

OIL AND GAS HEALTH AND SAFETY ISSUES BACKGROUNDER

*Susan Rutherford, Staff Counsel
West Coast Environmental Law*



The purpose of this handout is to provide an overview of the health and safety risks associated with oil and gas development in order to support a discussion that will lead to the adoption in British Columbia of legislation and regulations that reflect the very best practices for health and safety. The handout is organized by broad topic: air pollution, waste and by-product disposal, operational hazards, noise and accidents.

1. AIR POLLUTION - HYDROGEN SULPHIDE AND OTHER AIR EMISSIONS

Sour gas wells are wells that produce hydrogen sulphide gas, which is highly toxic to humans, and in some instances, can be lethal. The research indicates that even non-lethal, low-level exposure to sour gas poses risks that include "eye, nose and throat irritation, headache, sinus, etc., nausea, hoarseness, cough, nasal congestion, shortness of breath, stress, drowsiness,"¹ as well as negative neurological effects for both animals and human beings.²

Anecdotal reports from people who live close to sour gas wells suggest that people suspect that regular emissions lead to more frequent than normal chronic sinus infections, headaches, dizziness, nosebleeds, red and burning eyes, cancerous tumours, and body perspiration having an odour of sulphur.³ In addition, it is quite common for people to express fear and stress as a result of living near sour gas wells. Both the physical symptoms and psychological symptoms may lead to physical dislocation and disruption, as when families move in response to encroaching development.

Hydrogen sulphide is not the only emission of concern, however. Regular "sweet gas" wells may also contribute to a reduction in air quality

through regular emissions of gases that include polycyclic aromatic hydrocarbons, carbon monoxide, benzene, nitrogen oxides and sulphur oxides as well as particulates. In addition, construction and traffic associated with oil and gas operations may increase dust levels. Together, all of these air pollutants contribute to human respiratory diseases such as asthma.

Current regulatory response:

Oil and gas emissions, or their effects, are regulated in BC in a variety of ways. These include, amongst other things, the establishment of setbacks, measurement of ambient air quality, the establishment of emergency planning zones and the establishment of evacuation plans for sour pipelines.

The Western Interprovincial Scientific Studies Association (WISSA) recently (May 2006) completed a study of the effects of hydrogen sulphide on livestock. BC had previously indicated it will use the results of this study to inform new setback regulations.

Recommendations:

West Coast recommends the adoption of a precautionary approach to hydrogen sulphide gas and other air emissions, and greater opportunity for public input into the establishment of standards. In particular, West Coast recommends that an independent public task force (like the Alberta Public Safety and Sour Gas Committee) be established to review sour gas issues and standards (e.g. for ambient levels, setbacks, emergency procedures and no development zones) and make recommendations that are precautionary, science-based and protective of public health and safety. We recommend that statutes and regulations:

- specifically contemplate and protect vulnerable populations such as children, the elderly and asthmatics through appropriate standards;⁴
- establish a mandatory process for cumulative effects analysis, including health effects associated with background or ambient sour gas levels;
- require the collection of baseline data and require ongoing air quality monitoring;
- implement appeal procedures for the public vis-à-vis decisions having to do with public health and safety.⁵ B.C. also needs to establish a public office to receive and investigate concerns/complaints of health effects on humans or animals.⁶

2. WASTE AND BY-PRODUCT DISPOSAL

(A) PRODUCED WATER

Produced water is water that is pumped from deep underground, either in preparation for, or as a by-product of, oil and gas production. It is especially associated with coalbed methane operations, as preparation for production may entail the extraction, for months at a time, of large volumes of water from the coal seam, in order to reduce the pressure underground that keeps the methane gas bound to the coal.

The primary health and safety risks include the potential contamination of stream and groundwater sources, associated with the discharge of produced water to the surface and into streams, and subsequent potential contamination of fish or other organisms in the food chain. Produced water contaminants can include sodium and arsenic, as well as traces of heavy metals, including mercury, lead and chromium.⁷

Current Regulatory Response:

The governing standard in BC is the Code of Practice for the Discharge of Produced Water from Coalbed Gas Operations (“the Code”).⁸ The Code regulates all discharges of coalbed methane produced water resulting from coalbed gas exploration and production. The Code allows

discharges of produced water to the ground and to freshwater streams, provided the water meets the stipulated water quality standards. The Code also stipulates some requirements for monitoring, record-keeping and reporting.

