Safety Buffers between Gas Wells and Pipelines and Public Schools

By Jacqui McMorran, law student

and

Tim Thielmann and Calvin Sandborn, lawyers

For the Peace Environment and Safety Trustees Society (PESTS)

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DEVLIN GAILUS
Barristers & Solicitors
Nootka Court, Suite C100
633 Courtney Street
Victoria, BC V8W 1B9
Tel. 250.361.9469
http://www.devlingailus.com/

Environmental Law Centre
UNIVERSITY OF VICTORIA
PO Box 1700, STN CSC
Victoria, BC V8W 2Y2
Tel. 250.721.8188
www.elc.uvic.ca

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I. INTRODUCTION[1]

The oil and gas industry in northeast British Columbia is poised to enter an era of unprecedented expansion. If LNG exports proceed as planned, more than 6,000 new gas wells could be needed in the northeast.[2] Many of these wells contain potentially lethal volumes of sour gas and other harmful pollutants, and many of them are being installed in close proximity to elementary schools[3]. This Report includes a focus on health and safety issues faced by children in School Districts 59 and 60 in the Peace District of northeast BC. The authors document the research regarding the particular vulnerability of children to environmental pollutants, as well as unique challenges schools face in preparing for gas leak emergencies, and the regulations governing setback distances, emergency response planning, leak detection, and gas flaring. Each section concludes with a number of recommendations for enhancing public health and safety.

II. THE PROXIMITY OF WELLS AND PIPELINES TO SCHOOLS

Elementary school children are at a critical and sensitive age in their physical and mental development. Yet, within School District 59 (Peace River South) and 60 (Peace River North) alone, there are nine schools that are or have been located within oil and gas emergency response zones ("ERZs").[4] The following Google Earth images illustrate the issue facing the children and staff in these schools.[5]

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[1] This document is a sequel to the April 2012 memo "Improving Public Health and Safety Near Oil and Gas Operations: Selected Issues" by Tim Quirk and Katrina Andres of the Environmental Law Clinic. This document incorporates the research from April 2012, and expands on that research and set of recommendations, with a specific focus on improving safety buffers between oil and gas infrastructure and schools. Both memos were prepared for the Peace Environment and Safety Trustees Society (PESTS).

[2] See the National Bank Financial Daily Bulletin, July 9, 2013, "Quantifying the LNG Impact: Potential for Up To $11 Bln (30%) Lift to Annual E&P Spending Over the Next Decade".

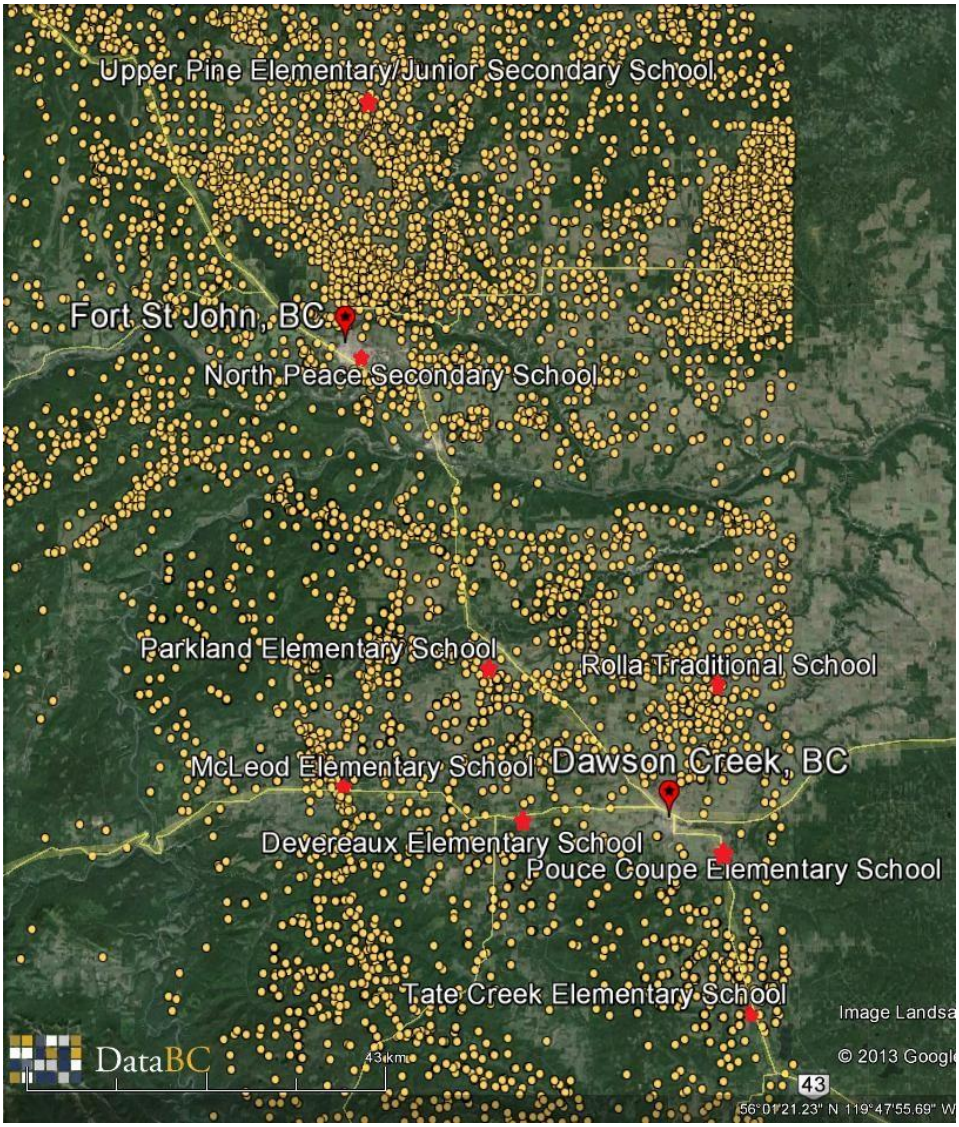
[3] Even when companies are drilling for sweet gas found at a certain depth, they often drill through zones (or pockets) that contain sour gas (H_2S). The Montney Formation is currently the main focus for natural gas development. This varies from very low levels to lethal concentrations depending on geographic location. Regardless, sour gas zones and sour gas pockets must be drilled though before reaching the Montney Formation. In addition, well blowouts do occur with the potential for an H_2S release. When ignited this gas converts to SO_2. "Molecule for molecule, SO_2 is more toxic than H_2S…but H_2S can present a unique danger because of its effects on the nervous system at higher concentrations" - Sour Gas and Your Health – Intrinsik Environmental Sciences Inc. http://www.intrinsik.com/environment/docs/Sour_Gas_and_Your_Health-Intrinsik-2009.pdf

[4] Schools that are or have been within an ERZ in Districts 59 and 60 include Devereaux Elementary, Mcleod Elementary, Rolla Traditional, Tate Creek Elementary, Clearview Elementary/Junior Secondary, Upper Pine Elementary/Junior Secondary, North Peace Secondary, Parkland Elementary School, and Pouce Coupe Elementary. These elementary schools run from kindergarten up to grade 7, with children between the ages of five and thirteen. Clearview School runs from kindergarten to grade 10 and Upper Pine runs from kindergarten to grade 8. School District 59, online: <http://www.sd59.bc.ca/>, last accessed 16 August 2013; and School District 60, online: < http://www.prn.bc.ca/>, last accessed 16 August 2013.

[5] The images below show gas wells and pipelines near schools. Note that these images are created with Google Earth and DataBC, and are accurate to the extent that Google Earth and DataBC are accurate and current. The gas wells and pipelines are

Overview

This image provides an overview of the situation faced by these schools. It depicts gas well sites near schools that are or have been within an Emergency Response Zone.



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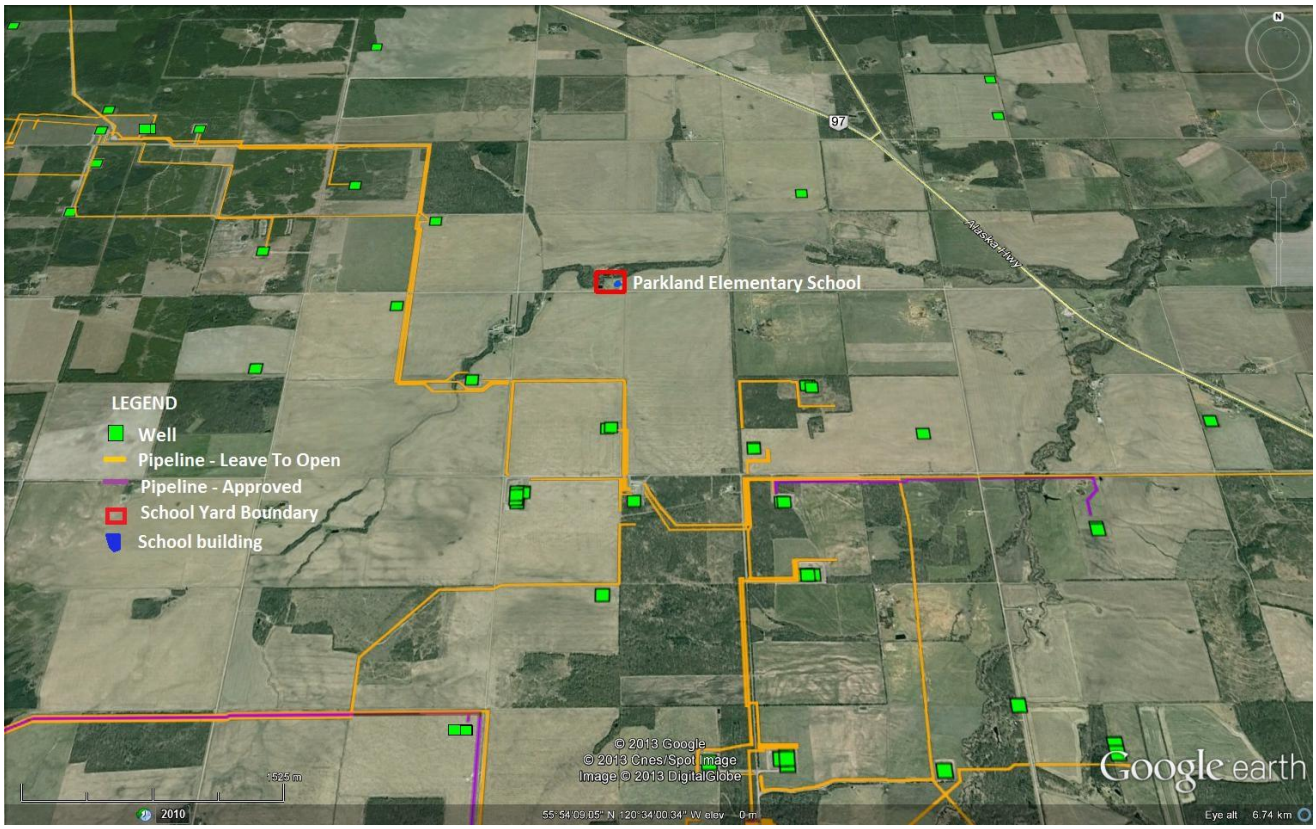
plotted using data from DataBC. The distance measurements between schools and wells and pipelines are approximate and calculated using the Google Earth Ruler function to measure distances between two points. Measurements were taken from the midpoint of the school building to the nearest pipeline and well edge. The wells indicated on maps include active, suspended and abandoned wells (since suspended and abandoned wells can be reopened).

The following images show gas wells and pipelines near the individual schools.

Parkland Elementary School



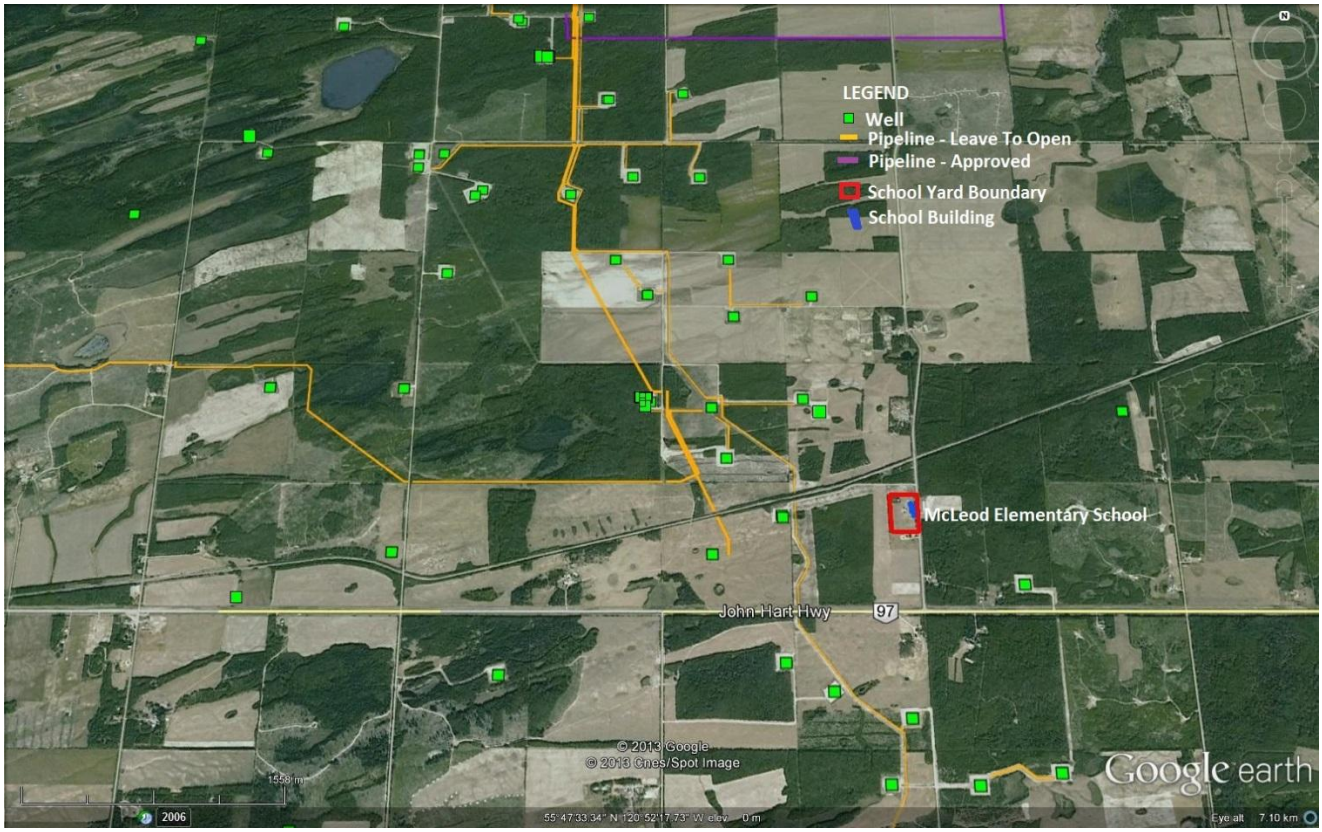
Google Earth Scale = 1525 meters

Closest Pipeline approximately 878 meters

Closest Well approximately 1276 meters

NOTE: There are 22 wells on nine pads within approximately 2000 meters of Parkland Elementary School

