

Highpine Oil & Gas Limited

Applications for Three Well Licences Pembina Field, Tomahawk Area

December 30, 2008

ENERGY RESOURCES CONSERVATION BOARD

Decision 2008-135: Highpine Oil & Gas Limited, Applications for Three Well Licences, Pembina Field, Tomahawk Area

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Telephone: 403-297-8311

Fax: 403-297-7040

E-mail: Publications@ercb.ca Web site: www.ercb.ca

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ENERGY RESOURCES CONSERVATION BOARD

Calgary Alberta

HIGHPINE OIL & GAS LIMITED APPLICATIONS FOR THREE WELL LICENCES PEMBINA FIELD, TOMAHAWK AREA Decision 2008-135 Applications No. 1520574, 1521704, and 1521626

1 DECISION

The Energy Resources Conservation Board (ERCB/Board) hereby approves Applications No. 1520574, 1521704, and 1521626 subject to the eight conditions set out in Appendix 2 of this decision report. In addition, Appendix 2 sets out a list of 62 commitments made by Highpine Oil & Gas Limited (Highpine) to address community and individual concerns.

The Board is satisfied that Highpine's applications, together with its commitments, meet or exceed all applicable regulatory requirements for the safe drilling, completing, and servicing of the proposed wells. The Board is also satisfied that Highpine has demonstrated it has the experience and technical capability to drill, complete, and service these wells in a manner that protects public safety. Furthermore, the Board believes these wells can be drilled safely with the Tomahawk School and Hamlet of Tomahawk inside or adjacent to the wells' emergency planning zones (EPZs) and that the wells can be drilled safely with the school in session. However, the Board notes that for two of the wells, Highpine committed to conducting drilling and completions operations in the Nisku sour zone when the Tomahawk School is not in session. For the other well, where the EPZ does not encompass the Tomahawk School, Highpine committed to have buses and drivers on standby at the school during critical sour operations in the Nisku zone.

These commitments effectively remove the school students and staff from the drilling and completions EPZs for the wells in Legal Subdivision (LSD) 1, Section 16, Township 51, Range 6, West of the 5th Meridian (the 1-16 well) and LSD 7-17-51-6W5M (the 9-17 well). For the other well, where the EPZ does not encompass the Tomahawk School, the commitment will ensure an effective mode of evacuation of students should an incident occur.

Given that Highpine has made these firm commitments and considering the concerns of the community, in this instance the Board is taking the further step of making these three specific commitments conditions of approval of the applications.

The Board carefully considered a position taken by some interveners that no sour wells should be allowed within 7 kilometres (km) of the Tomahawk School or the Hamlet of Tomahawk, which has a volunteer fire station. The Board did not hear any evidence that indicates that the Tomahawk School or the hamlet is unique in Alberta and would justify the sterilization of all sour oil and gas resources within an arbitrary 7 km radius. The Board notes that many communities in Alberta with similar surface developments are located within EPZs for a variety of potential emergency situations, including sour gas. The Board is convinced by the evidence

In this context, the term "sour" used in conjunction with the words gas, wells, facilities, drilling, completions, production, operations, etc., denotes a significant percentage of hydrogen sulphide (H_2S) in the gas stream.

before it that these wells can be drilled, completed, and serviced safely, notwithstanding their proximity to a school and hamlet.

The Board is also satisfied that there is no evidence at this time that indicates that the wells cannot be produced safely. If these wells go into production, they will have automatic emergency shutdown equipment installed to significantly reduce the volume of gas in the event of a release. The production EPZs for these wells are expected to be much smaller than for drilling and would be based on actual well data. The Tomahawk School and Hamlet of Tomahawk will not be within the production EPZs for these wells. Highpine will be required to file additional applications for any production facilities.

2 INTRODUCTION

2.1 Applications No. 1520574, 1521704, and 1521626

Highpine applied to the ERCB pursuant to Section 2.020 of the *Oil and Gas Conservation Regulations* for three critical sour well licences at surface locations in LSD 1-16-51-6W5M (the 1-16 well), LSD 7-17-51-6W5M, with a bottomhole location at 9-17-51-6W5M (the 9-17 well), and LSD 8-25-51-6W5M (the 8-25 well). The purpose of the proposed wells is to produce crude oil from the Nisku Formation. Two of the proposed wells are new, and the 1-16 well will use an existing wellbore that will be deepened to the Nisku Formation.

