The basics of a compressor station

TransCanada
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As natural gas flows along a pipeline, it slows due to friction between it and the pipeline. This results in a loss of pressure along the pipeline. In order to make the gas flow continuously at a desired flow rate, it is re-pressurized at suitable locations along the pipeline. This is done by mechanically compressing the gas at sites connected to the pipeline known as compressor stations. The location and quantity of compressor stations required in a pipeline system is dependent on a number of factors, including the operating pressure of the pipeline, the diameter of the pipe used, elevation changes along the pipeline route and the desired volume of gas to be transported.

Safety factors

Safety is the first consideration in planning and constructing a compressor station. A number of safety systems are built into the stations to ensure the safety of the facility, our employees and the environment. Our stations are equipped with a multi-layered control system that provides routine operational control and fire and gas monitoring of all piping and equipment. A dedicated emergency shutdown system provides constant monitoring for hazardous conditions such as gas leaks, high temperatures, fire and abnormal operating conditions. The control system is capable of shutting down all equipment and removing all natural gas from the station piping system in the event of an emergency.

Personnel

Compressor stations are designed to be remotely operated in a safe and efficient manner. There is no requirement for employees to be at the site during normal operation, although the sites are checked regularly by operations personnel who monitor, inspect and maintain the equipment. Processes are continuously monitored from a centralized control center. Site personnel will be on call 24/7 and will quickly respond to the site if required.

There are many components that make up a typical compressor station, some of which are described below:

1. **Yard Piping and Valves**
   The piping in the yard provides the conduit that directs gas from the main line through the station yard, into the compressor, out through the station coolers and back into the mainline. Control of the gas through the yard piping is done using mechanically operated valves that are capable of isolating pipeline segments, and diverting all of the gas away from the station. These valves are directly controlled by the station's micro-processor-based control system.

2. **Station Natural Gas Scrubber**
   As gas enters the compressor station from the pipeline, it passes through a natural gas scrubber vessel. This vessel is designed to remove free liquids, dirt or other particulates from the gas stream before it enters the compressors. Water and natural gas liquids removed by the scrubber are sent to a double-walled holding tank for further processing or disposal.

3. **Station Turbine Compressor**
   The station's compressor building(s) house(s) the turbine compressor that is the heart of the compressor station. These consist of two main components: a gas turbine and a compressor. The compressor mechanically re-pressurizes the gas in the pipeline using an impellor similar to that of a water pump in an automobile. The energy required to drive the compressors is provided by the gas turbines that are mechanically coupled to the compressor impellor. The gas turbines are powered by a portion of the natural gas that flows through the pipeline. Each turbine compressor unit is controlled by a state-of-the-art control system that monitors its operation, controls the interaction between it and the yard piping systems, and safety shuts it down if a fault condition exists

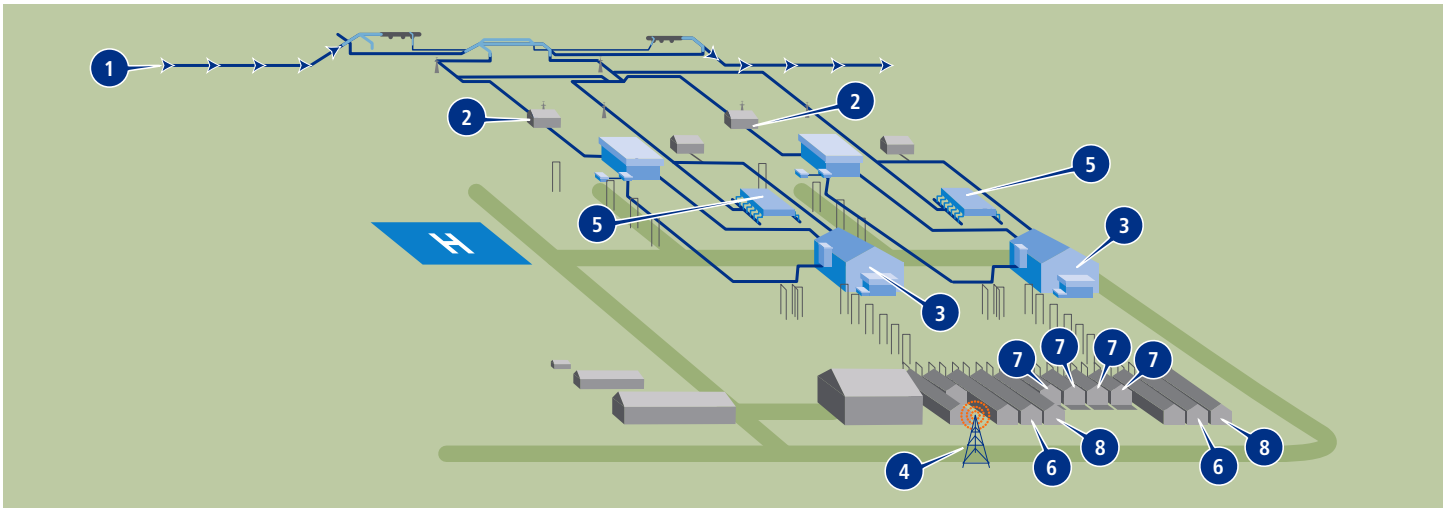
4. **Telecommunications**
   Telecommunications equipment provides voice and data services between the station and our central control centre. These systems include redundant communication pathways that ensure that remote access to all of the station's systems is available at all times