McLeod Elementary School



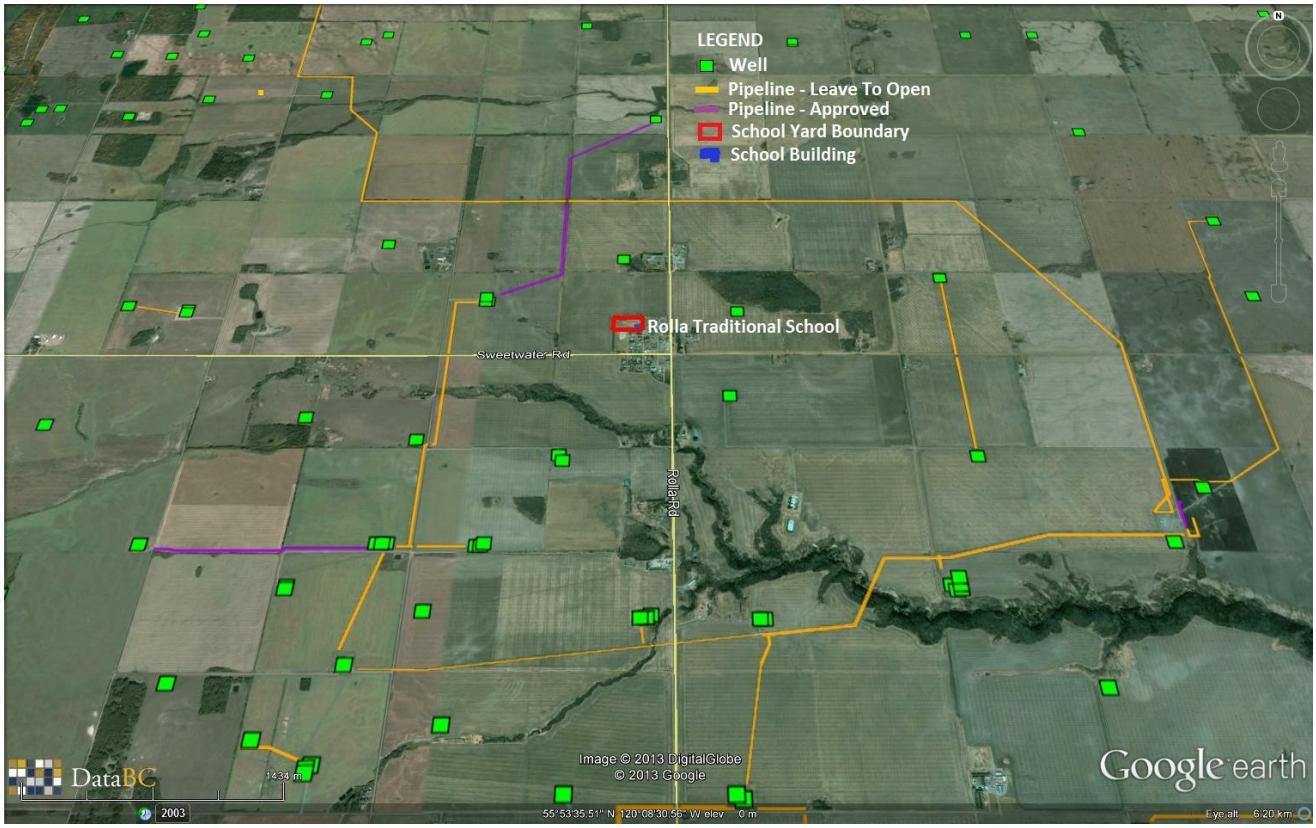
Google Earth Scale = 1558 meters

Closest Pipeline approximately 732 meters

Closest Well approximately 813m

NOTE: There are 29 wells on 16 well pads within 2000 meters of McLeod Elementary School

Rolla Traditional School



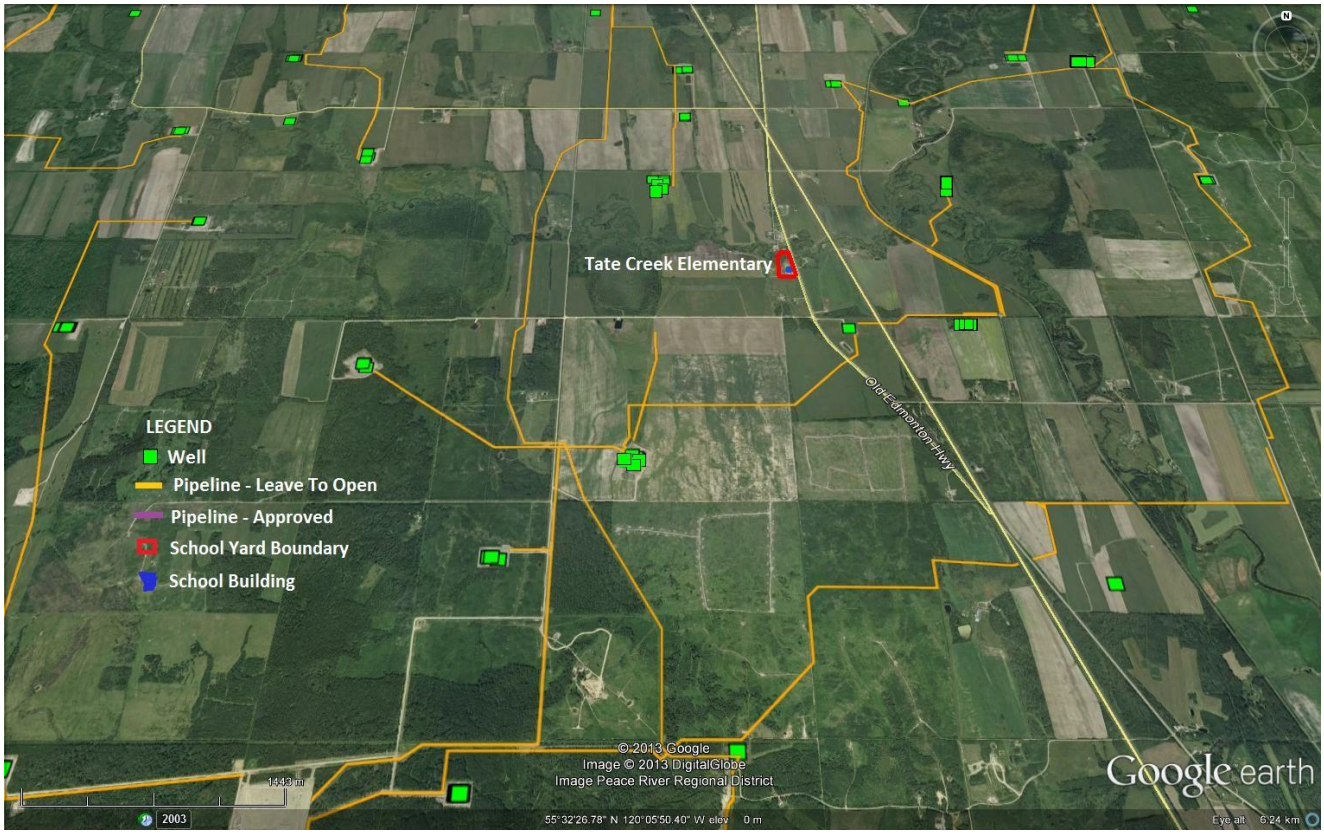
Google Earth Scale = 1434 meters

Closest Pipeline approximately 770 meters

Closest Well approximately 680 meters

NOTE: There are eight wells on five well pads within 2000 meters of Rolla Traditional School

Tate Creek Elementary



Google Earth Scale = 1443 meters

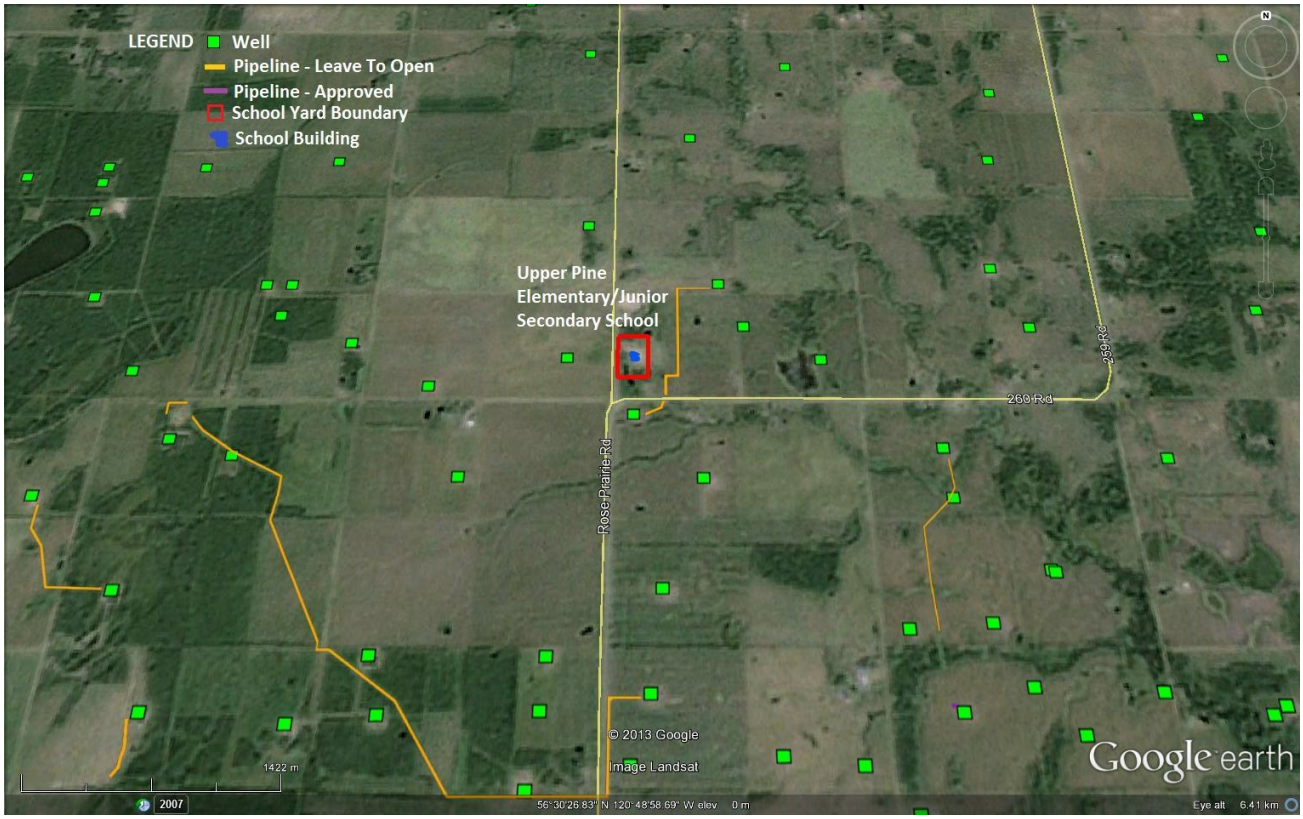
Closest Pipeline approximately 700 meters

Closest Well 700 meters

Closest Multi-Well pad is to the Northwest approximately 1359 meters

NOTE: There are 24 wells on six pads within approximately 2000 meters of Tate Creek Elementary School, with an extra seven wells on a pad within 2000 meters of the playground.

Upper Pine Elementary/Junior Secondary



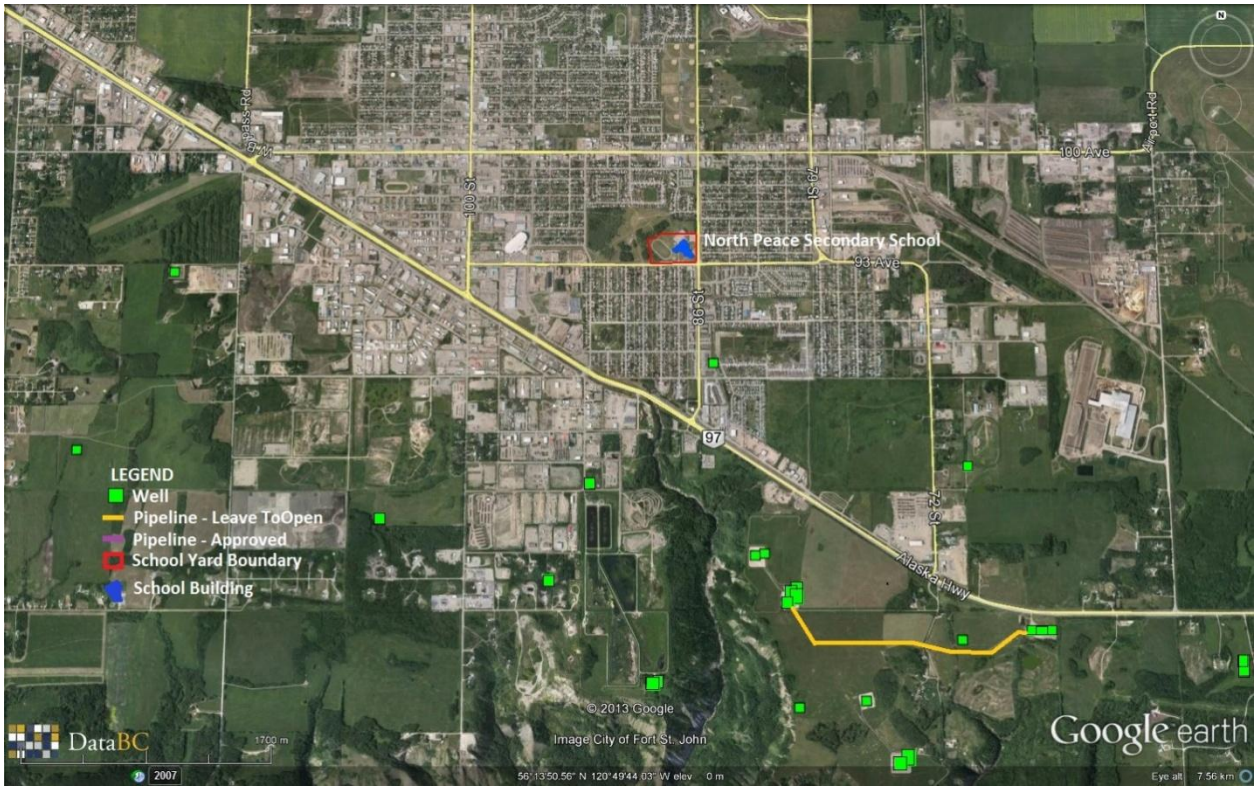
Google Earth Scale = 1422 meters

Closest Pipeline approximately 236 meters

Closest Well approximately 415 meters

NOTE: There are thirteen wells on twelve pads within 2000 meters of Upper Pine Elementary/Junior Secondary School