The maximum hydrogen sulphide (H₂S) concentration expected to be encountered in the drilling of the three proposed wells is 160 moles per kilomole (mol/kmol), or 16.0 per cent.

The maximum H_2S release rate for drilling, completion, and servicing of the 1-16 and 9-17 wells is 2.5 cubic metres per second (m^3/s). The corresponding EPZ for both wells is 4.29 km. The maximum H_2S release rate for the production or suspension of these two wells is 0.51 m^3/s , with EPZs of 1.46 km.

The maximum H_2S release rate for the drilling, completion, and servicing of the 8-25 well is 1.51 m³/s, with an EPZ of 3.04 km. The maximum H_2S release rate for production or suspension of the 8-25 well is 0.51 m³/s, with an EPZ of 0.98 km.

The applications reflect the most current ERCB-approved H₂S release rates and EPZs. However, Highpine stated that it adopted larger EPZs for the purpose of design and implementation of the drilling and completion ERPs. These larger EPZs were based on previously ERCB-approved H₂S release rates and were used to design the Highpine public consultation programs.

The 1-16 well is located 3.2 km west of Tomahawk, the 9-17 well is located 5.2 km west of Tomahawk, and the 8-25 well is located 3.3 km northeast of Tomahawk.

2.2 Interventions

Interventions were filed by Parkland County, Parkland School Division, and a number of community members who reside within one or more of the EPZs. Some of the community members formed a group called the Concerned Citizens of Rural Tomahawk (CCORT). Two

other community members were parents with children in the Tomahawk School and were involved with the school parent council.

The main concerns expressed by intervening parties were public safety, the proximity of the wells to the school, the hamlet, and its fire station, the adequacy of equipment design, the adequacy of emergency response plans for both drilling and production, flaring, human health, the adequacy of consultation, animal health and compensation, and property values.

The Board also heard concerns from several members of the larger community in the form of oral statements.

2.3 Hearing

The Board held a public hearing in Tomahawk, Alberta, before Board Member B. T. McManus, Q. C. (Presiding Member), Board Member G. Eynon, P.Geol., and Acting Board Member W. A. Warren, P.Eng. Site visits, which included the school grounds, were conducted by the panel the afternoon prior to the hearing on September 22, 2008. The hearing commenced on September 23, 2008, and concluded on October 3, 2008. Those who appeared at the hearing are listed in Appendix 1.

2.4 Background

Highpine originally filed eleven well licence applications for the greater Tomahawk area and advised the Board that it was prepared to proceed with all eleven applications at one hearing. In early 2008, the Board held community information sessions, where it canvassed views on a single hearing. It received feedback that a single hearing would make it difficult to coordinate community members' efforts and ensure that individual concerns were not overlooked. It was also apparent from the feedback that there were specific concerns about the proposed wells closest to the Tomahawk School. The Tomahawk School has an enrollment of about 140 children from kindergarten through grade nine and most are bused to school from the surrounding rural community. Two of the eleven applications were subsequently withdrawn.

Based on community input, the Board decided to hold two hearings. The first was held in June 2008 and dealt with six wells, for which the school and hamlet were not inside an EPZ. The subject hearing deals with the remaining three wells, for which the school and hamlet are within one or more of the EPZs adopted by Highpine.

Proceeding No. 1577611, a Section 39 review of Well Licence No. 0389651, was also considered at this hearing. On October 28, 2008, the Board issued *Decision 2008-106* in connection with that proceeding.

2.5 Overview of ERCB Sour Well Application Process

The Board believes an overview of its sour well application process will assist the reader in understanding how the Board evaluated these sour well applications.

The ERCB's sour well application process and requirements are designed with the following in mind:

- Sour gas is found throughout Alberta and is associated with many oil and gas operations.
- H₂S is a dangerous substance that needs specific requirements and attention if it is to be developed safely.
- All industrial developments, including sour gas, that coexist with other surface uses impose some societal risk, which must be reduced by all practical means possible.
- The design and implementation of mechanical systems and emergency response plans should account for the reality that mechanical failure or human error cannot be eliminated completely. Therefore, with sour gas developments, a protective design approach and redundancy of safety measures are required to ensure public safety.
- Persons who may be directly and adversely affected by a sour gas development should have an opportunity to learn about the development and work with the proponent to resolve concerns whenever possible before approval.
- If all concerns are not resolved, the Board must provide a fair hearing process to determine if any specific circumstances or flaws in the application merit either revisions to or denial of the application.

