

1. How does sour gas get dealt with?

Sour gas is natural gas containing measurable amounts of hydrogen sulfide (H₂S). Exposure to natural gas containing more than 10 ppm H₂S can cause severe health impacts. H₂S concentrations can be toxic to humans and animals, and corrosive to certain types of metals. Wells that have a presence of sour gas demand more rigorous engineering and safety controls, as detailed in both the Drilling Production Regulations and Gas Processing Plant Regulations.

The conventional Devonian Manetoe facies dolomite play in Liard Basin is a sour gas play. This play produced from the Kotaneelee field in Yukon from 1979 to 2012. Sour gas produced from this play was transported by the Spectra Energy Pointed Mountain Pipeline to a gas plant in Fort Nelson, where the sulphur was stripped from the gas. Some of the sulfur and CO₂ is removed and flared from the raw gas at Kotaneelee so gas can be used as a source of power and heat for the facilities there. This is done by an amine treatment system, which is the most common method in the industry (http://www.naturalgas.org/naturalgas/processing_ng.asp). It is less common to find sour gas in unconventional resources.

2. Is the current low cost of gas resulting in an increase in venting/flaring?

In jurisdictions where regulatory development has been significantly behind the pace of investment, there have been observances of high levels of gas flaring during exploration and production of oil. This is also partly due to the limited pipeline capacity and resultant ability to cost effectively gather natural gas, especially in the Bakken formation. In general terms, the shale gas influx has driven the North American spot price to historic lows, and producers find that recovery of the natural gas derived by hydraulic fracturing was uneconomic as compared to the relatively higher price for oil. The practice of flaring and venting is being reduced as regulators become more cognizant of its environmental impacts and are able to enforce provisions set out in modern legislation.

3. What are the Best Practices for flaring/venting?

The Alberta Energy Regulator (AER) Directive 60 and British Columbia Oil and Gas Commission's (BCOGC) Guideline provide a framework for reduced flaring and venting during operations. The Canadian Standards Association is currently working on the development of a national consensus standard on flaring and venting suitable for adoption in regulation across Canada.

The Canadian Association of Petroleum Producers (CAPP) has also published its recommended industry best management practice. Section 127 of the Yukon Drilling and Production Regulations prohibits any release of produced gas, unless by authorization from the Chief Operations Officer. If flaring and venting were allowed by Yukon's Chief Operations Officer, current practice would be to use a regulatory tool rather than a best practice.

4. How do you test for sour gas - is it contained in the system?

Drilling fluid returns are tested for hydrocarbons (chromatograph) and H₂S when the target is expected to be sour. This is done using standardized monitoring equipment and analysis in

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accordance with recognized best practices. Preparations prior to drilling in sour service include emergency preparations, air monitoring, and control equipment in accordance with Section 170 of the Drilling and Production Regulations. Formation gas samples are tested for sulphur content during any flow test, well test, or wireline test. Upon production, regular gas analysis is done at minimum once every 12 months or if there is a reason to expect a change in composition.

5. Have there been any studies done on Canol pipeline re: contaminated sites?

The Department of Environment will answer this question directly to the Select Committee.

6. How much waste was trucked out from Eagle Plain basin and where did it go?

During the 2012/2013 drilling project, 6220 tonnes of drill solids were transported away from NCY drilling sites. 6120 tonnes of that were transferred to Tervita's Northern Rockies landfill in Fort Nelson, BC. 100 tonnes were transported to KBL Environment in Whitehorse.

7. Do we know what chemicals were used in Eagle Plain in the drilling mud?

Mud additive products used in the 2012/2013 drilling operation include, but are not limited to:

BARITE	BENTONITE	BIOCIDE
BLEACH	CALCIUM CARBONATE	CALCIUM CARBONATE
CAUSTIC SODA	CITRIC ACID	DEFOAM X
DETERGENT	ENVIROFLOC	GYP SUM
HR-2725 (H2S Scavenger)	HYPERDRILL	KWIK SEAL
LIGNITE	LIME	POTASSIUM CHLORIDE
POTASSIUM HYDROXIDE	RING FREE	SAWDUST
SOAP STICK	SODA ASH	SODIUM BICARBONATE
SULFAMIC ACID	WALNUT PLUG	ZINC CARBONATE

8. How did/does waste get dealt with in Liard basin?

A diesel incinerator is used for solid waste disposal, while a lagoon is used for sewage. Drilling waste is transported to an approved disposal site in Alberta or BC.

9. In Liard Basin, who pays for road infrastructure costs (government and/or industry) and is there a land use permit for the existing road?

Road infrastructure costs are paid by industry, unless it is a highway maintained by YG Department of Highways and Public Works. There is no land use permit for the existing road into the Kotaneelee field. EFLO has leases for the existing access road.