North Peace Secondary School

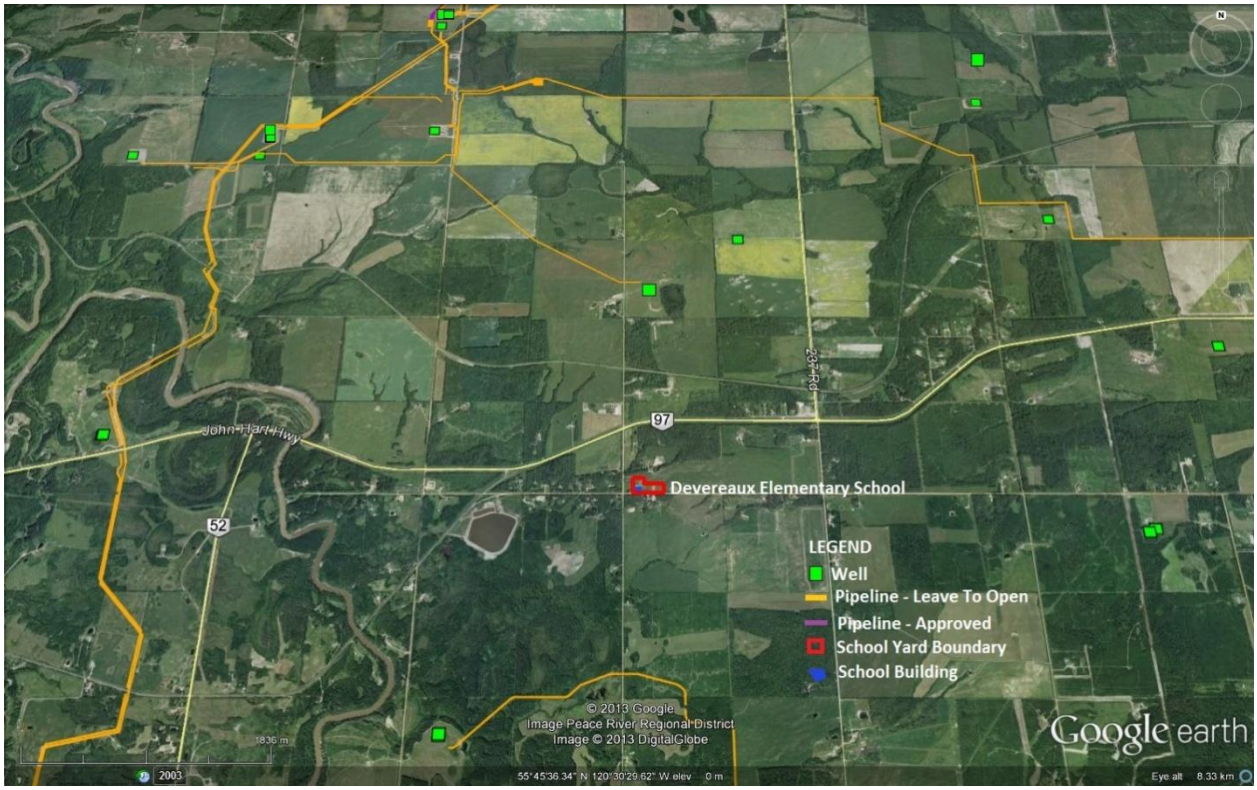


Google Earth Scale = 1700 meters

Closest Pipeline approximately 2610 meters

Closest Well approximately 800 meters

Devereaux Elementary



Google Earth Scale = 1836 meters

Closest Pipeline approximately 1466 meters

Closest Well approximately 1830 meters

Pouce Coupe Elementary

Google Earth Scale = 1970 meters

Closest Pipeline approximately 4710 meters

Closest Well approximately 1990 meters

III. HEALTH AND SAFETY RISKS OF OIL AND GAS DEVELOPMENT

A. Scientific Evidence

Pollution of the air from gas operations can present a variety of risks to health and safety, including the following:

- Studies in Alberta have found a connection between cattle proximity to flare sites and increased incidences of reproductive complications.
- Air emissions from gas production contain significant concentrations of volatile organic compounds (VOCs), such as benzene, toluene, ethylene, and xylene, as well as other highly toxic dioxins.[6]
- VOCs can travel up to 100 kilometres when carried by ambient winds.[7] VOCs releases are precursors to smog[8] and extremely carcinogenic. Toluene is carcinogenic and a potent central nervous system toxicant.[9] Xylenes are developmental-toxins leading to delayed development, decreased fetal body weight and altered enzymes.[10] Benzene is a class 1 carcinogen with zero recommended exposure and acknowledged health risk at any level of exposure.
- Natural gas flares emit carbon particles (soot), unburned hydrocarbons, carbon monoxide, other partially burned and altered hydrocarbons, nitrogen oxides and SO_2. Exposure to air polluted by flaring has been linked to cancer and other diseases. Sulfide dioxide (SO_2) is a powerful respiratory irritant which can injure or kill.[11]

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[6] M Strosher, "Investigations of Flare Emissions in Alberta, Final Report to Environment Canada Conservation and Protection" (November 1996) *The Alberta Energy and Utilities Board, and the Canadian Association of Petroleum Producers,* Environment Technologies, Alberta Research Council Calgary, Alberta, online: <http://www.ags.gov.ab.ca/publications/SPE/PDF/SPE_005.pdf> ("M Strosher") contains a chart which identifies a "short-list" of 43 of the chemicals found downwind of sweet flare plumes.

[7] M Strosher

[8] Charles G Groat and Thomas W Grimshaw, "Fact-Based Regulation for Environmental Protection in Shale Gas Development" (February 2012) *A Report By The University of Texas at Austin Energy Institute*, online: Colorado Energy Water Consortium, online: <http://groundwork.iogcc.org/sites/default/files/UT%20Energy%20Inst%20%20Fracking%20Report%202-15-12%20.pdf> at 27.

[9] M Strosher, contains a chart which identifies a "short-list" of 43 of the chemicals found downwind of sweet flare plumes.

[10] M Strosher

[11] The World Health Organization reviewed 120 peer reviewed studies of the health effects of SO_2. A panel of approximately 80 experts recommended, by consensus, that 20 ug/m3 24 hour average be the WHO guideline for SO_2. These studies were mostly mortality studies. The WHO further acknowledged studies that showed significant effects (i.e. increased death) following 24 hour exposures to very low concentrations of SO_2. Studies have shown reproductive effects, such as low birth weight pre-term birth, are also significantly associated with a number of pollutants including SO_2 in low 24 hour concentrations. See *"WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide"* (2005) online: <http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf>; Shiliang Liu, Daniel Krewski, Yuanli Shi, Yue Chen, and Richard T Burnett "Association between Gaseous Ambient Air Pollutants and Adverse Pregnancy Outcomes in Vancouver, Canada" (November 2003) *Environmental Health Perspectives* 111:14, 1773, online: <http://www.ncbi.nlm.nih.gov/pubmed/14594630>.

- Studies in Nigeria indicate that emissions from flares may corrode the roofs of nearby buildings; impair plant growth; reduce hemoglobin and red blood cell counts; and increase abnormalities in blood cells.[12]

One of the greatest health and safety risks associated with oil and gas development arises from the potential release of hydrogen sulfide (H_2S), which due to its odour is also known as "sour gas." Currently, the BC Oil and Gas Commission (OGC) only classifies pipelines carrying more than 10,000ppm of H_2S as sour pipelines.[13]

The harmful effects of H_2S have been well documented. Sour gas was used as a chemical weapon in World War I. In British Columbia, there have been 73 documented leaks in a recent five-year period. Over the last 30 years, 34 workers in BC and Alberta have died from sour gas leaks. The effects of H_2S depend on its concentration and the duration of exposure. It is lethal to humans even at very low concentrations. The US Centre for Disease Control (CDC) has established that 100 parts per million (ppm) of H_2S is "immediately dangerous to life and health."[14] At 600ppm, H_2S is lethal at exposures of 30 minutes. At 800ppm, it is lethal in 5 minutes.[15] Concentrations between 700 - 1,000 ppm can result in rapid loss of consciousness, cessation of respiration and death.[16] Acute exposure may also cause "reduced respiratory function, eye and nasal irritation, headache, and nausea."[17] Concentrations as low as 50 to 100 ppm can cause respiratory irritation in one hour.[18] Multiple studies have confirmed adverse health effects from chronic exposure, including depression, fatigue and reduced mental function.[19]

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[12] Environmental Law Centre, February 2012, Recommendations for Human Health Risk Assessment of British Columbia Oil and Gas Development; United States Environmental Protection Agency, "Emission Factors" (2005) online: <http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s05.pdf> at para 13.5.

[13] BC Oil & Gas Commission, "B.C. Oil and Gas Commission Emergency Response Plan Requirements", (2004), online: <http://www.bcogc.ca/document.aspx?documentID=746&type=.pdf>, last accessed 16 January 2013.

[14] Center for Disease Control, "Documentation for Immediately Dangerous To Life or Health Concentrations (IDLHs)", (May 1994), online: <http://www.cdc.gov/niosh/idlh/7783064.html>,("Center for Disease Control")>, last accessed 27 July 2013.

[15] Center for Disease Control, last accessed 27 July 2013.

[16] Center for Disease Control, last accessed 27 July 2013.

[17] Michigan Department of Community Health , "Health Consultation" (3 May 2010), online <http://www.atsdr.cdc.gov/HAC/pha/WestBranchOilField/WestBranchOilFieldsHC532010.pdf>,("Michigan Department of Community Health")>, last accessed 27 July 2013.

[18] The American Industrial Hygiene Association in the United States has established Emergency Response Planning Guidelines, to protect the health of the public in the event of an emergency hydrogen sulfide leak. The guidelines specify a one hour exposure limit.

[19] The above information is documented in Environmental Law Centre, (February 2012) "Recommendations for Human Health Risk Assessment of British Columbia Oil and Gas Development".

B. Particular Vulnerability of Children

The Environmental Law Centre paper "Children's Clean Air Act Backgrounder" summarized various studies regarding particular vulnerability of children to air pollutants and reported the following findings:[20]

Children are more vulnerable than adults to environmental pollutants due to:

- Their physiological makeup, their activities and pastimes and as a result of the fact that their bodies are still growing and developing.
- Children spend more time outside than do adults, and when outdoors, they tend to be more active than adults, breathing faster during play activity, and therefore increasing exposure to outdoor air pollutants.
- They might also be more exposed because at the time they come home from school to play in the afternoon, ozone levels are usually peaking.
- They are also more often involuntarily exposed to environmental chemicals because they are still dependent on adults for their supervision and care and are not sufficiently cognitively developed to avoid environmental exposures on their own.

Differences between children and adults:

- Children are smaller than adults, they breathe more rapidly than adults and, as a result of having smaller lungs, they have a much greater surface area to volume ratio, resulting in a greater dose of pollution delivered to their lungs. As a result, children's absorption of contaminants through inhalation is greater than that of adults.
- Children have narrower airways than adults and irritation or inflammation caused by air pollution that would produce only a slight response in an adult can result in a potentially significant obstruction in the airway of a young child.
- Because children's lungs and airways are still developing, they are especially sensitive to air pollution.
- Overall, children's developing organs and tissues are more susceptible to damage from some environmental contaminants than are adult organs and tissues.

In a Health Consultation paper prepared by the Michigan Department of Community Health, the vulnerability of children to H_2S exposure was specifically considered. The paper noted that since H_2S is denser than air, "it may be more concentrated near the ground than higher up."[21] Children, being shorter than adults, breathe vapors found closer to the ground, and thus may breathe greater amounts of H_2S, and receive a larger dosage per unit of body weight than adults.

[20] Environmental Law Centre, "Children's Clean Air Act Backgrounder" (May 2005), online: <http://www.elc.uvic.ca/projects/2005-02/ChildrensCleanAirActBackground.pdf>, last accessed 16 August 2013.

[21] Michigan Department of Community Health, last accessed 16 August 2013, at 10.

"Children under 18 years of age had a stronger association between hospital visits for asthma and a high exposure to H_2S (on the day previous) as compared to the association with adults."[22] *"The developing body systems of children can sustain permanent damage if toxic exposures are high enough during critical growth stages. Injury during key periods of growth and development could lead to malformation of organs (teratogenesis), disruption of function, and premature death."*[23]

In 2012, expert Miriam Rotkin-Ellman for the Natural Resources Defence Council (NRDC) provided comments regarding public health implications for Colorado's proposed setbacks for natural gas development.[24] She provided a summary of studies examining health impacts at schools in relation to their proximity to a pollution source. She used an array of public health organizations and scientific reports to inform her analysis and recommendations. The findings include the following:

- Children in schools 100 to 1,000 metres from a pollution source recorded higher levels of respiratory problems based on proximity to the pollutant source;
- Children in schools within 2,000 metres of an industrial source showed a correlation between air pollution levels and poor school performance; and
- Children in schools within 5,000 metres of a pollution source found DNA damage associated with proximity to the pollutant source.[25]

Rotkin-Ellman concludes that the

"…research, monitoring data, and public health expertise available to date indicate that oil and natural gas facilities produce air pollution that can increase health risks. The risks increase with proximity, particularly for populations more vulnerable to the impacts of air pollution, which include children, elderly, and those with underlying health problems. In addition, proximity to these facilities can also subject individuals to light and noise pollution and increases health and safety risks from explosions and other malfunctions."[26]

Lana Skrtic discusses the threats of H_2S to human health. In a literature review of acute exposure to H_2S, she finds that "the hazard zone for sublethal effects around sour gas wells encompasses from less than 400 meters up to 6,500 meters, while lethal exposure to H_2S could occur as far as 2,000 meters from the source."[27] Note that the BC schools above all fall within the "hazard zone" identified in this University of California study.

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[22] Michigan Department of Community Health, last accessed 16 August 2013, at 10.

[23] Michigan Department of Community Health, last accessed 16 August 2013, at 10.

[24] Miriam Rotkin-Ellman, "Comments of Miriam Rotkin-Ellman Regarding Proposed Colorado Oil and Gas Conversation Commission Statewide Setbacks and Public Health" (19 December 2012), Final Prehearing Statement of Colorado Environmental Coalition, et al., online: < http://cogcc.state.co.us/RR_HF2012/setbacks/PrehearingStatements/1211-RM-04%20Western%20Resource%20(et%20al)%20Prehearing%20Statement%20with%20Exhibits.pdf>, ("Miriam Rotkin-Ellman"), last accessed 16 August 2013.

[25] Miriam Rotkin-Ellman, last accessed 16 August 2013.

[26] Miriam Rotkin-Ellman, last accessed 16 August 2013.

[27] Lana Skrtic, "Hydrogen Sulfide, Oil and Gas, and People's Health" (2006) University of California, Berkely, online: <

C. Recent Incidents in Northeast BC

The Pouce Coupe incident of November 22, 2009 provides an example of how existing regulatory standards and emergency response processes have failed to protect the health and safety of local residents. As recorded in the UVic Environmental Law Centre's paper "Improving Public Health and Safety Near Oil and Gas Operations: Selected Issues," residents reported smelling H_2S six hours before a sour gas pipe suddenly failed. After the pipe failed, another 27 minutes elapsed before an emergency shutdown valve was automatically activated --and the gas continued to flow, as the break was below the emergency shutdown valve. Residents in the emergency planning zone were not contacted until nearly two hours had elapsed -- and it took Encana more than two hours to stop the leak. The leak reportedly resulted in the death of a horse and respiratory problems in local residents.[28]

There have been numerous incidents where schools in northeastern BC have had to undergo safety precautions due to the risk of a sour gas leak. On October 16, 2008, Tate Creek Elementary School was forced into lock down due to a sour gas leak from a nearby pipeline. The leak was caused by an explosive device set by the "Encana bomber," which caused a sour gas release.[29] This incident exposed serious challenges schools face in implementing Emergency Response Plans (ERPs). First, Tate Creek School was expected to duct tape cracks around school windows and doors. But this proved impractical and was not implemented. More important, the school was expected to shut off all furnaces and ensure outside air dampers were closed. But during the incident, the school only shut down two of its furnaces, later finding out that two more remained on during the leak, including the primary air-intake furnace.[30] Fortunately, the failure to fully implement lock-down procedures did not appear to result in any serious bodily harm.

At Upper Pine School, a gas well was drilled approximately 500 metres from the school. On October 5, 2004 the hallways and classrooms of the schools were permeated with sulfurous gas fumes resulting from a truck servicing the nearby gas well. Fortunately, the principal was able to contact the company responsible for the well and terminate the leak. Because the well was considered a "sweet gas" well, the school was not in an ERZ and had no emergency response plan ("ERP") in place. Since the leak, the Upper Pine School has taken precautionary measures including having school buses parked at the school on drilling days that might produce sour gas and using air monitoring equipment.[31]

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http://erg.berkeley.edu/people/Lana%20Skrtic%20-%20Masters%20Paper%20H2S%20and%20Health.pdf >, last accessed 16 August 2013, at 18.