The next sections describe the various stages of a sour gas well application process.

H₂S Release Rate Approval

Before a company files a critical sour well application, it must first perform an H₂S release rate assessment, and through a presubmission, it may obtain an early approved H₂S release rate. The approved H₂S release rate comes from an independent review by ERCB technical staff. A conservative release rate is calculated using the highest representative values in the subject area for a number of parameters, including H₂S concentration, pressure, and gas/oil ratio (GOR). The compounding effect of highest values results in a conservative H₂S release rate to ensure a significant margin of safety in facility design and the EPZs calculated from this release rate. The H₂S release rate is also adjusted for casing size, because casing effectively acts as a choke controlling the volume of gas that can flow to surface.

A company would use its H₂S release rate to determine whether the well is critical, as defined in *Directive 056: Energy Development Applications and Schedules*.

Emergency Planning Zone

An EPZ radius is determined using the ERCB-approved H₂S release rate, in accordance with *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry*. The method used to calculate EPZs was recently revised to use ERCBH2S models. However, the Board determined that the previous nomograph method remains a safe and cautious approach and may still be used for applications initiated prior to the revision.

A company is required to expand the EPZ boundaries to address any special circumstances, such as an egress issue or if the boundary divides a community.

Public Consultation

Directive 056 requires that public consultation and notification be conducted before an applicant files applications for well licences, batteries, gas plants, and pipelines. For a critical sour well, the EPZ based on an approved H₂S release rate is used by the company as its starting point for public consultation. Often companies will conduct open houses and provide information to interested parties outside the EPZ.

Companies use a variety of methods to consult with the public. The purpose of consultation is to inform, gather concerns and try to resolve them, and gather information for emergency response plans. The consultation process is iterative and can extend over a long period of time, depending on the nature of the development and the number of people and concerns involved. Information and company plans can change throughout the process. At some point, the company will decide to file a formal ERCB application. In many cases this is done when there are no outstanding objections, but in other cases objections remain for the Board to consider, and this may result in a hearing.

Emergency Response Plan

For all critical sour wells, a site-specific ERP is required. For all other sour wells and pipelines, an ERP is only required if there are any surface developments inside the EPZ. ERPs are designed to ensure that the public is notified of activities in the area, to inform the public throughout varying levels of emergency, and to ensure isolation of the area and efficient evacuation of persons within the EPZs in the event of an escalating emergency.

Different types of applications have different site-specific ERPs. If a company applies for a well licence, the ERP will deal with drilling, completion, and servicing operations. If a company applies for a battery or pipeline, the ERP will deal with production and suspension operations. The Board recognizes that well licences generally lead to facility applications for production operations. While production facility scenarios can be developed at the well licensing stage, the proper design of production facilities and their associated ERPs must be based on actual well data that come from drilling the well.

An ERP is not static. While there are standard components and procedures in all plans, an ERP requires continuous updating and adjustment leading up to an operation like well drilling or throughout the life of a facility in the case of production. The Board expects that an ERP developed as part of an application will require updating should approval be granted. The Board also requires that production ERPs be updated on an annual basis and exercised regularly to ensure that they remain current and can be implemented.

Site-specific ERPs are designed to address any situation encountered inside a particular EPZ, including regarding schools, hospitals, fire stations, residences, recreational uses, and industrial developments. Critical sour drilling operations are planned events of short duration, with the well manned 24 hours a day, and the ERP is activated during the operation. In the event of a release, the ERPs are designed to monitor ground-level concentrations, track the plume, and adjust the response as the plume moves within or even outside an EPZ.

For well production operations that have remote monitoring and operator inspections, the EPZs are expected to be much smaller, because automatic emergency shutdown valves and sensors are installed to severely limit the volume of any potential release. In addition, the flow potential will be reduced as pressure reduces with depletion and with vertical flow constraints introduced following wellbore completion.

Public notification is a critical part of any plan to ensure that the public is informed through all levels of emergency. Ignition of a release is used to add thermal lift to a release and reduce ground-level concentrations. If necessary, evacuation is also used either prior to or during a release to prevent exposure by removing the public from the hazard. Sheltering in place is a viable option in a number of instances, such as if someone is waiting for evacuation assistance or if evacuation is unsafe and exposure is imminent.

