# FLARING

CLEAN ENERGY TECHNOLOGIES

## FLARE TEST FACILITY

*CETC-Ottawa's collaborative program on flare testing and development addresses the concern of industry and federal and provincial regulatory bodies to have the most cost effective, safe and environmentally responsible technology to dispose of waste gases.*

### Background

Flaring is a common method of disposal of flammable waste gases in the upstream oil and gas, downstream refining and chemical processing industries. The flare is an open-air flame usually at the top of a long stack, exposed to the wind. Gases may be flared as a result of an emergency shutdown, as an unwanted by-product of refining or chemical processing, or as part of the production in oil and natural gas fields. A particular problem results from the flaring of solution gas at widely dispersed oil well sites. Solution gas, also called associated gas, is a mixture of light hydrocarbons that come out of solution when crude oil is brought from high pressure in the reservoir to near-atmospheric pressure at the surface. In certain areas, solution gas can contain significant amounts of hydrogen sulphide, and is called 'sour gas'. Over 100 billion $m^3$ of solution gas is flared each year around the world.

Gas may be flared in the initial period of production of an oil or gas well, testing the flow rate. Solution gas flares and process flares usually operate at low flow rates relative to the prevailing winds, while emergency flares and well test flares have very high flow rates. The performance of solution gas flares in the Oil Patch of western Canada has recently been a topic of great interest, with tests indicating the potential for release of significant amounts of incomplete combustion products under certain wind conditions. As one of these products can be methane, there is a particular environmental concern because of the high global warming potential of methane (23 times that of carbon dioxide).

*View of Flare Test Facility*

Canada

CETC – OTTAWA
CANMET Energy Technology Centre
Natural Resources Canada
1 Haanel Drive, Ottawa, Ontario K1A 1M1
**Tel:** (613) 996-8693 **Fax:** (613) 995-9584
www.cetc.nrcan.gc.ca

## Flare Testing

The performance of flares in the field is difficult to quantify. Wind speed and direction are highly variable, so sampling or collecting combustion gases is almost impossible. The composition (and therefore heating value) and flow rate of solution gas vary with time and well site. There is a need, therefore, to have a controlled situation that mimics the actual flaring conditions, particularly as affected by ambient winds, and allows accurate measurement and speciation of combustion products, and the determination of combustion performance.

CETC-Ottawa has constructed the Flare Test Facility (FTF) to achieve this goal. The construction and commissioning of the FTF was completed in 2000. It has been used to determine the performance of flares with a range of model solution gases, a range of gas and air flow rates, to measure the chemical species produced. It is being used to test improvements in flare tip design.

## Features of the FTF

The FTF has a once-through configuration, with the wind driven by a large, variable speed high-capacity fan delivering air to the working section, where the flare is located, perpendicular to the wind flow. The working section is 1.2 metres wide, 8.2 metres long, with a height variable between 1.5 and 2.6 metres. All walls are flame, for a wide variety of ambient and air-cooled to minimize heating of the flare by back radiation. This variable test section allows full development of the flare fueling conditions. Large ceramic windows at strategic locations allow complete viewing of the flame, along with digital recording of the same. Complete gas sampling can be performed both in or near the flame in the horizontal test section, and downstream in the vertical stack.


*The Flare Test Facility is the host of the International Flare Consortium*
*www.ifc.org*

All flows are measured by high precision mass flow meters and digitally controlled for stability. Other features include:

- Moveable ceiling, height ranges from 1.5 to 2.6 metres (5 to 8.5 feet);
- Wind speed up to 45 km/h;
- Gaseous fuels such as natural gas and propane, alone or in combination, up to 60 $m^3$/h;
- Inert diluents: $CO_2$, $N_2$;
- Liquid droplet injection (octane/gasoline, diesel, water);
- Flare pipes from 1 inch to 6 inch nominal diameter, with different designs;
- Total fuel heat input up to 2.1 GJ/h (2 million BTU/h); and
- Variable grids upstream of the flare, allow the development of wind turbulence similar to those experienced with real-life conditions.

*Stack gases are analyzed for:*

- Combustion products CO, $CO_2$, $O_2$, $NO_x$, $SO_2$ in real time;
- Unburned fuel ($CH_4$, NMHC) in real time;
- HRVOC and BTEX by on-line GC;
- Particulate loading by isokinetic sampling; and
- Specific and total measurements of VOCs and PAHs are performed by bulk sampling.

With its relatively large scale and lateral wind capability, this unique facility can closely represent a wide range of industrial flares, including those of off-shore oil rigs and of downstream refining and chemical processing facilities.

### Your Invitation to Work with Us

We are interested in collaborating with you. Please contact the Business Office to discuss your particular needs.
☎ (613) 996-8693
✉ cetc-bdo@nrcan.gc.ca

### For Further Information Please Contact:

Dr. Peter Gogolek
Project Leader
☎ (613) 947-2082
✉ pgoglek@nrcan.gc.ca

CANMET Energy Technology Centre - Ottawa
Natural Resources Canada
1 Haanel Drive
Nepean, Ontraio, K1A 1M1
Canada

**cetc.nrcan.gc.ca**