[28] Environmental Law Centre, April 2012, Improving Public Health and Safety Near Oil and Gas Operations: Selected Issues; BC Oil and Gas Commission, "Failure Investigation Report", (November 2010), online: < http://www.bcogc.ca/document.aspx?documentID=1026&type=.pdf>.

[29] Author's personal email with Rob Dennis, Assistant Superintendent School District #59 (Peace River South), June 25, 2013.

[30] Author's personal telephone conversation with Christina Elywood, former Principal of Tate Creek Elementary School, 12 July 2013.

[31] Ben Parfitt, "Gas Well Worries Principal", straight.com, (16 December 2004), online <http://www.straight.com/news/gas-well-worries-principal>, last accessed 16 August 2013.

Clearview Elementary School took precautionary measures around 2006 when there was drilling on land next to the school. School officials determined that it was necessary to have buses on standby in case there was a safety risk from drilling operations.[32]

Local Peace River residents recently protested the proposal for two wells to be drilled less than one kilometre west of Rolla Traditional School.[33] With west winds and the proximity of the wells, residents were greatly concerned about the proposal. Members of the community, including the principal wrote letters to the Oil and Gas Commission (OGC) expressing their concerns. Notwithstanding these concerns, both wells were approved and have been drilled.[34]

A well pad has recently been cleared within 1.2 kilometres of Parkland Elementary School in Farmington as well. Encana plans to drill four wells on the pad in 2013 and possibly into 2014. Encana has had some discussions with the school board and it has been agreed that Encana will provide school buses on standby to alleviate concerns if necessary.[35]

IV. EMERGENCY PROCEDURES AND SCHOOLS

A. Current Procedures

School District 59 has issued a "Safety Guidelines and Practices" memo to protect the well-being of students and employees in the event of an uncontrolled gas leak (see Appendix A). The plans and practices were developed through cooperation with the Peace River Regional District, the Oil and Gas Industry, and School District 59. In the event of a gas leak, the school must attempt to contact the drilling company responsible to determine whether or not to evacuate the school. There is therefore a deep reliance of schools on oil and gas personnel and their monitoring equipment.[36]

As a part of their ERP, it is a drilling company's responsibility to provide information to schools and other stakeholders within the ERZ of the company's operations. However the school must provide the following information to parents:

- Parents will be informed of the drilling operations schedule in advance, by way of school newsletter, or a notice to parents through other media;
- Shortly after the drilling operation has commenced, a reminder notice will be sent home with

[32]Author's personal email with Chad Cushway, Supervisor of Safety Services School District #60 (Peace River North), 27 June 2013.

[33] Author's personal telephone conversation with Mary Miller, Dawson Creek Resident, 12 July 2013.

[34] Author's personal telephone conversation with Mary Miller, Dawson Creek Resident, 12 July 2013.

[35] Allison Gibbard, "Learning with Gas Wells" (25 March 2013), Dawson Creek Daily News, online: <http://m.dawsoncreekdailynews.ca/article/20130325/DAWSONCREEK0101/130329935/0/dawsoncreek0101/learning-with-gas-wells&template=JQMArticle >, last accessed 29 July 2013.

[36] School District 59 (Peace River South), "Safety Guidelines and Practices: Where Oil and Gas Activity is in the Vicinity of a School District 59 School", online <http://www.sd59.bc.ca/pubs/pdfs/Oil%20and%20Gas%20Safety%20Guide.pdf>, ("School District 59"), last accessed 16 August 2013.

the students. This reminder will detail the emergency procedures that will remain in place, including the emergency evacuation plan;

- If parents are concerned regarding drilling operations, the school will provide a venue for the drilling company to host a meeting that will address concerns.[37]

District 59's "Stay in Place" procedure involves:

- immediately gathering all students, faculty and staff indoors;
- closing and locking all windows and outside doors;
- if possible duct taping the crack around exterior doors and window frames;
- turning off all appliances and equipment that either blow outside or suck air into the school;
- shutting off furnaces and ensuring outside air dampers are closed; and
- turning off ventilation fans over stoves.[38]

The "Evacuation Procedure" involves evacuating students, staff, and faculty from the school if it is deemed by oil and gas personnel to be necessary. Evacuation will be done via a school bus; however, the school bus will only approach the school if it is deemed safe for the bus to do so.[39]

B. Other Jurisdictions

Alberta's Parkland School Division No. 70 has provided a comprehensive Standard of Conduct (see Appendix B), which was collaboratively developed with the Parkland School Division and the individual Oil and Gas companies operating in that region. This Standard of Conduct outlines additional safety measures schools and companies will implement in addition to Alberta's legislative requirements. These requirements address training, notification, air monitoring, and evacuation, among other things. The Standard of Conduct includes the following measures:

- Provide training to staff and bus drivers including, but not limited to, oil and gas operations, H_2S awareness, emergency planning and response, and oil and gas regulations. The training costs will be reimbursed by the industry operators; [40]
- Industry operators will make every effort to plan the drilling and completion operations...to coincide with periods where school is not in session. If circumstances do not permit this to happen, a face-to-face meeting will take place between the responsible Company and Parkland School Division to ensure that all required emergency plans and precautions have been implemented; [41]
- Detailed notifications will be given to schools and completed as follows:

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[37] School District 59 , last accessed 16 August 2013.

[38] School District 59, last accessed 16 August 2013.

[39] School District 59 >, last accessed 16 August 2013.

[40] Parkland School Division No. 70, "Standard of Conduct" (23 June 2009), ("Parkland School Division No. 70") at 1.2.

[41] Parkland School Division No. 70, at 3.3

- intention of drilling;
- commencement of drilling operations (5 business days);
- prior to entering a sour zone a 4 day, 96 hours, timeframe to include a minimum of one instruction day, where relevant;
- When sour drilling operations are completed;
- Prior to commencing sour well completion operations;
- Prior to well testing/flaring operations;
- When sour well completion/testing operations are completed; and
- Well servicing operations[42];

- Industry operators will provide and support the costs of addition safety equipment necessary to address concerns of staff, bus drivers and students;[43]
- Temporary air monitoring equipment will be placed between the school and wellsite during drilling and completion operations and when a school is within a Protective Action Zone (PAZ);[44]
- For schools inside EPZ, during a level-2 emergency[45]a rover will be equipped to monitor H_2S levels and will lead the School Bus out of the EPZ;[46]
- The responsible company will be responsible to compensate the school division for any costs associated with emergency evacuation;[47] and
- Decisions regarding permanent air quality monitoring for the school division will be made in accordance with the Drayton Valley Pembina Sentinel Air Monitoring System.[48]

C. Recommendations

1. The Parkland School Division No. 70's "Standard of Conduct" should be considered as a blueprint for school districts in northeast BC wishing to develop or improve training, notification, monitoring, and evacuation procedures.[49]
2. Schools should review Emergency Response Plans with new staff and regularly with all staff, students, and parents.

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[42] Parkland School Division No. 70, at 3.4

[43] Parkland School Division No. 70, at 3.7.

[44] Parkland School Division No. 70, at 3.8.

[45] "Level-2 Emergency" is defined in Directive 071 "as an incident where there is no immediate danger outside the licensee's property or the right-or-way, but there is the potential for the emergency to extend beyond the licensee's property. Outside agencies must be notified. Imminent control of the hazard is probable but there is a moderate threat to the public and/or the environment. There may be local and regional media interest in the event." - Alberta Energy Regulator, "Directive 071 – Emergency Preparedness and Response Requirements for the Petroleum Industry" (24 November 2009), online <http://www.aer.ca/documents/directives/Directive071-with-2009-errata.pdf>, last accessed 16 August 2013.

[46] Parkland School Division No. 70, at 4.2.

[47] Parkland School Division No. 70, at 4.6.

[48] Parkland School Division No. 70, at 5.3.

[49] See Appendix B.

V. SETBACKS

A. Current Standards

The *Oil and Gas Activities Act* is the overarching legislation in British Columbia for oil and gas activities. The *Drilling and Production Regulation* and *Pipeline and Liquefied Natural Gas Facility Regulations* provide guidance on setbacks for wellsite, facility, and pipelines.

1. Well Setbacks

In British Columbia, oil and gas wells can be drilled up to 100 metres away from places of "public concourse," which includes schools.[50] There is no requirement that wells with the potential to release sour gas be set back at greater distances, nor is consideration given to the volume or concentrations of potential sour gas releases in the determination of setback distances.

2. Facility Setbacks

There are currently no minimum setbacks for oil or gas facilities, such as pump stations.[51]

3. Pipeline Setbacks

The *Oil and Gas Activities Act* and its regulations do not specify any minimum setback distance for oil and gas pipelines. Pipeline setbacks were formerly governed by the *Sour Pipeline Regulation*[52] (SPR), until it was repealed on October 4, 2010 and replaced by the *Pipeline and Liquefied Natural Gas Facility Regulation*[53] (PLNGFR). Section 3 of the SPR had calculated pipeline setbacks based on the H_2S concentrations of gas within pipelines. Under the SPR, level 3 pipelines[54] were set back up to 1,500 metres from urban and public facilities, which included schools. There was also the potential for the chief inspecting engineer to require level 4 pipelines[55] to be set back at a distance greater than 1,500 metres.

However, these standards were not carried over to the PLNGRF and therefore do not apply to any new pipelines constructed in the province. In their place, the PLNGF requires only that the design, construction, operation, and maintenance of pipelines must be in accordance with the Canadian Standards Association's "CSA Z662, Oil and Gas Pipeline Systems" document, as it may be amended from

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[50] *Drilling and Production Regulation,* s. 5(2)() and 39(1).

[51] However, the *Drilling and Production Regulation* Part 7 indicates that facilities established within 1600 metres of a place of public concourse, such as a school, must have an automatic shut-off system if those facilities are capable of producing sour gas releases in excess of 100ppm at the facility boundary.

[52] Sour Pipeline Regulation, B.C. Reg 359/98 [Repealed].

[53] Pipeline and Liquefied Natural Gas Facility Regulation, B.C. Reg 281/2010.

[54] "level 3 pipeline" is defined in the SPR as "a release volume of between 2 000 and 6 000 cubic metres of H_2S or a release rate of between 2.0 and 6.0 cubic metres of H_2S".

[55] "level 4 pipeline" is defined in the SPR as "a release volume of more than 6 000 cubic metres of H_2S or a release rate of more than 6.0 cubic metres per second".

time to time. However, the CSA's standards are not readily available to the public, which means local schools are left in the dark as to what setbacks or other safety measures if any may apply. Furthermore, the standards within the CSA document can be amended at any time by the CSA without any approval of the provincial government or OGC.

In addition to the lack of transparency described above, section 14 of the PLNGFR authorizes OGC officials to exempt pipeline companies from any provision of the regulation. The official must only be satisfied that compliance is "not reasonably practicable" for the company, or that the exemption is "in the public interest." There is no indication of what might make compliance "not reasonably practicable" (e.g. re-routing a pipeline would increase costs? Or cause delays?), nor is the official obligated to assess risks to children or to the public generally.

B. Other Jurisdictions

Alberta has given consideration to setbacks between rural schools and pipelines, wells, and facilities.[56] Sour gas facilities are categorized by the Alberta Energy Regulator (AER) into four hazard levels based on release rates for wells, release volumes for pipelines, and H_2S content. There are predetermined setback distances for each level of sour gas facility. Once the appropriate level has been established for a particular facility, AER staff then examines the types of developments in the vicinity and how people typically use the general area.[57] Setback distances from rural schools range from 500 metres to 1,500 metres depending on the hazard level and potential sour gas release of the pipeline, well, or facility. The Global Environmental Action Group, found that based on Alberta's legislation "if a 16" sour gas pipeline were to be built in Alberta today, the formula that the province applies for a rural school would result in a mandated setback of 1,500 metres from the ***property line*** of the school, and not just the structure".[58]

In Fort Worth Texas, the Fort Worth League of Neighborhoods recommends a one mile (1609 metre) setback for drilling from schools. Their recommendations come from scientists and experts in drilling emissions and pipeline issues and are based on air quality analysis at schools.[59] Specifically, the primary focus is on the harmful effects of carbon disulfide[60] which is produced byH_2S methane reformation (i.e. it is produced from sour gas).[61]

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[56] Alberta Energy Regulator, "Directive 056 – Energy Development Application and Schedules" (1 September 2011), online: < http://www.aer.ca/documents/directives/Directive056.pdf>, last accessed 16 August 2013.

[57] Alberta Energy Resources Conservation Board, "EnerFAQs 5 - Explaining ERCB Setbacks" (September 2011), online: < http://www.lica.ca/attachments/077_5%20Explaining%20ERCB%20Setbacks.pdf>, last accessed 16 August 2013.

[58] Katherine Parsons, "Summary of Gas Pipeline Regulations in Ontario: Using Rhodes 'Rs Safety Setback' to Plan Hazard Distances for Municipalities and Regional Governments" & Charles Rhodes, "Natural Gas Pipeline Rupture/Fire: Calculating safety setbacks from high-pressure gas lines" (Januarys 2010), online: < http://greglocke.ca/wp-content/gallery/NATURAL_GAS_PIPELINE_SETBACKS.pdf >, last accessed 16 August 2013, at 10.

[59] Fort Worth League of Neighborhood Association, "Recommendations for Policy Changes for Gas Drilling Near Schools" (February 2011), online: , http://www.fwlna.org/documents/ISDReport.pdf>, ("Fort Worth League of Neighborhood Association") last accessed August 14, 2013.

[60]Fort Worth League of Neighborhood Association, last accessed August 14, 2013.

[61] H. Hosseini, M. Javadi, M. Moghiman, and M. H. Ghodsi Rad, "Carbon Disulfide Production via Hydrogen Sulfide Methane

In California, a risk analysis must be conducted if a school site is proposed within 1,500 feet of a natural gas pipeline.[62] Title 5 Section 14010(h) of the California Code of Regulations states that if a safety hazard is determined to exist based on the risk analysis then the school must not be located within1,500 feet of the pipeline.[63] The California Department of Education provides a protocol that recommends a three-stage risk analysis.[64] California also has a minimum requirement for a risk analysis for proposed schools within 1,500 feet of a pipeline.

C. Recommendations

The scientific evidence regarding the health and safety risks of natural gas production for children and the example of other jurisdictions demonstrate the need for law reform in British Columbia. We recommend a precautionary approach to the determination of setback distances. The precautionary approach definition used by the Science and Environmental Health Network is:

> *"When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof. The process of applying the precautionary principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action." - Wingspread Statement on the Precautionary Principle, Jan. 1998.*[65]

The following recommendations are proposed to protect school children and staff from the harmful effects of H_2S and other pollutants:

1. Require a minimum 1,500 meter setback distance from a school's property line for all pipelines, wells, and facilities containing H_2S.
2. Undertake a comprehensive review process to determine new criteria for varying (increasing) the above-recommended setback. This review should include consideration of the scientific and health research regarding acute and chronic effects of exposure to sour gas and other environmental pollutants, and include direct participation of the Ministry of Health and members of the public.

Reformation" World Academy of Science, Engineering and Technology 38 (2010), online: <http://www.waset.org/journals/waset/v38/v38-115.pdf> last accessed 16 August 2013.

[62] California Department of Education, "Guidance Protocol School Site Pipeline Risk - Volume 1 Users Manual" (2007), online: < http://www.cde.ca.gov/ls/fa/sf/protocol07.asp>, ("California Department of Education") last accessed August 14, 2013.