Well Licence Application and ERCB Technical Review

As defined in *Directive 056*, when a company files a well licence application, it is seeking approval to drill, complete, and service a well. The application undergoes a complete technical review by the ERCB. All critical sour well applications are considered nonroutine and receive a full audit by the ERCB for compliance with requirements in a number of directives, including *Directive 056*, *Directive 036*: *Drilling Blowout Prevention Requirements and Procedures*, *Directive 060*: *Upstream Petroleum Industry Flaring, Incinerating, and Venting*, and *Directive 071*.

Many of the special technical and procedural requirements for sour gas drilling were implemented following the inquiry on the Lodgepole blowout in 1982. The ERCB continues to review and update its requirements and procedures for sour gas. In 2000, the ERCB initiated a public safety and sour gas multistakeholder committee, which made 87 recommendations that the ERCB addressed with a three-year implementation project.

The ERCB's internal technical review for critical sour wells occurs whether or not an objection is received or a hearing is held.

ERCB Hearing

Given that the EPZ represents a protective area for emergency planning purposes, the Board uses the EPZ as one of its criteria for determining the persons who may be directly and adversely affected by a well licence application. If persons residing within an EPZ or who may be directly and adversely affected for other reasons are not able to resolve their concerns with the applicant, they are entitled to explore those concerns at a hearing. Certain interveners will also qualify for local intervener costs.

The fact that a hearing takes place means there are unresolved concerns and disagreement. This does not necessarily imply a failure in public consultation. The Board recognizes that some concerns cannot be resolved between the parties or there may be fundamental differences in perspectives.

The Board hearing panel must determine whether the applications should be approved based on all evidence presented in the course of the hearing. A panel may choose to deny an application, approve an application, or approve an application with conditions. If an application is approved,

the panel must be convinced the application satisfies all ERCB requirements, in particular the requirement that the proposed development is in the public interest. The panel must also be convinced that the applicant has the expertise to comply with ERCB regulations and that no special circumstances raise safety concerns that cannot be addressed.

If a well licence is approved, the applicant is required to update and review its ERPs before commencing any drilling operations.

Production Applications

If the well is successful and the applicant decides to proceed with production, it is required to repeat the application process for any facilities it needs to produce the wells. In this case, it will use actual well data for production H₂S release rates and EPZs. Once again, if concerns are not resolved with the persons who qualify for standing, there can be another hearing.

If a panel hearing a drilling and completions application is presented with clear evidence that a well cannot be produced safely, it can and will deny the drilling and completions application.

3 ISSUES

In regard to the subject applications, the Board has organized its review of the evidence into the following issue categories:

- the need for and location of the wells,
- H₂S release rates and EPZs,
- public consultation,
- public safety, and
- other issues.

In reaching the determinations contained within this decision, the Board considered all relevant materials constituting the record of this proceeding, including the evidence and argument provided by each party. Accordingly, references in this decision to specific parts of the record are intended to assist the reader in understanding the Board's reasoning relating to a particular matter and should not be taken as an indication that the Board did not consider all relevant portions of the record with respect to that matter.

4 NEED FOR AND LOCATION OF THE WELLS

4.1 Views of the Applicant

Highpine advised that since July 2001 it had safely drilled and completed or participated with partners in over 95 wells that have penetrated the Nisku Formation. Highpine stated that it had evaluated logs and core samples from wells drilled in the area, as well as more than 300 square miles of three-dimensional seismic data. Based on those analyses, it had acquired the necessary mineral rights to drill the proposed wells.

Highpine stated that the purpose of the applied-for wells was to obtain sour crude oil from the Nisku Formation. It added that the proposed wells were needed because there were no other wellbores in the area suitable for evaluating the production potential of the subject lands. It also stated that the wells would yield valuable information about the geology and occurrence of hydrocarbons in the Tomahawk area. Highpine stated that the seismic features it would be testing with the proposed wells were bank interior reefs. The bottomhole locations were specifically chosen to locate the highest structural position with the best porosity.

Highpine stated that the proposed wells and its ongoing Nisku development program would provide substantial economic benefits in terms of local employment and contracting opportunities, as well as royalties to the province for the benefit of all Albertans.

4.2 Views of the Interveners

The interveners did not comment on either Highpine's legal right to access its mineral rights or the potential economic benefits. A number of interveners took the position that no company should be allowed to access sour gas in areas that encompass a school or hamlet within an EPZ.