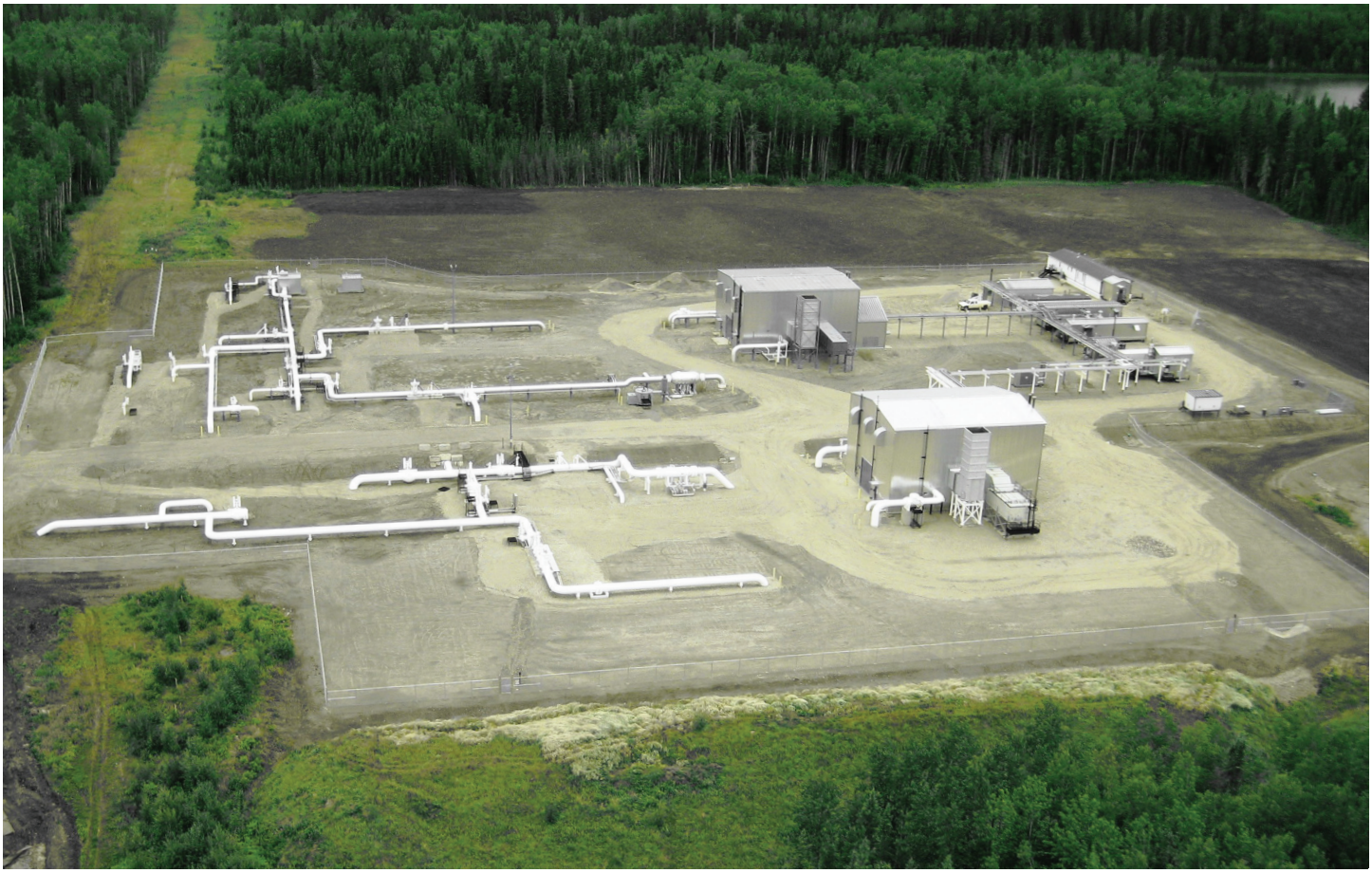
5. **Natural Gas Cooling System**
   Re-pressurizing natural gas in the compressor results in an increase in the temperature of the gas. Gas coolers are used to cool the gas to 45 C in order to maintain the efficiency of the pipeline and protect internal coatings from undue wear. These aerial gas coolers use electric motor-driven fans to pass air over cooling fins along the pipe components in which the gas passes, similar in operation to that of the radiator in an automobile.