[63] California Department of Education, last accessed August 14, 2013.

[64] California Department of Education, last accessed August 14, 2013.

[65] Science & Environmental Health Network, "Precautionary Principle", online: <http://www.sehn.org/precaution.html>, last accessed August 15, 2013.

VI. EMERGENCY MANAGEMENT

A. Current Standards

1. Regulatory Gaps

In 2010, when the provincial government brought in sweeping changes to oil and gas legislation, it introduced draft emergency management regulations for public review. However, after an initial comment period, these regulations were never enacted. As a result, the rules applicable to ERPs are found only in the "British Columbia Oil and Gas Commission Emergency Response Plan Requirements" (ERPR), a document published in 2004. As a result, there are numerous inconsistencies between the ERPR and current legislation and regulations governing this sector.[66]

2. Safety Measures for Pipelines

As stated above, there are no clear regulatory standards for pipeline setbacks. The few safety requirements that are articulated in the PLNGF are extremely vague, and almost certainly unenforceable. For instance, section 5 of the PLNGF provides that a permit holder must inspect and test safety devices to ensure they are "in good working order" and take other steps "reasonably necessary" to ensure that the pipeline is safe to use. These terms are not defined. Nor are the frequency and methods for such inspections or tests. Section 6 of the PLNGF provides that if a pipeline is to cross a public place, the permit holder must take "all reasonable steps" so as not to endanger public safety.[67] However there is no indication in the regulation of what "steps" might or might not be considered reasonable. This level of vagueness is remarkable given the serious health and safety risks that pipeline leaks pose to the public.

The PLNGF also defers to the CSA on what standards if any may apply to the preparation of pipeline integrity and pipeline damage programs in place for operating pipelines.[68] On the issue of emergency response zones and plans, the regulation states simply that for pipelines containing H_2S, the permit holder must determine the size of the ERZ and prepare an ERP that is submitted to the OGC. There are no regulations governing how large or small the ERZ might be, how the concentration of H_2S should affect the size of the zone, or how the presence of schools or other public places might affect emergency response plans. This leaves the approval of ERPs within the sole discretion of OGC officials, who are not required to consider the evidence pertaining to sour gas leaks or to make decisions based on established, publicly known criteria.

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[66] This was confirmed by the authors of the ELC paper "Improving Public Health and Safety Near Oil and Gas Operations: Selected Issues" in a personal phone call with Heidi Elias-Bertrim, OGC Emergency Management Coordinator, 20 March 2012.

[67] Section 6(a) Pipeline and Liquefied Natural Gas Facility Regulation, B.C. Reg 281/2010.

[68] Section 7 of Pipeline and Liquefied Natural Gas Facility Regulation, B.C. Reg 281/2010.

3. Emergency Response Plans

Section 39(9)(a) of the *Drilling and Production Regulation* states that "for each well or facility, a permit holder must develop and maintain an adequate emergency response plan." Section 39(9) also requires that "[f]or each well or facility, a permit holder must (b) submit the emergency response plan to the commission [OGC] before beginning operations at the well or facility, and … respond to an emergency at the well or facility in accordance with the emergency response plan." What is lacking in the regulation is any guidance to the public regarding what health or safety factors the OGC must consider in order to determine if a plan is indeed "adequate."

4. Emergency Planning Zones

The Emergency Planning Zone is the area in relation to which a company must prepare its emergency response plan. Section 1 of the *Drilling and Production Regulation* defines an Emergency Planning Zone as a:

> *"geographical area (a) that surrounds a well or facility, either of which contains one or more hazardous materials, and (b) within which, in the event of a release of a hazardous material from the well or facility, there could reasonably be expected to be that material in a quantity of concentration that could pose an immediate danger to the life or health of a person."*[69]

Once again, the lack of any standards or precise terminology in the regulation to define what should be considered an "immediate danger" to health and safety leaves the public guessing as to whether or not the health and safety of children and others will be considered in emergency planning.

The ERPR provides a different definition of an Emergency Planning Zone:

> *The EPZ is a priority area surrounding a well, pipeline, or facility where immediate response actions are required in the event of an emergency. A licensee must determine an initial EPZ using methodology defined below that delineates the area of greatest immediate impact from an uncontrolled release of hydrogen sulphide (H2S) or HVP product.*[70] *(underline added)*

In the context of sour wells, an EPZ is calculated by a guideline graph from section 11 of the B.C. Oil and Gas Handbook (Emergency Planning and Requirements for Sour Wells).[71] The graph is based on the H_2S release rate (m^3/second) which determines the size (in kilometres) of the EPZ.

The ERPR notes that "[o]nce a licensee establishes the size of the EPZ, it must carry out the necessary public and local government notification and consultation described in the [now amended] Drilling and Production Regulation, the [amended] Sour Pipeline Regulation and the [no longer in use] Public

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[69] Drilling and Production Regulation, B.C. Reg 282/2010.

[70] BC OGC, "B.C. Oil and Gas Commission Emergency Response Plan Requirements," (2004), online: <http://www.bcogc.ca/content/producing-well-pipeline-and-facility-emergency-response-plan-requirements>, ("BC OGC ERPR"), last accessed August 16, 2013.

[71] BC OGC ERPR, last accessed August 16, 2013.

Involvement Guideline prior to the development of a specific Emergency Response Plan."[72] This direction creates confusion as the amended Drilling and Production Regulation does not have provisions for notification and consultation, the Sour Pipeline Regulation is repealed and replaced by the Pipeline and Liquefied Natural Gas Facility Regulation (which also does not provide for notification and consultation requirements), and the OGC Public Involvement Guideline appears to no longer be available on the OGC website.[73]

5. Consultation on Emergency Response Plans

Once the proponent has determined its EPZ based on the above criteria, the next step is to consult and notify affected stakeholders. There is no legislation that specifically addresses consultation and notification about the content of Emergency Response Plans. The ERPR does set out guidelines, but this document is out of date and is often inconsistent with applicable regulation and legislation.

The CNR sets out the general process according to which industry consults with stakeholders when seeking permit applications for wells, facilities, or pipelines. Section 4(e)(iii) provides that an invitation to consult must be given to a school board if the school board is the registered owner in the land title office and a school or a related structure owned by a school board is within the applicable consultation distance. Sections 6-8 specify the applicable distances for determining the notification/consultation zone. These distances are calculated according to the type of oil and gas activity, and for sour gas wells, facilities, and pipelines, according to their maximum potential release rate of H_2S.

Pursuant to the CNR, "consultation" only requires an "invitation to consult."[74] The CNR contains only general descriptions of what content must be included in the notification. Once the notice is sent, companies must only respond to residents if they hear back within 21 days. Furthermore, they have no obligation to actually address the concerns raised by schools or others during this process, as long as the reply that they do send is in writing.

This is true of government regulators as well. OGC officials have no legislated obligation to meaningfully address any health or safety concerns that school boards or other land owners may raise during the consultation process. Their only obligation is to "consider" those submissions.[75] In many cases, school

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[72] BC OGC ERPR, last accessed August 16, 2013.

[73] A search on the OGC website fails to produce the OGC Public Involvement Guideline. A number of amendments and other documents referencing the OGC Public Involvement Guideline appear in the search, however the links provided in the documents to the actual OGC Public Involvement Guideline no longer work.

[74] There have been numerous reports of superficial notification and consultation processes. In one case, a company consulted by simply taping a notice to the front door of a home. The residents were expected to call company offices in Calgary and pay long distance charges if they wished to discuss the notice. Another company delivered their notification notices after the response deadline had passed. In another incident, residents learned that a well was being drilled that cut off their only emergency evacuation route, but were not heard by the oil and gas authorities until after the well was completed. Stephan Hume, " UVic urges B.C. to use Public Health Act to investigate sour gas leaks", Vancouver Sun , (8 February 2011), online: < http://www.elc.uvic.ca/media/2011Feb8-VSun-UVic-urges-BC-to-use-Public-Health-Act-to-investigate-sour-gas-leaks.pdf>, last accessed 16 August 2013.

[75] *Oil and Gas Activities Act,* section 22(5) and 25(1).

boards may not have the specialized technical expertise or financial resources to test the information submitted by oil and gas companies, or the time to prepare appropriate submission within the short timelines set out in the regulations.

The Assistant Superintendent of School District 59 has reported a number of inadequacies with the ERPs schools receive. These include that companies do not provide detailed timelines for their start and end dates when constructing new wells. Projects may be delayed without notice to school boards, leaving them in the dark as to when they should prepare for the safety risks associated with the construction phase of well installation.[76]

OGC officials have indicated that the OGC conducts an "enhanced review process" to address concerns regarding wells proposed for installation within two kilometres of schools.[77] This process is reported to address safety concerns such as setback distances, emergency response plans and associated procedures, and air monitoring requirements.[78] However, the OGC has no publicly available documentation of such a process and was unable to provide further details on such a process, including its outcomes or stakeholder satisfaction.[79]

B. Other Jurisdictions

The Alberta Energy Regulator (AER) Directive 071[80] is a comprehensive document covering the development and approval of emergency response plans. The AER requires licensees to use and submit a specific application form to apply to the AER for approval of an emergency response plan.[81] In contrast, the ERPR document only specifies that emergency response plans must be submitted to the OGC for approval, and provides very little guidance concerning what the emergency response plan must contain. AER Directive 071 Section 12 also identifies two Response Zones in addition to Emergency Planning Zones (EPZ). EPZs require specific emergency response planning, whereas the "response zones are where resources are focused during an incident to protect public safety."[82] An Initial Isolation Zone (IZZ) "defines an area in close proximity to a continuous hazardous release where indoor sheltering may provide limited protection due to proximity of release...If safe to do so, the licensee must attempt to

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[76] Author's personal email with Rob Dennis, Assistant Superintendent School District #59 (Peace River South), 25 June 2013.

[77] Author's personal email with Hardy Friedrich, OGC Communications Manager, 24 July 2013.

[78] Author's personal email with Hardy Friedrich, OGC Communications Manager, 24 July 2013.

[79] Author's personal email with Hardy Friedrich, OGC Communications Manager, 1 August 2013.

[80] Alberta Energy Regulator, "Directive 071 – Emergency Preparedness and Response Requirements for the Petroleum Industry" (24 November, 2009), online:< http://www.aer.ca/documents/directives/Directive056.pdf>, last accessed 16 August 2013.

[81] "ERP Application Form" in Alberta Energy Regulator, "Directive 071 – Emergency Preparedness and Response Requirements for the Petroleum Industry" (24 November, 2009), online:< http://www.aer.ca/documents/directives/Directive056.pdf>, last accessed 16 August 2013.

[82] Alberta Energy Regulator, "Directive 071 – Emergency Preparedness and Response Requirements for the Petroleum Industry" (24 November, 2009), online:< http://www.aer.ca/documents/directives/Directive056.pdf>, ("Alberta Enery Regulator, Directive 071") last accessed 16 August 2013, at 12.2.

evacuate the residents from the IIZ."[83] A Protective Action Zone (PAZ) is defined as "an area downwind of a hazardous release where outdoor pollutant concentration may result in life threatening or serious and possibly irreversible health effect on the public."[84] In the event of a H_2S gas leak, if it is safe to do so, public in the IIZ and PAZs are also notified and evacuated so as to protect the public from H_2S.[85] The PAZ also takes into consideration dispersion from wind.[86]

C. Recommendations

1. New regulations are required to specifically address Emergency Response Planning. These regulations must start from a science-based public health perspective and incorporate a precautionary approach to the determination of EPZ boundaries.
2. Rigorous public consultation procedures should be required prior to approval of any Emergency Response Plan (ERP) to ensure ERPs are drafted collaboratively to address needs of all affected groups, including schools.
3. ERPs should be made available to the public, with personal information in redacted form.[87]
4. Notification and evacuation procedures should be extended to schools within the entire Emergency Planning Zone (EPZ).

VII. LEAK DETECTION AND AIR QUALITY MONITORING

A. Current Standards

There are a number of notification and safety guidelines in section 39 of the *Drilling and Production Regulation* that can apply when operations are near populated areas or contain high concentrations of sour gas. These guidelines include leak detection and air quality monitoring. For example:

- if a completed well is capable of producing H_2S concentrations greater than 100ppm within 50 meters of a well, then the well must be equipped with an automated shut-off system;[88]

[83] Alberta Energy Regulator, Directive 071, last accessed 16 August 2013, at 12.2.1.

[84] Alberta Energy Regulator, Directive 071, last accessed 16 August 2013.

[85] Alberta Energy Regulator, Directive 071, last accessed 16 August 2013, at 14.3.3.

[86] Alberta Energy Regulator, Directive 071, last accessed 16 August 2013, at 14.3.3.

[87] This procedure is followed by the Dawson Creek Fire Department for a community ERP.Author's personal telephone conversation with Shorty Smith, Dawson Creek Fire Chief, 16 July 2013.

[88] *Drilling and Production Regulation, s.* 39(4)

- if a well is completed within 1,600 metres of a school, then the well must also be equipped with a continuously monitored H_2S detection and alarm system that is capable of activating the automated shut off system;[89]

These measures are best understood as potential guidelines, not as rules or requirements. This is because OGC officials may exempt permit applicants from any of the safety measures set out in section 39, or replace those measures with alternative conditions. Remarkably, these exemptions can be issued without any written justification for their necessity. There are no factors that must be considered by officials before granting exemptions or variances to the safety measures set out in the regulation.[90]

Further, the legislation does not specify the level of H_2S concentration necessary to trigger the automatic shutoff and alarm system. Given the documented adverse health effects of chronic exposure even at low concentrations of sour gas, the legislation may allow undetected low-level leaks to cause harmful effects to children or adults. This risk is compounded where there are clusters of wells, which, cumulatively, may be releasing significant volumes of sour gas into a given airshed without triggering the shut-off measures established by the regulations. Note the numerous well clusters around the schools mapped above.

The Pouce Coupe incident described above is a recent example of inadequate air monitoring. In that instance, it was an alarm at an adjacent well site that happened to eventually provide the gas leak alert.[91] The Pouce Coupe incident was reported to release nearly 13ppm of H_2S at the wellsite, though levels may have been higher depending on the time and prevailing winds during testing. In Alberta, the 15-minute occupational exposure limit for H_2S is 15ppm, with any exposure over this threshold requiring a breathing apparatus.[92] This demonstrates why it is essential that air monitoring equipment detect low levels of H_2S and provide early alarms to warn schools of gas leaks.

It is significant to note that there is no legislation that requires companies to monitor air quality around pipelines.

The OGC has recently experimented with air quality monitoring pilots in select regions of the province. This includes a Mobile Air Monitoring Laboratory (MAML), which is described as a "flexible and cost-effective way to monitor air quality in communities that do not have fixed air monitoring stations."[93] The results of the air monitoring are uploaded hourly to a government website. The MAML initiative is a

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[89] *Drilling and Production Regulation*, B.C. Reg. 282/2010, s. 39(4),

[90] *Drilling and Production Regulation,* s. 4(l)

[91] BC Oil and Gas Commission, "Failure Investigation Report: Final Report on the Nov. 22, 2009 Failure of Piping at Encana Swan Wellsite A5-7-77-14 L W6M", (November 2010), online: <http://www.bcogc.ca/document.aspx?documentID=1026&type=.pdf>, last accessed 16 August 2013.