4.3 Findings of the Board

The Board notes that Highpine has the necessary mineral rights to access the resources for the subject applications. The Board also notes that surface rights were acquired for all the wells, but that there is currently a dispute between Parkland Country and Highpine over the status of a surface agreement for the 9-17 well. Such surface rights issues are matters within the jurisdiction of the Surface Rights Board and will not be considered in this decision.

In this area, the target portion of the Nisku Formation is characterized by small, amorphous, isolated reef structures. The Board accepts that the proposed wells are necessary to evaluate the formation at these specific locations. The Board also agrees that if these wells are drilled and are successful, there will be royalty benefits for Alberta and local employment opportunities. The Board does not find any scientific or technical support for the complete sterilization of such developments adjacent to schools or hamlets, for reasons that follow in this decision. The Board accepts that there is a need to drill these wells in order for Highpine to evaluate and recover the mineral resources.

5 HYDROGEN SULPHIDE RELEASE RATES AND EMERGENCY PLANNING ZONES

5.1 Views of the Applicant

H₂S Release Rates

Currently Highpine operates 46 wells and has a nonoperating position in an additional 9 wells producing from the Nisku Formation in the greater Pembina area. Highpine stated that through this experience, it has gained significant knowledge about the composition of the hydrocarbons contained in the Nisku Formation.

In addition to its in-house expertise, in early 2005 Highpine participated with other area operators in a comprehensive study of the geology and hydrocarbon distribution in the Nisku Formation. Area operators organized themselves into the Pembina Nisku Operators Group (PNOG) for this project. As a result of this collaboration, two documents were created summarizing all the Nisku information available in the area. One of the documents discussed the current interpretation of the Nisku reef bank complex; the other discussed standardized H₂S release rates for the Pembina Nisku area. The PNOG documents formed the basis of Highpine's H₂S release rate presubmissions to the ERCB for the subject wells.

By December 2006, five wells had been drilled into porous reefs in the Nisku Formation in the greater Tomahawk area. Four of the five wells encountered hydrocarbons with a maximum H₂S concentration of 16 per cent. The other well, located at LSD 6-3-51-7W5M and drilled in 1978, reported an H₂S concentration of 23.5 per cent from a drillstem test. This test was reviewed by PNOG and discounted because it was taken from a water-bearing interval in the Nisku Formation. No laboratory record of the gas analysis was located. Highpine also stated that the reported H₂S concentration was inconsistent with gas evolved from a hydrocarbon column.

Highpine cited previously drilled wells that it believed were comparable to the proposed wells. These wells had H₂S concentrations ranging from 3.5 to 16 per cent. Based on this information, Highpine used a maximum H₂S concentration of 16 per cent in its applications. Highpine also provided GOR data from the comparable wells to substantiate that 150 m³ of gas would evolve from each cubic metre of Nisku oil produced. Highpine stated that its analysis of the hydrocarbon migration and composition along the Nisku trend clearly showed a decrease in H₂S concentration and GOR in the Tomahawk area.

Highpine used a GOR of $300 \text{ m}^3/\text{m}^3$, twice the GOR suggested by actual well data, and an H_2S concentration of 16 per cent to calculate its applied-for release rates of $2.5 \text{ m}^3/\text{s}$ for 177.8 millimetre (mm) casing and $1.51 \text{ m}^3/\text{sec}$ for 139.7 mm casing.

Highpine stated that it expected that the 16 per cent H_2S estimate was high, based on data from the most recent wells drilled in the area. It also stated that the H_2S release rate was conservative by a factor of two because of the 300 m³/m³ GOR it used. It was confident that the approved H_2S release rates for these wells were significantly higher than what would be assigned once actual data were obtained.

EPZs

Highpine stated that it originally used the ERCB nomographs to determine the EPZs for the three wells. At that time it used release rates and H₂S concentrations that were higher than the current approved values. Notwithstanding the fact that it later received approval for the lower release rates and accompanying smaller EPZs, it maintained ERPs that reflected the larger EPZs for the purpose of these applications. Highpine stated that at the request of the ERCB it had submitted ERCBH2S modelling for EPZ determination for informational purposes. Highpine claimed that the EPZs calculated using ERCBH2S and current approved release rates and H₂S concentrations would be smaller than the EPZs adopted for these applications.