Produced water by-product from conventional oil and gas operations is regulated separately and (with some exceptions) must be disposed of to an underground formation.⁹

Recommendations:

West Coast is concerned that the existing standard which permits surface and stream disposal of coalbed methane produced water allows our streams to be degraded and fails to protect fish and other aquatic life from total dissolved solids, pollutants or cumulative pollution levels. West Coast therefore recommends:

- Adoption of a precautionary approach,¹⁰ and in particular, a requirement for all discharges to be reviewed and authorized via permits on a site specific basis, rather than under a blanket, one size fits all Code of Practice.
- That deep well reinjection be mandatory,¹¹ unless geological conditions render it unsafe. Research in the United States confirms that deep well reinjection is the safest and most sustainable method for disposal of CBM produced water.
- Adoption of a stricter water quality standard for the discharges. West Coast recommends stricter standards for the substances that are currently regulated, and the addition of regulation for sodium, arsenic and sodium absorption ratio.

(B) PITS

West Coast is concerned with practices involving the disposal of toxic chemicals such as runoff from flaring operations into open earthen pits. The risk currently exists that animals and children may access pits, or that pits may be left in an unclean state - for years after production.

Recommendations:

Adopt a precautionary approach and implement best practices including:

- “Closed loop” or off-site disposal (use of professional disposal facility) systems
- Adequate monitoring, record-keeping and reporting systems so that it is easy to verify that the materials are in fact disposed of properly.
- Prohibition against pits in areas where groundwater is at pit level and require that all pits be lined with impermeable materials.
- Requirements for pit monitoring and inspection to ensure pit impermeability over time.
- Secure enclosure of pits to ensure no human or animal (livestock or wildlife) access. Guards or screens should be installed to prevent bird access.¹²

The Wildland Resources study made the following recommendations to the OGC, the petroleum industry and First Nations communities:¹³

1. Old and abandoned sumps and flare pits should be tagged for immediate disposal and clean-up.
2. Existing operations should make certain that all sumps, flare stacks and other potentially toxic substances are fenced with chain link fencing.
3. All sumps and flare pits, old and new, need to be inventoried, GPS'd and monitored throughout the entire Treaty 8 territory of northeastern BC.
4. Further research is required to determine the long term effects on all wildlife species as a result of ingesting drilling waste and flare pit chemicals.
5. Enhance corporate responsibility to ensure minimal impact to wildlife and its habitat.
6. Band offices need to establish a contaminants monitoring and reporting department.

3. OPERATIONAL HAZARDS – CONTAMINATION, SUBSURFACE DISTURBANCE AND VIBRATION

Oil and gas exploration and operations can pose two different kinds of contamination risk for human and wildlife health: the risk that naturally occurring subsurface toxics (e.g. methane or oil) once disturbed, will contaminate the surface or subsurface; and the risk that toxic substances introduced into the subsurface (e.g. fracking fluid), may migrate and contaminate soils, surface water or subsurface aquifers in unintended/unforeseen ways.

Seismic operations present an additional risk. If seismic holes are left unplugged, they may provide a conduit for the introduction of surface contaminants (agricultural runoff, etc.) into groundwater aquifers that supply drinking water.¹⁴ Seismic drilling may disrupt underground aquifers, causing water flow or quality to change.

The severe vibration of fracking may also cause methane to migrate and mix with underground drinking water sources, or rise to the surface, posing a fire risk.

Recommendations:

West Coast recommends that BC eliminate or reduce the use of toxics in oil and gas exploration and production, and their associated risks. Toxics should be phased out and replaced with non-toxic substances. If still used, government should consider whether there are some areas where toxics ought never to be permitted, or where controls ought to be instituted to avoid or reduce the risk of cross-contamination.

Activities involving significant vibration need to be adequately set back from sensitive aquifers and drinking water wells. Comprehensive baseline studies and ongoing monitoring of drinking water aquifers are further recommended.

4. NOISE – INCREASED NOISE, HEARING AND STRESS

Noise is generated at every stage of oil and gas exploration and development, by seismic explosions, drilling, construction, movement of earth, flaring, diesel generation, truck traffic,

compressor stations, turbines, cooling fans, and so on. Noise quality may vary, from a continuous drone, to intermittent noise that changes over time, to high frequency noise, low frequency noise, or extremely loud noise that may frighten wildlife and local residents.