[92] Drayton Valley Permanent Air Monitoring Committee, "Recommendations for a Permanent H_2S and SO_2 Sentinel Air Monitoring Network: Pembina Field - Drayton Valley Region Alberta, Canada", (December 2007), online: <http://pembinaagprotection.org/wp-content/uploads/2010/03/2007.12.29-PSAMS-Report-No-Appendix-Figures.pdf>, ("Drayton Valley Permanent Air Monitoring Committee") last accessed: 16 August 2013

[93] BC Air Quality, "The Mobile Air Monitoring Laboratory", online: <http://www.bcairquality.ca/readings/maml.html >, last accessed 16 August 2013.

small step in the right direction, but a poor substitute for mandatory leak-detection and air quality monitoring systems required to protect the health and safety of children and the public generally in oil producing regions of the province.

B. Other Jurisdictions

In Alberta, the Pembina Field, Drayton Valley Region provides a model for air monitoring. In that community, concerns arose because levels of H_2S and SO_2 were not high enough to trigger emergency response plans, but were above Alberta's ambient air quality objectives. The region undertook to implement a permanent air monitoring network and the following information comes from their report "Recommendations for Permanent H_2S and SO_2 Sentinel Air Monitoring Network: Pembina Field – Drayton Valley Region Alberta, Canada."[94]

The Drayton Valley Air Monitoring Committee identifies certain elements that a permanent air monitoring network should have. This includes early access to warning at low-level sour gas concentrations, tracking to identify the source of the emissions, the ability to identify when sour gas emissions were and were not present in specific areas, and the individual monitors included as part of the permanent air monitoring network can be included among the numbers needed to fulfill regulatory obligations during drilling and completion exercises.[95]

In the network that is currently implemented, there are approximately 70 existing H_2S and SO_2 monitors throughout the network area. The required range limits for the monitors is 0-10ppm for H_2S and 0-5ppm for SO_2 monitors. At least one of the monitors in the network will have sensors to detect temperature, wind direction and wind speed. Air monitoring reports are produced on an hourly basis and when an alarm occurs, the report is updated every 15 minutes. The data from the monitoring network is made accessible to residents directly through the internet or over the phone without the need for a password.[96]

C. Recommendations

1. Repeal section 4(l) of the *Drilling and Production Regulation* which allows OGC officials to exempt companies from the leak detection and other safety measures set out in section 39 of the regulation.
2. Emergency management legislation should require well, facility, and pipeline permit applicants to install a H_2S monitoring network as a precondition to permit approval. This network should include, at minimum, monitors at each potential H_2S -release source and receptor monitors spaced not more than two kilometres apart from each other throughout the entire Emergency Planning Zone. The network should have the capacity to detect low levels of H_2S, and to provide real time monitoring to all schools and residents within the EPZ.

[94]Drayton Valley Permanent Air Monitoring Committee, last accessed: 16 August 2013.

[95]Drayton Valley Permanent Air Monitoring Committee, last accessed: 16 August 2013.

[96]Drayton Valley Permanent Air Monitoring Committee, last accessed: 16 August 2013.

VIII. FLARING

A. Current Standards[97]

Flaring is currently regulated under the *Drilling and Production Regulation* and the Flaring and Venting Reduction Guideline. Sections 42, 43 and 44 of the *Regulation* respectively govern limits, notification requirements and flaring performance and quality requirements. A review of the regulations reveals that there are very few concrete, enforceable provisions relating to flaring.

There is a blanket provision contained in s. 42(2) which states that permit holders must not flare gas except for emergency purposes or drilling operations. This prohibition, is, however, subject to numerous exceptions, including a blanket exception where permission to flare is included in the well or facility permit. Further, "drilling operations" though referenced numerous times in the *Regulation* is not defined in the *Act* or *Regulation*.

Of particular concern is the connection between flaring and well completion. As the drilling of a new well nears completion, the well moves from the drilling stage to the production stage. This process is known as "well completion". During well completion, especially when dealing with hydraulically fractured wells, the well must go through a "flowback" process before it can begin producing marketable gas. During the flowback process, a large portion of the drilling chemicals and formation water is brought to the surface. Along with these fluid components, significant quantities of natural gas also come to the surface. Flowback and completion can occur over a period of over a week. If the well completion process is considered to be a part of "drilling operations" then the associated flaring and venting would be permitted even without express authorization in the well permit. Because "well completion" is not defined in the Regulation, this may in fact be permissible under current legislation.

The Flaring, Incinerating and Venting Reduction Report for 2010 (Flaring Report) indicates that since 1996 there has been a significant reduction in overall flared gas in BC. In that year, over 300 10^3 m^3 of gas was flared in the province. Well over half that amount was from "solution gas". Solution gas is natural gas that is produced from wells that are primarily oil wells. The industry has made important changes that have led to a dramatic reduction in the flaring of solution gas. In 2010, only a fraction of the total flared gas was solution gas. Unfortunately, the amount of gas from all other sources remained virtually unchanged between 1996 and 2000. Of particular concern to rural residents is the approximately 100 10^3 m^3 of gas flared each year from well cleanup and testing operations.[98] These flares are a particular concern because they occur everywhere a new well is drilled, which at times places them uncomfortably close to schools and other buildings.

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[97] This section is reproduced from the paper "Environmental Law Centre, April 2012, Improving Public Health and Safety Near Oil and Gas Operations: Selected Issues"

[98] British Columbia Oil and Gas Commission, "Flaring, Incinerating and Venting Reduction Report for 2010" (December 16, 2011), online: <http://www.bcogc.ca/document.aspx?documentID=1206&type=.pdf>. ("Flaring, Incinerating and Venting Reduction Report")

The Flaring and Venting Reduction Guideline (the Flaring Guideline) recognizes the BC Energy Plan goal to "eliminate all routing flaring at oil and gas producing wells and production facilities by 2016, with an interim goal to reduce routine flaring by 50 per cent by 2011."[99] Routine flaring is defined as the continuous flaring of gas that is not required for safety or environmental purposes and is economical to conserve. Of course, this definition leaves it open to companies to flare gas that they might consider "uneconomical" to conserve.

Well permit holders are required to notify the OGC 24 hours ahead of a planned flaring event, if the amount to be flared exceeds 10,000m^3. But what does this mean in real terms? According to the Canadian Gas Association, the average Canadian household consumed 2,626m^3 of natural gas in 2009.[100] That means that a permit holder can vent the equivalent of just under 4 households' annual natural gas consumption in a single flaring event without a requirement to notify the OGC. Further, the regulations contain no requirement to notify local residents or school boards. The Flaring Guideline specifies a notification table for flaring events in excess of 4 hours or where more than 10,000m3 will be flared or emitted.101 Flaring is also permitted at wells for "maintenance" so long as not more than 50,000 m3 is flared over the course of one year. A well permit may also authorize additional flaring.102

B. Other Jurisdictions

To a large extent, the BC OGC Flaring and Venting Reduction Guideline is nearly an exact copy of the Alberta Energy Regulator's (AER) Directive 060. However, a review of Alberta and other foreign regulations indicates there are numerous areas where BC's requirements are inadequate.

The Alberta AER has developed and employs a computer program modeling system to determine permit requirements for flaring and venting. More research is warranted to determine whether this system is effective at improving Air Quality and other objectives.[103]

Section 3.6(6) of the Alberta Directive requires licensees to consider cumulative effects of sulphur dioxide emissions. This section is reproduced here for convenience:

> *"Licensees must evaluate cumulative effects on ambient air quality if there are continuous SO2 emissions sources (e.g., sour gas plants, sour flaring batteries) within 7kms or within the isopleth of one-third of the AAAQO for SO2 (as described in Section 7.12.3), whichever distance is less. Sour gas burning operations must be planned so that AAAQO exceedances due to the combined effect of all sources in the area do not occur."*

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[99] Flaring, Incinerating and Venting Reduction Report, at 6.

[100] Canadian Gas Association, "Industry at a Glance: Information Sheet", online at http://www.cga.ca/wp-content/uploads/2011/02/Industryataglance-infosheetJuly2010.pdf accessed March 16, 2012.

[101] Flaring, Incinerating and Venting Reduction Report, at 44.

[102] Flaring, Incinerating and Venting Reduction Report, at 30.

[103] Energy Resources Conservation Board, "Flaring, Incinerating, and Venting" , see, Directive 060 Spreadsheets. http://www.ercb.ca/portal/server.pt/gateway/PTARGS_6_0_308_0_0_43/http%3B/ercbContent/publishedcontent/publish/ercb_home/industry_zone/rules__regulations__requirements/flaring/.

AAAQO is the Alberta Ambient Air Quality Objectives. Subsection (7) further stipulates that concurrent sour gas flaring may not occur within 14kms of another sour gas flare, unless the licensee can show that the AAAQO requirements will still be met. Subsection (8) requires dispersion modeling.

Section 3.9 of Directive 060 requires significantly enhanced notification and consultation in regard to flaring. In Alberta, licensees must notify the AER of any planned flaring event and must also notify local residents.

In the Jonah Field of Sublette County, Wyoming, EnCana has committed to performing flareless completions that will result in 90% lower emissions.[104]

The Bureau of Land Management, in its Record of Decisions for West Tavaputs Plateau, Utah, stated "Air Quality: Best management practices will be employed during completion operations to minimize emissions to the atmosphere as a result of well flowback. The preferential best management practice shall be "Green Completion where the well flowback is captured, separated, and sold as product. When Green Completions are not technically reasonable, flaring or other control practices shall be employed to minimize venting emissions directly to the atmosphere."[105]

The Watershed Plan for the Town of Palisade and the City of Grand Junction Colorado requires that operators, "Refrain from flaring except when necessary to avoid safety risks or greater damage to the surrounding environment and only use when properly permitted and supervised."[106]

A significant group of US investors has recently called on oil and gas producers to reveal the amount of natural gas they are flaring and to take steps to reduce this activity.[107]

According to a World Bank comparison table, routine flaring of associated gas is prohibited in Norway.[108]

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[104] Bureau of Land Management, —Jonah Infill Drilling Project Record of Decision: Appendix B: Operator Committed Practices (2006) online: <http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/pfodocs/jonah.Par.2814.File.dat/00rod2_b.pdf>, at B-16.

[105] Bureau of Land Management, —Record of Decision - West Tavaputs Plateau Natural Gas Full Field Development Plan: Attachment 2 , at 18, online: <http://www.blm.gov/pgdata/etc/medialib/blm/ut/price_fo/oil_and_gas_2.Par.83872.File.dat/Attachment%202%20-%20WTP%20Record%20of%20Decision[1].pdf>.

[106] Town of Palisade and City of Grand Junction, —Watershed Plan for the Town of Palisade and the City of Grand Junction Colorado , (2007), at 26, online: < http://genesispalisadecdp.org/History.htm>; note, "It is important for readers to understand that this Watershed Plan isn't legally binding because it is not a site-specific permit that has been approved by either the BLM, the State of Colorado, or other governments." at 4.

[107] Timothy Gardner, —Exclusive, Investors press U.S. shale oil drillers to control flaring , online: <http://www.reuters.com/article/2012/03/29/us-usa-fracking-investors-idUSBRE82S03120120329>.

[108] World Bank, —Comparison of Associated Gas flaring regulations: Alberta & Norway , online: < http://siteresources.worldbank.org/EXTGGFR/Resources/578068-1258067586081/Alberta_Norway_regulations_comparison.pdf>.

C. Recommendations

Current legislation's failure to require companies to notify schools, or any resident, of flaring, even when the flaring is planned, fails to adequately protect school children and staff. Further, given the proximity of numerous wells near schools in northeastern BC, and the potential for enormous well development with LNG expansion, the flaring associated with well completion is of great concern -- as this could lead to a significant increase of pollutants released into the atmosphere without adequate notification, monitoring, or cumulative effects management measures in place to protect the health of children and other residents. Therefore, we recommend the following:

1. Require Green or flareless completions.
2. Require OGC Approval for all non-emergency flaring, not just amounts exceeding 10,000.[3]
3. Require notification to all schools within EPZ 24 hours prior to all non-emergency flaring events.
4. Require companies to make every effort not to flare during times when school is in session.

APPENDIX A

School District 59 (Peace River South)
11600-7th Street, Dawson Creek, B.C. V1G 4R8
Phone: (250) 782-8571 Fax: (250) 782-3204

Safety Guidelines and Practices

Where Oil and Gas Activity is in the Vicinity of a School District 59 School

Preamble:

The Peace River Regional District is the primary authority, and bears primary responsibility for maintaining safe environmental conditions for those residing in rural areas. In cooperation with the PRRD, and the Oil and Gas Industry, School District No. 59 (Peace River South), has developed plans and practices to protect the safety and well being of students and employees.

School District No. 59 is dedicated to safeguarding our students and employees from harm. When oil and gas drilling, well maintenance and exploration activities are taking place in proximity to schools, a response is necessary in the event of an uncontrolled gas leak. A written emergency plan, which describes the action to be taken will be available to all staff while drilling, fracturing, or maintenance operations are occurring (attached Appendix I and II). District personnel will provide readiness training and assistance to staff in affected schools, so they will understand the actions to be taken during an emergent event.

Site principals and District managers will rely heavily on the advice of oil and gas personnel and the monitoring equipment available in their operations. Decisions against evacuating a school during a gas release, versus a decision to evacuate, will be done in consultation with those working with the event. Releases of sulphur dioxide (SO_2) or hydrogen sulphide (H_2S), may be at levels that must be permitted to dissipate before anyone is exposed to the gas in full concentration. In this case, the safest place may be inside the school. On the other hand, should gas be releasing over time, causing a prolonged threat of exposure, evacuating the school may present the best option. The decision to evacuate a school will be made in consultation with or by recommendation from those working with the gas release.

Industry Responsibilities:

The company operating the drilling rig or performing operations within the emergency response area will provide the School District and School with the following:

- The date that drilling activities are planned to commence;
- A contact person and telephone number to respond to school concerns and to communicate emergent events;
- A copy of their approved Emergency Response Plan***** as filed with the Oil and Gas Commission;

- Expected levels of H_2S gas in the zones they will be penetrating, including a detailed explanation of the unit of measurement they are using to define H_2S risk to residences in the Emergency Response Plan;
- Compensation for expenses associated with providing emergency planning response services at a location. This includes, but is not limited to: stand-by school buses, additional transportation costs, air monitoring equipment, alarm systems, communications equipment, informational evenings with parents/residents, photocopying and distribution of emergency plans to parents, additional supervision and care of students in the event of evacuation;
- Restorative measures with the school and the parents should an evacuation occur.

***note:** *The Emergency Response Plan is generally considered to apply to residents who are within 1 kilometre of well operations. This is considered the Emergency Planning Zone. Schools within that zone will receive additional consultation.*

Initial Procedures/Practices:

If a principal is approached from a representative of the oil and gas industry, they will take detailed notes and ask the agent to provide the same information to the SD#59 Facilities Manager and the Assistant Superintendent. The school principal will notify the Facilities Manager and Assistant Superintendent of the proposed drilling activities and timelines, as soon as possible following a contact of that nature.

If the proposed activities will involve the potential release of H_2S gas, the following will occur:

- A review of the Fire and Emergency Response Plans that are in place for the school;
- District staff will show principals, custodian and other staff the emergency shut-down procedures for the furnace intake and ventilation systems;
- A staff person at the school (and an alternate) will be identified and their contact number will be provided to the drilling company. This will be the emergency contact person between the drilling platform/operations, and the school, should an event arise;
- The District Transportation Manager will be notified of the planned activities;
- The Transportation Manager will require 24 hours notice prior to the need for stand-by bussing;
- The Assistant Superintendent will be informed and updated of any disturbances to school routines that have occurred as the result of drilling or maintenance activities.