5.2 Views of the Interveners

H₂S Release Rates

CCORT submitted that the evidence on the H₂S release rates presented by Highpine was not as clear cut as Highpine stated. CCORT stated that should the subject wells be approved by the ERCB, it hoped testing would be done on the first well drilled by Highpine and the results made public prior to the other wells being drilled.

EPZs

CCORT's expert stated that there were deficiencies in ERCBH2S modelling (see Section 7.3.2), and therefore the EPZ sizes were underestimated. Under cross-examination, he acknowledged that he had not reviewed any of the ERPs submitted by Highpine and was unaware that the EPZs Highpine used to design its ERPs were not based on ERCBH2S modelling.

The Parkland School Division also stated that the information provided by Highpine regarding H₂S content and EPZs for the wells was confusing. The Parkland School Division acknowledged that if Highpine had used the latest requirements of the ERCB to calculate its EPZs, the Tomahawk School would not be in the EPZs for either the 8-25 or the 9-17 wells.

5.3 Findings of the Board

H₂S Release Rates

The Board agrees with the conclusions of the PNOG study that there is a decreasing trend in H_2S concentrations and GORs northeastward into the Tomahawk area. The Board also agrees that the data from the 6-3 well should not be used because the zone tested was over a water-bearing interval in the Nisku Formation. While there are recent data that suggest potentially lower H_2S release rate values in the Tomahawk area, the Board believes it is appropriate to use the higher concentration of 16 per cent and the higher GOR of 300 m³/m³. This ensures that a conservative release rate is calculated and will translate into a margin of safety in emergency planning that is protective of the public.

While the Board is confident that the H₂S release rates are conservative, it will nevertheless require that Highpine conduct an appropriate test to ascertain the H₂S concentration in the Nisku Formation from the first successful well approved pursuant to this decision report, the results of which must be submitted to the ERCB prior to entering the Nisku Formation in any subsequent well approved in this decision. Given the concerns in the community regarding these wells and their proximity to the Tomahawk School, the Board directs Highpine to drill the 8-25 well prior to the 9-17 well or the 1-16 well.

EPZs

The Board notes that the EPZs calculated based on the approved H₂S release rates and included in the applications were not used by Highpine for the purpose of designing and implementing its ERPs. Instead, Highpine has adopted larger EPZs based on previously approved H₂S release rates and has used these larger EPZs for all consultation and design of its ERPs. The Board also notes that the EPZs that it asked Highpine to calculate, based on the method in the July 2008

edition of *Directive 071*, are in all cases significantly smaller than those calculated using the previous version.

Tables 1 through 3 summarize the different EPZ calculations for each well and provide the location of the Tomahawk School and hamlet in relation to the EPZ boundary. The Board observes that because Highpine adopted the larger areas, the Hamlet of Tomahawk is inside all three EPZs and the Tomahawk School is in two EPZs (but not in that of the 8-25 well).

The Board believes that all the calculated EPZs are protective of public safety. Had Highpine adopted either the approved EPZs reflected in its applications or the EPZs based on the revised *Directive 071*, both the school and hamlet would be outside the EPZs for both the 8-25 and 9-17 wells. Regardless of which EPZ calculation method is used, the school remains inside the EPZ for the 1-16 well. It was apparent at the hearing that the proximity of the 1-16 well to the school was of most concern to the Parkland School Division.

The Board understands that Highpine chose to adopt the larger EPZs for the purpose of consultation and ERP design to avoid confusion in the community. The Board observed that confusion remained among some interveners and may have been compounded by the concerns about production EPZs and ERPs. Given the extended timeframe over which consultation occurred, the multiple wells, and the multiple EPZ calculations, the Board is not surprised that there was some confusion.

Highpine's adopted EPZs and associated ERPs represent the largest areas of all the calculated EPZs and are protective of public safety. The Board accepts that it is reasonable for Highpine to proceed with the larger EPZ and that this will not result in unmanageable ERPs.

6 PUBLIC CONSULTATION

6.1 Views of the Applicant

Highpine stated that it began its public consultation program for the 9-17 well in January 2006 and for the 1-16 and 8-25 wells in August 2006.

Highpine explained that the consultation process for these wells extended over a long period of time, during which changes occurred with respect to the regulatory process, community outlook, and stakeholder representatives. It acknowledged that its consultation program and process also evolved.