6. **Air System**
   Pressurized air is provided from air compressors located in the mechanical buildings at the station. Air lines are distributed throughout the site and used as part of the control system for instrumentation, valve actuators, compressor gas seals and as service air for tools and pneumatic equipment.

7. **Generators**
   Multiple electric generators are located at each of our stations. If the station is self-contained and not connected to the electrical utility, the generators provide power at all times, otherwise they provide power only when there is a disruption of the primary electrical service to the station. Reciprocating natural gas engines, similar to an automobile engine, are used in these generator packages. These engines are powered by natural gas supplied directly from the pipeline.

8. **Station UPS**
   An uninterruptable power supply (UPS) is installed at all of our stations to provide continuous electrical power to station controls and essential systems in the event of a complete power disruption, including a failure of the backup generation system. The UPS is sized to provide sufficient time to permit station personnel to respond to any complete power failures at the station while still being to remotely monitor and control the station's operation.





Q&A

1. What are you doing to keep noise levels down?

Noise levels will be at or less than 40 decibels when measured 1.5 km from the compressor station. Noise levels are routinely monitored to ensure they remain in compliance. We minimize the noise generated by the stations through the use of engineered noise suppression devices such as silencers, baffles, and sound absorbing liners. The largest source of station noise is from the gas turbines used to power our gas compressors. These units are located within a sound proofed acoustical enclosure which is housed within compressor buildings, and the buildings are built to further dampen noise.

Sources of Noise:

- turbine intakes and exhaust stacks adjacent to the compressor stations,
- generator set,
- blowdown vents,
- aerial gas coolers
- instrument air compressor

Noise reduction methods:

- Building walls and roof have two layers of acoustical high density insulation foam at 25 mm and 50 mm thick to reduce noise generated inside the building.
- Silencers on turbine intake, exhaust and blowdown vents,
- Acoustical designed building enclosures.

2. What about lighting? Will lights be left on all night?

Our compressor stations are unmanned and facility lights are off at night (except for safety lights over doorways) unless there are maintenance activities being conducted.

3. What is the size of an average compressor station?

A typical compressor station will consist of two compressor plants.

The footprint will be 320 m x 280 m. The station footprint will overlap pipeline right-of-way by about 30 m.

The construction of a compressor station will take approximately 12 months to complete.

4. Air pollution is a concern. What kind of emissions will be released?

There are no flare stacks at compressor stations. Emission of nitrous oxides from burning natural gas will be under 25 ppmv (parts per million by volume). Pipeline gas is dry and sweet, so no H2S will be released at any time. The CO2 emissions from a compressor station will be similar to those generated by a Boeing 767 aircraft engine. Emission levels depend on the size of the station. Levels are documented for each particular compressor station design.