Evacuation Procedures/practices:

In the event that a drilling company recommends the evacuation of a school in their emergency response zone, the following will occur;

- When a rural principal receives the recommendation to evacuate the school s/he will immediately contact the Transportation Manager and inform him that the rural school's emergency evacuation plan has been activated (The Assistant Superintendent/Superintendent and Facilities Manager will also be immediately informed);

- The Transportation Manager will dispatch sufficient buses to evacuate all students and staff that are positioned at that school;
- Drivers will be informed of the gas leak, and will be informed of routes to avoid;
- In the event that a rural school in the Dawson Creek area is evacuated, all students will be transported to South Peace Secondary School;
- The principal of SPSS will be notified by the rural school principal that the rural school's emergency evacuation plan has been activated and approximately how many students and staff will be arriving;
- A list of students and their home phone numbers will accompany the evacuated students and staff, so all affected parents may be contacted;
- An evacuation plan will be developed/reviewed by the Transportation Department each year to maintain awareness of the procedures;

Remote Monitoring Equipment:

Remote monitoring equipment, a stand-by bus and transportation personnel may be provided to a school when a company's drilling platform is close to a school, and drilling is through areas that have dangerous H_2S concentrations. If this equipment is on the school grounds:

- The company will inform the school of the guidelines for when to engage the school evacuation plan;
- School personnel will be trained to read and understand the information from the remote monitoring equipment;
- A communication protocol will be in place between the drilling platform and the school.

The School and Parent Relationship:

The school will assume no responsibility with regard to being the expert on risks associated with oil and gas activities, and will not take on the role of being the main contact with the drilling company, or be responsible for the distribution of information on behalf of the drilling company. The school will cooperate with the drilling company to distribute safety information to students and parents. The school evacuation plan will also be communicated to parents/guardians. The safety of the students and staff while attending school is the primary concern of the District. The principal and District staff will not become involved in community health and safety concerns that are the responsibility of the drilling company. Parent concerns regarding the activities of a drilling company near their residence will need to be addressed to the drilling company directly rather than the school.

Notification of Risk to Students, Staff, Parents:

It is the responsibility of the drilling company to provide information to everyone within the emergency response area. The information will include planned drilling activities, and the risks associated with those activities. The school will provide the following support for parents:

- Parents will be informed of the drilling operations schedule in advance, by way of school newsletter, or a notice to parents through other media;
- Shortly after the drilling operation has commenced, a reminder notice will be sent home with the students. This reminder will detail the emergency procedures that

will remain in place, including the emergency evacuation plan;

- If parents are concerned regarding drilling operations, the school will provide a venue for the drilling company to host a meeting that will address concerns.

Superintendent Notification:

The Superintendent of Schools will be advised immediately if a school activates the Emergency Evacuation Plan. Media enquiries will be directed to the Board Office.

Appendix I
Managing a Hazardous Gas Release

OUTDOOR GAS RELEASE PROTOCOL

* NOTE: A school will only be evacuated if it is safe for the driver(s) to approach the school, and staff/students are able to move safely from the school to the bus for transport. Another worthy note is that: "There have been no recorded instances of sour gas exposure killing a member of the general public in the 80 years of sour gas development in Western Canada."[1] The fatalities that have occurred were occupational, and primarily the result of workers climbing into contaminated spaces.

In the event a rural school:

- Receives an audio signal from a remote monitoring device.
- Notes a strong gaseous odour, or a rotten egg odour outside.
- Principal believes that emission of a hazardous substance may have occurred.
- The school receives a phone call or other communication from a drilling company or from the Board Office that there has been a gas release. The drilling company will advise the response to use to protect the students and staff. Essentially, the options will be to stay in place and seal off the school, or to initiate evacuation procedures.

"Stay in Place " procedure;

1. Ring the outdoor buzzer or bell that will bring everyone into the school if recess or lunch break happen to be occurring. Immediately gather everyone inside and close the doors. Ensure all the students and staff are accounted for class-by-class. Teachers stay with their students in the classroom.
2. Close and lock all windows and outside doors, and if possible tape the crack around exterior doors and window frames.
3. Turn off all appliances and equipment that either blow outside or suck air into the school. Shut off furnaces and ensure outside air dampers are closed. Ventilation fans over stoves or in shop areas will need to be turned off.
4. Leave all interconnecting doors within hallways and classrooms open.
5. Be patient as the gas cloud dissipates and the area becomes safe. Oil and gas personnel will be monitoring the air quality and may order an evacuation as needed.
6. The school will be notified when the gas cloud has dissipated and it is safe to leave the school.

"Evacuation" procedure;

If an evacuation of the school has been advised, all of the above steps will be carried out to ensure safety while the buses are enroute to the school. Then, follow the steps below:

7. Contact the Transportation Manager to inform him that you have initiated your School Evacuation plan.
8. Contact the Board Office and inform the Assistant Superintendent that you have initiated your School Evacuation Plan.
9. Contact the Principal of South Peace Secondary School to inform of the arrival of your school population.
10. Be patient and remain calm as the buses are enroute. It is an event that is out of the ordinary, however routines will soon be back to normal.
11. Keep an open phone line between the Board Office and the school if possible;
12. Notify students and staff that they will be transported to South Peace Secondary School, where staff and students are expecting their arrival. Notify students that their parents will be called and informed that they are being moved to SPSS.
13. Assemble phone numbers and contacts for the students, so parents can be notified once you arrive at SPSS.

1. *Sour Gas: Questions + Answers, Canadian Centre for Energy Information, (www.centreforenergy.com)*

APPENDIX B

Standard of Conduct

Parkland School Division No. 70

The Standard of Conduct (SOC) confirms that oil and gas operations in Parkland School Division are conducted in compliance with all relevant laws and regulations. Additional safety measures for those persons, students and staff in Parkland School Division (Tomahawk School) have also been included in the Standard of Conduct.

June 23, 2009

Standard of Conduct

Parkland School Division and the Oil and Gas Producers in the Tomahawk Area acknowledge that:

1. It is of utmost importance to take reasonably practicable steps to protect the health and safety of community members including students, staff and others at Parkland School Division's schools and on school buses when the oil and gas operations of the Companies may affect such persons;
2. Oil and gas exploration and development can be done safely when in compliance with all applicable laws and will not adversely interfere with Parkland School Division providing educational activities at its schools or with those on school buses for whom Parkland School Division has responsibility;
3. A spirit of cooperation is needed between area stakeholders to ensure that the lawful rights, interests and obligations of each other are respected;

In recognition of these principles, the following stakeholders have collaborated to develop this Standard of Conduct:

- **Parkland School Division**
- **Oil & Gas Producers**
  - ConocoPhillips Canada
  - Great Plains Exploration Inc.
  - Grizzly Resources Ltd.
  - Highpine Oil & Gas Limited
  - West Energy Ltd.

Energy Resources Conservation Board (ERCB) was consulted in the development of this process.

1 Community Engagement and Consultation

We are neighbours in this community. Effective consultation and honest communications are important. The main expectations for effective public consultation that form the foundation for this Standard of Conduct are detailed in the following Energy Resources Conservation Board Directives and Industry Recommended Practices (IRPs):

- D056 – Energy Development Applications: This directive sets out the consultation and notification requirements for energy development in Alberta.
- D071 – Emergency Preparedness and Response Requirements: This directive sets out the consultation and notification requirements related to the preparation of emergency response plans.
- Guide for Effective Public Involvement: This a comprehensive guide of recommended industry best practices developed by the Canadian Association of Petroleum Producers (CAPP).

In recognition that these documents represent a starting point, industry operating practices specific to the Tomahawk area include the following standards of conduct to enhance the overall level of communication and consultation between stakeholders throughout the life of these projects:

#	Standard of Conduct	Stakeholder	Action By
1.1	Tomahawk Area Operators will notify and consult with Parkland School Division prior to submitting an application to the ERCB for approval whenever a school is located within either the Emergency Planning Zone (EPZ) or the Emergency Awareness Zone (EAZ) or when buses carrying Parkland School Division students are required to travel through the EPZ or the EAZ. As referenced in ERCB Directive 056, 060 and 071, consultation will take place for all proposed projects, operations, or activities that are likely to have an impact on existing resources, the environment, and the public. Parkland School Division will ensure during the consultation phase, that increased attention is paid to: 35/17 sour well drilling and/or completion operations requiring a site-specific Emergency Response Plan (ERP) 35/17 sour facility or pipeline operations requiring an ERP 35/17 High Vapour Pressure (HVP) pipelines and related facilities requiring an ERP		Area Operators
1.2	Providing energy related training and education is important to creating and maintaining an effective relationship between the Tomahawk Area Operators and Parkland School Division. In support of this, area producers will work with Parkland School Division to: 35/17 Identify type of training required, level of information and the audience with an emphasis on staff and bus drivers. This would include but not be limited to: o Introduction to Oil and Gas Operations o H_2S Awareness o Emergency Planning and Response o Overview of Oil and Gas Regulations (context / topics) o Additional training opportunities mutually agreed upon 35/17 Tomahawk Area Operators agree to pay for or reimburse the costs for providing agreed to training.		Area Operators, Parkland School Division
1.3	The stakeholders involved with the development of this document are committed to maintaining an open and honest ongoing dialog. This includes communicating and addressing any additional concerns as they arise or are contemplated. The stakeholders recognize that changing circumstances may require changes or additions to this document. Any changes made will be done in communication with and the involvement of affected stakeholders. Whenever revisions are made, the revised document will be reissued to all involved stakeholders.		Area Operators, Parkland School Division

	If necessary to ensure an honest, effective ongoing dialog is established **and** maintained, the stakeholders agree to establish a formal multi-stakeholder process utilizing the strategies and resources of Synergy Alberta.		
1.4	In the event that an important issue cannot be resolved in the normal course of discussion, the stakeholders involved with this Standard of Conduct agree to outline the framework for dispute resolution in a Memorandum of Understanding.		Area Operators, Parkland School Division

2 Planning and Design of Oil and Gas Operations

The ERCB has established regulations and directives specific to design standards that form the foundation for this Standard of Conduct include:

- D008 – Surface Casing Requirements: This revised directive clarifies the minimum surface casing depth requirements, sets out requirements for setting deep surface casing, for using a Class I blowout prevention system, and the standards for conductor casing.
- D009 – Casing Cementing Requirements: This directive details the cementing standards for intermediate and production casing as required to protect usable groundwater.
- D010 – Minimum Casing Design Requirements: This directive provides detailed design and metallurgy criteria for sweet, sour, and critical sour wells.
- D026 - Setback Requirements for Oil Effluent Pipelines: This directive must be consulted when filing applications or amendments for oil pipelines with more than 1.0% H_2S gas. Include reference to ID 081-3 , 97-6
- D033 – Well Servicing and Completion Operations: This directive outlines the ERCB's requirements regarding the potential for explosive mixtures and ignition in wells.
- D036 – Drilling Blowout Prevention Requirements and Procedures: This directive specifies the minimum equipment and procedure requirements that must be followed when drilling a well.
- D037 – Service Rig Inspection Manual: This directive details ERCB requirements for service rigs.
- D038 – Noise Control: This directive deals with permissible sound levels in the vicinity of ERCB approved well and facility operations.
- D039: Revised Program to Reduce Benzene Emissions from Glycol Dehydrators: This directive specifies the design and operating requirements for minimizing the emissions from dehydrators.
- Directive 041: Adoption of CSA Z662-03, Annex N, as Mandatory: This directive specifies pipeline licensees must implement an integrity management program as per CSA Z662-03.
- D055 – Storage Requirements for the Upstream Petroleum Industry: The purpose of this directive is to identify requirements for the storage of materials produced, generated (including wastes), or used by the upstream petroleum industry.
- D056 – Energy Development Applications: An important focus of this directive is to outline the design and installation requirements for the approval of drilling, facility or pipeline application.
- D057 – Fencing and Site Access Requirements for Oil and Gas Facilities: This directive introduces the new fencing and security requirements that apply to ERCB-regulated facilities.
- D060 – Upstream Petroleum Industry Flaring, Incinerating and Venting: This directive details

ERCB requirements for a number of air quality related issues including, well test flaring, solution gas flaring and fugitive emissions (read: odours) for oil and gas operations.

- D064 – Requirements and Procedures for Facilities: This directive provides industry with a guide for complying with the ERCB's requirements for production, injection and disposal facilities.
- D066 – Requirements and Procedures for Pipelines: This directive outlines the requirements for to achieving compliance with ERCB pipeline regulations and ensuring safe and efficient practices at all pipeline projects. This also ties in with the ERCB requirements detailed in D041.
- D071 – Emergency Preparedness and Response Requirements: While the focus of D071 is mainly emergency response planning, this directive considers facility and pipeline design factors, including: operating pressures, pipeline length and diameter, the number and location of emergency shutdown (ESD) valves and other operating conditions in calculation of EPZ and release scenarios.

Relevant Industry Recommended Practices (IRPs) that are also important foundation documents for this Standard of Conduct include:

- IRP Vol. 1 - Critical Sour Drilling
- IRP Vol. 2 - Completing and Servicing Critical Sour Wells
- IRP Vol. 4 - Well Testing and Fluid Handling
- IRP Vol. 5 - Minimum Wellhead Requirements
- IRP Vol. 6 - Critical Sour Underbalanced Drilling
- IRP Vol. 7 - Standards for Wellsite Supervision of Drilling, Completion and Workovers
- IRP Vol. 8 - Pumping of Flammable Fluids
- IRP Vol. 13 - Slickline Operations
- IRP Vol. 14 - Non Water Based Drilling and Completions/Well Servicing Fluids
- IRP Vol. 15 - Snubbing Operations
- IRP Vol. 18 - Fire and Explosion Hazard Management
- IRP Vol. 20 - Wellsite Design Spacing Recommendations

NOTE: Related safety requirements identified by Alberta Occupational Health and Safety (OHS) regulations and the Alberta Safety Codes Act, Regulations and Code are included in ERCB Directives and Industry Recommended Practices.
Copies of the above documents are included in a reference binder that has been prepared at the request of the Parkland School Division. Updates to these documents will be provided to Parkland School Division as they become available.
In addition to the above requirements, industry operating practices used by Tomahawk Area Operators are outlined in the following standards of conduct related to oil and gas development:

#	Standard of Conduct		Action By
2.1	As part of the process for placing wells and facilities in the area, Tomahawk Area Operators will review the ERCB Minimum Setback Requirements and Calculated Emergency Planning Zones with Parkland School Division and confirm the suitability of these criteria on a case-by-case basis.		Area Operators, Parkland School Division
2.2	To ensure the safe operation and reliability of their pressure		Area
	equipment and compliance with the Safety Codes Act, Tomahawk Area Operators will develop and maintain an Owner-User Pressure Equipment Integrity Management program consistent with the requirements of the Alberta Boiler Safety Association (ABSA) AB-512.		Operators

2.3	To ensure the safe operation and reliability of their pipelines, Tomahawk Area Operators will develop and maintain a Pipeline Integrity Management Program consistent with the requirements of CSA Z662-07 Annex M and N.		Area Operators
2.4	In addition to the above standards for facilities and pipelines, the following Pembina Nisku Operators Group (PNOG) design standards will be employed by Tomahawk Area Operators: Added discussion re: emergency controls, back-up systems		Area Operators

3 Emergency Preparedness and Planning

To ensure the safety of the community, it is important to have a consistent and effective emergency response strategy. The key requirements governing emergency planning that form the foundation for this Standard of Conduct include the following documents:

- D071 – Emergency Preparedness and Response Requirements: ERCB Directive 71 details Emergency Response Plan (ERP) requirements that ensure that there is an effective level of preparedness when preparing and implementing an ERP. The ERCB regulatory system ensures that there is the capability and capacity in terms of trained personnel and equipment to carry out an effective emergency response to incidents and that industry plans are discussed and coordinated with other response agencies and mutual aid partners..
- Petroleum Industry Incident Support Plan: This document, mandated by Alberta Municipal Affairs and supported by the Alberta Emergency Management Agency, provides a framework to direct and coordinate how the government works together to support industries response to a serious upstream petroleum industry incident.
- Canadian Standards Association (CSA) *CAN/CSA-Z-731-03: Emergency Preparedness and Response*[1]. The ERCB references this CSA standard and expects applicable portions of it to be used in conjunction with *Directive 071* for the development of emergency preparedness and response programs.
- Relevant guides and regulatory documents detailing Parkland School Division safety requirements and emergency response include:
  - Parkland School Division's Emergency Response Plan.

