.	Fully stocked conifer plantations; complete crown closure regardless of mean stand height; mean stand crown base height controls ROS and crowning.	
Coniferous Fuel Type C-7 (Ponderosa Pine-Douglas-fir)			
Continuous needle litter; absent to shallow organic layer	Discontinuous grasses, herbs, except in conifer thickets, where absent; light woody fuels; tree crowns separated from ground except in thickets.	Open ponderosa pine and Douglas fir stands; mature uneven-aged; assoc. sp. western larch, lodgepole pine; understory conifer thickets.	
Deciduous Fuel Type D-1 (Leafless Aspen)			
Continuous leaf litter; shallow, uncompacted organic layer.	Moderate medium to tall shrubs and herb layers; absent conifer understory; sparse, dead, down woody fuels.	Moderately well-stocked trembling aspen stands; semi-mature; leafless (i.e., spring, fall or diseased).	

Forest Floor and Organic Layer	Surface and Ladder Fuels	Stand Structure and Composition
Mixed Wood Fuel Types M-1 and M-2 (Boreal Mixed Wood)		
Continuous leaf litter in deciduous portions of stands; discontinuous feather moss and needle litter in conifer portions of stands; organic layers shallow, uncompacted to moderately compacted.	Moderate shrub and continuous herb layers; low to moderate dead, down woody fuels; conifer crowns extend nearly to ground; scattered to moderate conifer understory.	Moderately well stocked mixed stand of boreal conifers (e.g., black / white spruce, balsam / subalpine fir) and deciduous species (e.g., trembling aspen, white birch). Fuel types are differentiated by season and percent conifer / deciduous sp. composition
		
Mixed Wood Fuel Types M-3 and M-4 (Dead Balsam Fir Mixed Wood)		
Continuous leaf litter in deciduous portions of stands; discontinuous feather moss, needle litter and hardwood leaves in mixed portions of stands; organic layers moderately compacted, 8-10 cm.	Dense continuous herbaceous cover after green up; down woody fuels low initially, but becoming heavy several years after balsam mortality; ladder fuels dominated by dead balsam understory.	Moderately well stocked mixed stand of spruce, pine and birch with dead balsam fir, often as an understory. Fuel types differentiated by season and age since balsam mortality.
		

Fuel Type 0-1 (Grass) Subtypes: O-1a – matted grass, O-1b – standing grass		
Continuous dead grass litter; organic layer absent to shallow and moderately compacted.	Continuous standing grass (current year crop). Standard loading is 0.3 kg / m2, but other loading can be accommodated; percent cured or dead must be estimated. Sparse or scattered shrubs and down woody fuel. Subtypes for both early spring matted grass (O-1a) and late summer standing cured grass (O-1b) are included.	Scattered trees, if present, do not appreciably affect fire behavior.
		

Appendix 3: Glossary of Terms

Term	Description
Canadian Forest Fire Behavior Prediction System	A subsystem of Canadian Forest Fire Danger Rating System. The fire behavior prediction system provides quantitative outputs of selected fire behavior characteristics for certain major Canadian fuel types and topographic situations. The system depends partly on the Canadian Forest Fire Weather Index System components as inputs.
Coniferous vegetation fuel type	Any of various mostly needle-leaved or scale-leaved, chiefly evergreen, cone-bearing gymnospermous trees or shrubs such as pines, spruces, and firs.
Debris	The woody or herbaceous material which results from vegetation clearing operations.
Deciduous vegetation fuel type	Typically used in reference to trees or shrubs that lose their leaves seasonally, and to the shedding of other plant structures such as petals after flowering or fruit when ripe.