The primary health and safety risks with noise are:

1. *Psychological impacts.* People who are exposed to noise may experience associated stress from enduring constant noise (whether loud or low-volume) or from being subject to loud irregular noises. Noise may also elicit an emotional reaction: e.g., the sudden “jet engine” noise of a flaring well may serve as a reminder of the risk of danger of a sour gas escape and exposure.
2. *Physical impacts.* Loud noises may cause hearing damage to people with sensitive or developing hearing, such as children.

Current regulatory response:

The *Oil and Gas Commission Act*, the *Petroleum and Natural Gas Act*, the *Environmental Management Act* and their respective regulations all fail to regulate noise. Online sections of the BC Oil and Gas Handbook also fail to establish any policy on noise. There is a dearth of provincial-level policy and law regulating the noise generated by oil and gas operations.

Under the *Community Charter* (s. 8(3)(h)), municipal councils are empowered to pass bylaws to address noise; and under the *Local Government Act*, under circumstances where a regional district undertakes to provide services related to noise control, regional district boards can also pass noise bylaws (s. 724). As a result, it is possible for noise to be regulated at the local level.

Recommendations:

West Coast recommends that BC consider regulatory changes that contemplate:

1. noise standards (e.g. decibel limits) for both urban and rural operations/areas, for the benefit of both residents and wildlife that are potentially impacted;

2. the use of certain sound-mitigating technologies, such as enclosures for compressor stations, the use of barriers, choice of location, standards for timing of certain operations, etc.;
3. setback increases for equipment such as compressor stations.

5. ACCIDENTS – EQUIPMENT AND PIPELINES, TAMPERING

Unsecured oil and gas well equipment presents an accident risk to the general public. Risks of well and production equipment include:

- o gas that is under high pressure
- o gears, pump jacks and other equipment that turn at considerable forces¹⁵
- o storage of flammable materials in unsecured tanks.

Pipeline at well sites, connecting valves and other equipment may also become dangerous if tampered with, or bumped into with some force, such as by a vehicle.

All of the listed risks underline the need to secure all equipment from access by animals or humans. Currently, fences and locking gates are only required for sour gas wells, which are considered high risk.

Recommendations:

West Coast recommends that all well sites and well site equipment be secured behind high fences with locking gates. Equipment needs to be isolated and secured, so that the public cannot access equipment, tamper with it, or climb onto it.

NOTES

¹ See "Determination of Threshold Levels of Sour Gas and H₂S on the Mammalian Brain", by Dr. Sheldon H. Roth, Faculty of Medicine, University of Calgary, shroth@ucalgary.ca. Also quoting from Schiffman, H₂S Health Research and Risk Assessment Symposium 2000. See also Calgary Health Region Submission to the Energy and Utilities Board, November 26, 2004 "Hydrogen Sulfide and Sour Gas Effects on the Eye. Part II: A Critique of Alberta Health and Wellness (2002) Report"

² Recent scientific study at the University of Calgary has revealed deleterious learning and memory function in snails following chronic exposure to low levels of H₂S; these findings and the precautionary principle support erring on the side of caution and consulting with local residents to be sure sour gas wells are far enough away from human habitation. (David Rosenegger, Sheldon Roth and Ken Lukowiak, "Learning and memory in *Lymnae* are negatively altered by acute low-level concentrations of hydrogen sulphide," *The Journal of Experimental Biology* 207, 2621-2630 (Accepted 4 May 2004))

Other studies on human subjects have confirmed changes in the central nervous system and effects on neurobehavioural function as a result of non-lethal exposure to H₂S; studies of patients who underwent neurophysiological testing confirmed that subjects with non-lethal exposures do not recover completely from H₂S but rather suffer adverse effects, possibly even at exposures to doses as low as 1 ppm: Kaye H. Kilburn, "Effects of Hydrogen Sulfide on Neurobehavioural Function," 96 *Southern Medical Journal* No 7, 639-646 (July 2003); Kaye H. Kilburn, "Evaluating health effects from exposure to hydrogen sulfide; central nervous system dysfunction," *Environmental Epidemiology and Toxicology* (1999), 1, 207-216 .

³ Citizen meeting to discuss health concerns with Dr. Lorna Medd, Medical Health Officer, Northern Health Region, Fort St John, BC, March 8, 2005.

⁴ Standards should contemplate and protect both smaller body sizes than the "160 pound average"; and measurement of toxicity levels should consider that toxic gases may be heavier than air and tend to

accumulate near the ground – the exact location where children crawl and walk. ("Evaluating environmental health concerns," a presentation by Dr. Gina Solomon at the People's Oil and Gas Summit, October 28-29, 2005, Farmington, New Mexico, October 28-29, 2005. Visit <http://www.earthworksaction.org/Summit.cfm> to download.)