In addition to the planning requirements by the ERCB in Directive 71, industry operating practices include the following standards of conduct specific to emergency planning and response:

#	Standard of Conduct	Stakeholder	Action By
3.1	The following standards are employed by Tomahawk Area Operators when preparing emergency response plans: Parkland School Division: Where school or bus routes are included in an approved Emergency Planning Zone (EPZ) or the Emergency Awareness Zone (EAZ),		Area Operators, Parkland School Division

	Parkland School Division will be provided with a map of the proposed EPZ to allow for confirmation of bussing routes, the identification of any related emergency planning requirements. Parkland School Division will provide confirmation of any need for having busses available on stand-by during drilling and completion operations. Parkland School Division has internal policies regarding criteria used to determine their need to have busses on stand-by and will provide explanation of the criteria to Tomahawk Area Operators upon request.		
3.2	Once an emergency response plan is reviewed and approved by the ERCB, Parkland School Division will be provided with copies of approved Emergency Response Plan (ERP)		Area Operators
3.3	When a school is in the Emergency Planning zone, Tomahawk Area Operators will make every effort to plan the drilling and completion operations in the Nisku sour zone to coincide with periods where school is not in session. If circumstances do not permit this to happen, a face-to-face meeting will take place between the responsible Company and Parkland School Division to ensure that all required emergency plans and precautions have been implemented.		Area Operators
3.4	Notifications of Parkland School Division will be completed as follows: Intention to drill Commencement of drilling operations – 5 business days Prior to entering sour zone – 4 days, 96 hours, timeframe to include a minimum of 1 instruction day, where relevant. Responsible company will confirm timing with Parkland School Division calendar. When sour drilling operations are completed Prior to commencing sour well completion operations Prior to well testing / flaring operations When sour well completion / testing operations are completed Well Servicing operations		Area Operators
3.5	Tomahawk Area Operators will ensure that the Parkland School Division is extended an invitation to all pre-sour meetings for plans that identify the presence of a school in the Emergency Planning Zone (EPZ) or Emergency Awareness Zone (EAZ). The purpose of the meeting will be review emergency and evacuation procedures prior		Area Operators

	to commencing sour operations including the confirmation of bussing information. Timing of invitation will include a minimum of 1 instruction day, where relevant. Responsible company will confirm timing with Parkland School Division calendar.		
3.6	When preparing site-specific Emergency Response Plan (ERP), names and contact information for bus drivers will be provided by Parkland School Division schools. This **confidential** information will be included by Tomahawk Area Operators in ERP documentation provided to responders. As required by ERCB, this requirement will be updated annually.		Area Operators, Parkland School Division
3.7	Tomahawk Area Operators will work with the Parkland School Division to identify those circumstances where supplemental safety equipment is a requirement to address the safety concerns of staff, bus drivers and student. In those circumstances where it is agreed that additional safety equipment is necessary, Tomahawk Area Operators will support the costs for providing that equipment.		Area Operators, Parkland School Division
3.8	In addition to the air monitoring requirement specified by the ERCB in D71, the following criteria will be applied for providing additional **temporary** air monitoring equipment: During drilling and completion operations and when a school is within a PAZ, temporary stationary air monitoring equipment will be placed between the School and the Wellsite. Also see Section 5 of this Standard of Conduct regarding the installation of permanent air monitoring equipment.		Area Operators

4	**Emergency Response Plan Activation and Area Specific Public Safety Measures**

Tomahawk Area Operators acknowledge their responsibility for ensuring that they are fully prepared and capable of responding to any level of emergency. The key requirements governing emergency response that form the foundation for this Standard of Conduct are detailed in operations specific emergency response plan as per the requirements of ERCB Directive 71. As highlighted in Directive 071, this includes activities such as:

- Identifying hazards.

- Preparing and maintaining Emergency Response Plans and procedures.
- Ensuring that the Emergency Response Plans identify sufficient resources and equipment for use by response personnel during an emergency.
- Assigning response personnel and ensuring that they are suitably equipped to carry out their duties through training, drills, and exercises.

In addition to the response requirements by the ERCB in Directive 71, industry site-specific response plans will include the following standards of conduct specific to Level-1, -2 and -3 emergency response actions:

#	Standard of Conduct	Stakeholder	Action By
4.1	**Level-1 Emergency** is defined as an incident where there is no danger outside the licensee's property, there is no threat to the public, and there will be no or minimal environmental impact. The situation can be handled entirely by licensee personnel. There will be immediate control of the hazard. There will be little or no media interest. In addition to emergency action identified in ERCB D71, the following Level-1 Emergency Actions will be implemented: - The affected school and Parkland School Division will be notified via a personal telephone call directly by the Responsible Company's emergency response personnel to allow Parkland School Division to move forward with its decision to begin the voluntary evacuation of school personnel and students at Level-1. - Upon request from Parkland School Division, the Responsible Company will provide rovers to lead school busses in the Emergency Planning Zone (EPZ). - The Responsible Company will mobilize all required resources including the Pembina Area Operators Group to provide assistance as required.		Area Operators, Parkland School Division
4.2	**Level-2 Emergency** is defined as an incident where there is no immediate danger outside the licensee's property or the right-of-way, but there is the potential for the emergency to extend beyond the licensee's property. Outside agencies must be notified. Imminent control of the hazard is probable but there is a moderate threat to the public and/or the environment. There may be local and regional media interest in the event. In addition to emergency action identified in ERCB D71, the following Level-2 Emergency Actions will be implemented: - The Affected School and Parkland School Division will again be notified by the Responsible Company and advised of the change in emergency status. Mandatory evacuations of all school personnel and students who have not already voluntarily evacuated will begin. - The Responsible Company will have manned roadblocks to isolate the Emergency Planning Zone (EPZ) and School Buses will not be permitted to enter the EPZ.		Area Operators, Parkland School Division

	(Regulation) - If a school bus is inside the Emergency Planning Zone (EPZ), a rover will be made available to lead the School Bus and will escort it out of the EPZ using a safe evacuation route. The rover travelling with the School Bus will have the ability to monitor H_2S levels and communicate with the Responsible Company's Emergency Operations Centre (EOC). - The responsible Company will continue with all required emergency response actions including the continued evacuation of all school personnel who have not already voluntarily evacuated.		
4.3	**Level-3 Emergency** is defined as an incident where the safety of the public is in jeopardy from a major uncontrolled hazard. There are likely to be significant and ongoing environmental impacts. Immediate multi agency municipal and provincial government involvement will be required. In addition to emergency action identified in ERCB D71, the following Level-3 Emergency Actions will be implemented: - The Affected School and Parkland School Division will again be notified by the Responsible Company and advised of the change in emergency status. - The responsible Company will continue with all required emergency response actions including confirmation that all school personnel had been successfully evacuated. The Responsible Company will advise all unevacuated parties inside the Emergency Planning Zone (EPZ) on how to proceed (stay indoors until a safe evacuation route has been identified, and/or evacuate the area).		Area Operators, Parkland School Division
4.4	To improve their ability to respond to emergencies, Tomahawk Area Operators will participate in the Pembina Area Operators Group (PAOG), a joint Industry - ERCB initiative established to provide mutual aid among operators for emergency response and incident investigation in the Pembina area.		Area Operators
4.5	Specific to Parkland School Division, additional emergency response actions supplemental to ERCB Directive 71 requirements will include: - If the evacuation of a Parkland School Division facility is required, the Tomahawk Area Operator emergency responders will work in cooperation with school officials to confirm that lockdown and evacuation procedures have been fully and completely implemented. - Parkland School Division facilities will not be identified in		Area Operators, Parkland School Division

	Tomahawk Area Operator Emergency Response Plans (ERPs) for shelter-in-place other than for school officials and students while their evacuation is being implemented. Tomahawk Area Operator Emergency Response Plans will not identify Parkland School Division facilities as community gathering points.		
4.6	Responsible Company acknowledges their responsibility for compensating Parkland School Division for those costs associated with necessary emergency evacuation of a Parkland school. **Key** compensation considerations include: Where the requirement for standby bussing has been agreed to between the Parkland School Division and a Tomahawk Area Operator, the Tomahawk Area Operator will reimburse Parkland School Division within 30 days of being invoiced at the mutually agreed to rates . These rates will be revisited and confirmed annually during the budgeting portion of the Parkland School Division fiscal year (September – September) Bussing costs for required evacuation Any associated costs of providing meals during an evacuation process, should they be required Any additional cost directly associated with a required evacuation Look at IL 8920 – Industry protocol for compensation that operators should follow.		Area Operators, Parkland School Division

5 Community Health and Environmental Protection

Protecting the local environment and community health is of paramount importance. This includes protecting the health and well being of our animals and livestock in Tomahawk area. In addition to the requirements detailed in Section 2 of this Standard of Conduct, the key environmental requirements, established by the ERCB in consultation with Alberta Environment (AENV), that form the foundation for this Standard of Conduct include the following documents:

- D001 – Requirements for Site-Specific Liability Assessments
- D006 - Licensee Liability Rating (LLR) Program and Licence Transfer Process
- D011 - Licensee Liability Rating (LLR) Program Updated Industry Parameters and Liability Costs
- D013 - Suspension Requirements for Wells
- D020 - Well Abandonment Guide
- D050 - Drilling Waste Management
- D058 - Oilfield Waste Management Requirements for the Upstream Petroleum Industry

One important Alberta Environment standards that deserves to be highlighted is:

- Alberta Ambient Air Quality Objectives: These objectives are intended to provide protection of the environment and human health to an extent technically and economically feasible, as well as socially and politically acceptable.

In addition to the above requirements, industry operating practices include the following standards of conduct:

#	Standard of Conduct	Stakeholder	Action By
5.1	Tomahawk Area Operators will make every effort to minimize flaring associated with completion clean-up operations and flow testing successful wells. Companies expect to limit flow test flaring to a maximum period of eight (8) hours where operationally feasible, targeting a four hour clean-up and a four hour flow test. In cases where a Tomahawk Area Operator has committed to notifying Parkland School Division of sour operations, the operator will advise Parkland School Division if additional well testing is required to successfully evaluate well.		Area Operators
5.2	If area development requires the installation of permanent facilities, Tomahawk Area Operators will work with Parkland School Division, where relevant, to develop Standards of Conduct to address issues related to continuous flaring during normal production operations at: - Oil or gas well sites, satellites and field compressors - Central production facilities (i.e. batteries and gas plants) (See also 6.2)		Area Operators
5.3	Decisions to install permanent air quality monitors in vicinity of Parkland School Division facilities will be made in consultation with and in support of the Pembina Sentinel Air Monitoring System (PSAMS) network and their criteria for strategic placement of monitors. The strategic placement will consider technical and social implications.		Area Operators, Parkland School Division, PSAMS

6 Other Community Safety and Quality of Life Issues

In addition to ERCB and Alberta Environment environmental requirements, industry operating practices to address additional community safety and quality of life concerns include the following standards of conduct:

#	Standard of Conduct	Stakeholder	Action By
6.1	Road use during peak bussing periods is an important safety issue. Tomahawk Area Operators will make every effort to minimize the number of heavy and oversized vehicles using local roads during peak bus hours of 0700 hours to 0900 hours and 1500 hours and 1700 hours. In the event that a		Area Operators

	school bus is encountered during a move of heavy equipment, the equipment will pull to the right as much as possible and stop – so long as this is deemed the safest course of action for all parties concerned. Tomahawk Area Operators will notify Parkland School Division of anticipated high activity periods for heavy equipment related to their operations.		
6.2	Site specific discussions regarding the criteria for the installation of permanent facilities will consider the following: (1) Effects on a school; (2) Monitoring of activities at the facilities site so they do not interfere with school activities: (3) Continuous flaring, noise, and related pollution controls; (4) Using administrative and engineering controls to ensure the permanent facilities reasonably practicably protect the safety of persons at the PSD school affected. The content of the Standard of Conduct needs to focus on the general standards that help with driving both company and project-specific actions. (See also 5.2)		Area Operators, Parkland School Division
6.3	If an off lease odour is confirmed, the operator is required by ERCB regulation to control emissions immediately or suspend facility/operations until repairs can be made.		Area Operators, Parkland School Division

Definitions and Acronyms

Emergency	A present or imminent event outside the scope of normal operations that requires prompt coordination of resources to protect the health, safety, and welfare of people and to limit damage to property and the environment
Emergency Awareness Zone (EAZ)	A distance outside of the EPZ where public protection measures may be required due to poor dispersion of the hazard.
Emergency Operations Centre (EOC)	An operations centre established in a suitable location to manage the larger aspects of an emergency. In a high-impact emergency, there may be a number of EOCs established to support the response. These may include the ERCB Field Centre incident command post, regional and corporate EOCs, a municipal EOC (MEOC), and the provincial government EOC (GEOC).
Emergency Planning Zone (EPZ)	The geographical area surrounding a well, pipeline, or facility containing hazardous product that requires specific emergency response planning by the industrial operator.
Emergency response plan (ERP)	A comprehensive plan to protect the public that includes criteria for assessing an emergency situation and procedures for mobilizing response personnel and agencies and establishing communication and coordination among the parties.
High vapour pressure (HVP) pipeline	A pipeline system conveying hydrocarbons or hydrocarbon mixtures in the liquid or quasi-liquid state with a vapour pressure greater than 110 kilopascals absolute at 38°C, as determined using the Reid method (see ASTM D 323).
Initial isolation zone (IIZ)	An area in close proximity to a continuous hazardous release where the public may be exposed to dangerous and life threatening outdoor pollutant concentrations and indoor sheltering may provide limited protection due to the proximity of the release.
Industry Recommended Practice (IRP)	An IRP is a set of best practices and guidelines compiled by knowledgeable and experienced industry and government personnel. It is intended to provide owners, operators, and contractors with advice regarding the specific topic. The recommendations set out in this IRP are meant to allow flexibility and must be used in conjunction with competent technical judgment. It remains the responsibility of the user of the IRP to judge its suitability for a particular application.
Hydrogen sulphide (H_2S)	A naturally occurring gas found in a variety of geological formations and also formed by the natural decomposition of organic matter in the absence of oxygen. H_2S is colourless, has a molecular weight that is heavier than air, and is extremely toxic.
Protective action zone (PAZ)	An area downwind of a hazardous release where outdoor pollutant concentrations may result in life threatening or serious and possibly irreversible health effects on the public.

Key Support Agencies and Associations

Alberta Boilers Safety Association (ABSA)	
Alberta Environment (AENV)	
Alberta Health Services – Capital Region	
Canadian Standards Association (CSA)	
Enform	
Energy Resources Conservation Board (ERCB)	
Pembina Area Operators Group (PAOG)	
Pembina Nisku Operators Group (PNOG)	
Pembina Sentinel Air Monitoring System (PSAMS)	
Synergy Alberta	