10. With extensive discontinuous permafrost in S.E. Yukon, will changes to the permafrost be an issue?

Permafrost characteristics of a specific site are studied as part of infrastructure planning. Systems and practices are put in place to ensure the permafrost is maintained. For example, a cooling system in the well casing can be used. Permafrost is considered in both the

environmental assessment phase and the regulatory phase of each specific project and appropriate terms and conditions would be placed on a licence to ensure permafrost integrity is maintained

11. How do royalties work in Yukon?

A royalty rate of 2.5% is applied during an initial period of production which constitutes the energy equivalent of 2,000,000 gigajoules. Thereafter, a base royalty rate for oil, gas and field condensate is 10 per cent and increases to a maximum of 25 per cent in accordance with a price sensitive formula. The amount of royalties that industry will pay each month is affected by fluctuating production volumes and transportation and processing allowances.

12. Have there been any leaks or other issues on the pipeline out of Kotaneelee?

The NEB advises that there was one incident in 1996 on the Pointed Mountain pipeline file.

13. Would gas from Eagle Plain have to be shipped to Fort Nelson or could it be used directly in Yukon?

Gas produced in Eagle Plain could be conditioned and processed by a Yukon gas plant and used in Yukon. This depends upon economics and scale. Please refer to Eagle Plain Case study: [http://www.emr.gov.yk.ca/oilandgas/pdf/eagleplain\(1\).pdf](http://www.emr.gov.yk.ca/oilandgas/pdf/eagleplain(1).pdf)

14. What 'stimulation' technique was used in Kotaneelee?

There have been acidizing treatments used on the Kotaneelee wells. This involves injection of 15% Hydrochloric acid, gels, and proppants. More info available at http://www.rigzone.com/training/insight.asp?insight_id=320&c_id=4

15. Absent of land use plans are there certain other areas not available for disposition?

Yes, there are certain areas that are not available for disposition by law and by policy such as:

- a. Yukon First Nations Category A and B Settlement Lands
- b. Special Management Areas, Habitat Protection Area, Natural Environment Park, and Protected Areas
- c. National or Territorial Parks
- d. Active Yukon oil and gas dispositions
- e. Coal leases
- f. Land Withdrawal Orders
- g. Fee Simple lands
- h. Interim Protected First Nation Lands – these are lands that are protected to facilitate the settlement of FNs without ratified land claims.

16. How far does a development have to occur before a permanent road is required?

There is no set limit or guideline in Yukon that works in every oil and gas development scenario. As a general guideline, temporary roads are encouraged and used during exploration however; during production a permanent access road is required.

17. For seismic, why is the technique not using helicopters?

Extensive use of helicopters is more expensive. Northern Cross is using helicopters for recording of their 3D seismic. They are not using helicopters to drill shot holes because the sparseness of trees and lack of topography, coupled with the packed snow protection of the ground, makes them unnecessary. This is particularly true because new recording systems and GPS makes the exact drill locations much more flexible and allows avoidance of environmentally sensitive areas such as riparian zones and archeologically sensitive areas.

18. Are there any audits on the seismic program so we learn from what worked on mitigation or not?

Yes, there is a post shoot evaluation and cleanup to inspect the 3D seismic lines and impact. Previous inspection of the Devon 2001 2D seismic shoot versus the older vintage 1960's, 70's and 80's, 2D seismic lines at Eagle Plain supports the premise that Low Impact Seismic is successful at reducing surficial environmental impact, especially the narrower lines and the elimination of cat machinery. EMR is currently conducting research into the recovery rate and remediation methods for seismic lines in the Eagle Plains area. This will inform us about practices that minimize and reduce surficial impacts from seismic activities.

19. What is available on the Eagle Plain basin seismic program?

Please refer to the YESAB online registry project number 2013-0067 for publically available studies, descriptions, mitigations, etc. A final report (confidential) will be submitted to the COO of the Oil and Gas Branch following completion of the program. Regulators of all aspects of the project regularly conduct and document inspections to monitor and address compliance.

20. What is an operational memorandum?

An operational memorandum is an agreement, such as a service agreement or memorandum of understanding, usually between two organizations for the purpose or objectives set out in the document. Many jurisdictions have such agreements in place, including BC and Yukon. BC has a memorandum of understanding (MOU) with the National Energy Board (NEB) to improve pipeline safety and provide opportunities for further regulatory efficiency for energy development. Yukon also has a number of similar oil and gas related agreements in place, including the Services Agreement with the NEB. This enables the NEB to provide oil and gas technical expertise to Yukon. A Services Agreement with the Northern Pipeline Agency regarding administration of the the Alaska Highway Gas Pipeline Easement also exists. Further, Yukon is finalizing a Services Agreement with the BC Oil and Gas Commission which will provide for collaboration in a number of areas where efficiencies can be achieved, such as sharing geological and other technical knowledge, training, and regulatory collaboration.

21. Is there a restriction on how much traffic can occur on the winter road?

No. However, public access to roads authorized for use by the oil and gas industry are often restricted to reduce environmental effects or public safety reasons.