⁵ Tim Howard, *This Land is Their Land An Audit of the Regulation of the Oil and Gas Industry in British Columbia* (Vancouver: Sierra Legal Defence Fund, 2005), p. 34: "Create stronger institutional accountability and review mechanisms. It is unacceptable that a company can appeal the loss of a lease, but a landowner with a sour gas well 100 m upwind has absolutely no appeal or review rights. The provincial government should review appeal and review procedures in other jurisdictions, including Alberta, and amend the PNG Act to provide for appeal rights from decisions affecting landowners, First Nations and communities."

⁶ See 10 Steps...Also note that Alberta has a formal process for investigating complaints of health effects on animals.

⁷ "Lead, chromium and nickel are often among the most abundant. Also, barium, manganese, iron, strontium, zinc, silver, cadmium, lithium, copper, mercury, arsenic, selenium, boron and antimony may also be present in produced water." ("Produced water from oil and gas production," a presentation by Lisa Sumi of the Oil and Gas Accountability Project, at the People's Oil and Gas Summit, Farmington,,New Mexico, October 28-29, 2005. Visit <http://www.earthworksaction.org/pubs/Sumi2.pdf> to download.)

⁸ The Code is authorized by the Waste Discharge Regulation, B.C. Reg. 320/2004, which is itself authorized by the *Environmental Management Act*

⁹ Section 94 of the Drilling and Production Regulation addresses water produced as a by-product of conventional oil and gas operations. Unlike coalbed methane produced water, any produced water from conventional operations is required to be disposed of to an underground formation in accordance with a scheme approved under s. 100(1)(d) of the Act, or by a method acceptable to an authorized OGC employee.

On an emergency basis, and in keeping with certain requirements set out, earthen pits may be used to contain produced water on an interim basis until the water can be disposed of underground. Underground disposal is required to be reported to the OGC on a monthly basis.

- ¹⁰ For a full review of West Coast's concerns with the Coalbed Methane Code of Practice, please see "Comments on the B.C. Ministry of Water, Land and Air Protection's Coalbed Methane Produced Water Code of Practice Intentions Paper," and Center for Science in Public Participation, "Technical Review Code of Practice for the Discharge of Produced Water from Coalbed Gas Operations in British Columbia." Both are found on West Coast website at <http://www.wcel.org>.
- ¹¹ Kuipers, J., K. MacHardy, W. Merschhat and T. Myers, 2004. Coalbed Methane Produced Water: Management Options for Sustainable Development. Prepared for Northern Plains Resource Council, Billings, MT. Recently, Alaska passed Bill HB395, which states the commission may regulate "...the hydraulic fracturing of shallow natural gas wells to assure protection of drinking water quality by requiring reinjection of the water produced from coal seam dewatering to depths below known subsurface water supplies that are a source of the owner's drinking water for human consumption or that are used by the owner for agricultural purposes." West Coast recommends that B.C. adopt a similar legislative requirement for the regulation of produced water, to protect the safety of drinking water and other freshwater supplies.
- ¹² Chapter 5 of the California Laws for Conservation of Petroleum & Gas (January 2005) requires that whenever the supervisor receives written notice of an oil sump that is hazardous to wildlife, he shall forthwith give written notice to the operator to clean up or abate the condition by screening or eliminating the oil sump...if not done within 10 days or 30 days (depending on urgency of situation specified) the supervisor shall order the closure of the oil and gas production operation. See <ftp://ftp.consrv.ca.gov/pub/oil/laws/PRC01.pdf>
- ¹³ Claudia Houwers, *Petroleum Contaminants Community Research Project Final Report* (Fort St. John: Wildland Resources, April 2004), p. 7

¹⁴ *This Land is Their Land*, p. 19

¹⁵ In 2005, a 12-year old New Mexico girl was tragically killed after she climbed onto a pump jack and was caught and crushed by the movement of its high pressure hydraulic equipment. The child was able to access the pump jack (located 3-4 miles from any home and having a lower safety rail than similar equipment located closer to towns and residential areas) despite the fact that safety equipment in place met the prevailing regulations. "Girl, 12, dies playing on pump jack," by Valerie Gritton, *Farmington Daily Times* (April 5, 2005)