Disposition	A surface land lease of Crown lands.
Ember transport	Embers or fire brands are produced as trees and other combustible objects burn. These embers are entrained in the atmosphere and may be carried by winds over long distances. Hot embers ultimately come to rest and may ignite surfaces far removed from a fire, resulting in fire spread. This process is commonly referred to as spotting.
Fire behavior	The manner in which fuel ignites, flame develops and fire spreads exhibits other related phenomena as determined by the interaction of fuels, weather and topography.
Fire hazard	A hazard based on physical fuel characteristics, such as fuel arrangement, fuel load, condition of herbaceous vegetation and presence of elevated fuels. A general term to describe the potential fire behavior, without regards, to the state of weather influenced fuel moisture content, and / or resistance to fireguard construction for a given fuel type.
Fire occurrence	The number of fires started in a given area over a given period of time.
FireSmart™	A proactive initiative that enhances safety and stewardship through the creation of best management practices aimed at the prevention and mitigation of wildfires.
FireSmart™ landscape	Landscapes designed to reduce the likelihood of large, uncontrollable wildfires. A FireSmart™ landscape is designed to recognize the interaction between the ecological, economic and social impacts of wildfire.
Fire Weather Index System	The Canadian Forest Fire Danger Rating System (CFFDRS) system provides a uniform, numeric method of rating fire danger throughout an area; it is dependent on weather only and does not consider differences in risk, fuel, or topography. Its six components are (FFMC, DC, DMC, BUI, ISI, and FWI).
Fire Weather Index	A numerical rating of fire intensity that combines ISI and BUI. It is suitable as a general index of fire danger throughout forested and rural areas.
Fuel break	An existing barrier or change in fuel type (to one that is less flammable than that surrounding it) or a wide strip of land on which the native vegetation has been modified or cleared, that act as a buffer to fire spread so that fires burning into them can be more readily controlled. A strategically planned barrier, either manually or mechanically constructed, intended to stop or retard the rate of spread of a fire, and from which suppression action is carried out to control a fire.
Ladder Fuels	Vegetation that will help carry a surface fire up the tree to the crowns / tops can create a crown fire (typically in coniferous fuel types).
Local Fire Authority	Dependant on jurisdiction, an organization involved in fire prevention, emergency preparedness and response of emergency services.

Hazard reduction	Treatment of living or dead forest fuels to diminish the likelihood of a fire starting, and to lessen the potential rate of spread.
Mineral soil	Nonorganic soil.
Mitigation	Action that moderates the severity of a fire hazard or risk (NFPA1144).
Mixed wood vegetation fuel type	A 'mixed' forest in which two or more tree species are predominant in the canopy (typically a coniferous and deciduous mix).
Radiant heat transfer	Heat transfer to the surrounding environment through radiation.
Risk from wildfire	The potential of loss from wildfire. For example, there is a 25% chance a value at risk will be destroyed by a wildfire sometime in the next 50 years. Risk can also be calculated by multiplying damage (or loss) by uncertainty (CIFFC).
Strategic evacuation	When sufficient lead time exists, a strategic evacuation can be arranged through the declaration of a State of Local Emergency under the authority of the Emergency Management Act and the local Emergency Management Bylaw.
Suppression capability	Suppression capability includes the factors and limitations that are related to the ability to contain a wildfire upon detection in order to protect values at risk.
Staging area	A location at an incident where resources can be placed while awaiting tactical assignment.
Tactical evacuation	Without sufficient lead time, the Incident Commander at the scene may have to initiate a tactical (immediate) evacuation. Evacuation under this situation is voluntary and cannot be enforced.
Values at risk	The specific or collective set of natural resources and man-made improvements / developments that have measurable or intrinsic worth that could be destroyed or otherwise altered by fire in any given area.
Wicking	Vegetation connectivity or pattern that contributes to an increase in fire spread.
Wildland Urban Interface	A popular term used to describe an area where structures meet or are intermingled with the forest and vegetation.
Wildfire	Any unwanted or unplanned wildland fire that burns in forested or grassland areas.

Phone:
1 800 667 5557

Email:
Safety@EnergySafetyCanada.com

Web:
EnergySafetyCanada.com