Highpine stated that it believed building and maintaining a positive relationship with the community throughout the life of a project was a key success factor. Highpine also believed that a positive relationship was dependent upon having a trustworthy, fair, respectful, sincere, inclusive, and accessible public consultation program. Highpine believed it had conducted a successful consultation program for these projects.

Highpine stated that it had provided area residents and stakeholdes with the opportunity to understand its Nisku development program and to state their concerns in regard to both these specific wells and its overall Nisku project. Highpine further stated that it had worked diligently with individual residents and stakeholder groups to address and resolve specific issues and

concerns. It had also kept stakeholders informed of any changes to their projects and area development plans.

Highpine's consultation included the use of site-specific project information, information update letters, community updates, and area development plans. It also incorporated individual consultation meetings, group open house meetings, group appropriate dispute resolution sessions, area open house sessions, and ERP review sessions. Highpine explained that it had also introduced H₂S awareness sessions, area operator group meetings, and stakeholder meetings.

Highpine explained that during its initial consultation process, it developed resident information packages to provide area stakeholders with pertinent information regarding each project. The packages included information about Highpine, H₂S concentrations and release rates, setbacks, on-site equipment, flaring, EPZ size, emergency planning, and H₂S and sulphur dioxide (SO₂) information. As a supplement to these information packages, Highpine also created community update brochures with technical, operational, and community information in a single document.

Highpine stated that it recognized the need for an overall area development plan and had attempted to address community concerns by providing all area stakeholders with information regarding the entire Tomahawk-Highvale Nisku trend development.

Highpine conducted open houses in June 2006 and May 2007 with respect to the 1-16, 9-17, 8-25, and several other wells in the area. Highpine believed it had worked diligently to continue its public consultation program throughout the licensing process. In addition, it engaged in numerous other consultations with individuals and groups in the area through its involvement in joint consultation programs with other area operators.

Highpine described its commitment to keeping the community and stakeholders updated throughout the life of its project as positive, consistent, and ongoing. Highpine believed that even with an exhaustive consultation process to build good relations and provide current, consistent information to the public, there might still be circumstances in which all of the concerns would not be resolved to the satisfaction of a potentially affected party.

Highpine believed it had been thorough and sincere with its public consultation program and had adequately fulfilled the *Directive 056* requirements.

6.2 Views of the Interveners

CCORT believed that its members were not provided with adequate public consultation by Highpine, as set out in *Directive 056*. CCORT stated that the consultation evidence portion in Highpine's submission did not accurately reflect the concerns and issues raised or the discussions between the public and Highpine staff.

CCORT also submitted that an application must be provided to all parties that might be directly and adversely affected, but maintained that this did not occur and, therefore, the public was not appropriately consulted. In particular, CCORT stated that consultation commenced on these applications in early 2006 and that the line lists might not have included new residents who had moved into the area.

CCORT also raised concerns regarding whether personal information provided by the local residents for ERP purposes was accurately recorded.

However, some CCORT witnesses stated that Highpine's consultation was sufficient and that their concerns were heard and understood, but that certain issues regarding the wells and applications would never be agreed upon by both parties. They acknowledged that full resolution was sometimes impossible between industry and the public, given their different perspectives.

The Parkland School Division stated that it had used funds from its discretionary budget to deal with oil- and gas-related issues that should only have been used for educational purposes. Additionally, considerable staff time had been allocated to attend meetings and prepare for hearings. The Parkland School Division asserted that it should not have had to use its time and resources to fight for the health and safety of its students.

Parkland County also raised concerns regarding whether consultation with its officials was adequate.

While certain community members advised that they had consulted with Highpine, they emphasized that not all of their concerns regarding the school were resolved, and in particular, they remained concerned about sheltering in place. They also felt that they were not adequately informed on consultation with the school.

6.3 Findings of the Board

The Board finds ample evidence of an extensive consultation program on the part of Highpine. Parties were provided with the required information in various formats: information packages, one-on-one meetings, open houses, community updates, plans for an ERP exercise, and activities in the area involving a number of area operators.

The Board observed that some interveners were dissatisfied with the public consultation process. Some interveners admitted they had trouble understanding all the technical information in the applications. Others acknowledged that Highpine's consultation process allowed them to understand the project and express their concerns, but that there was no resolution because their perspectives were different from those of Highpine.

The Board believes that the public consultation concerns raised are not unusual in a large public consultation program and can be adequately addressed through further process and consultation. The hearing, for example, is just such an opportunity for interveners to state their concerns and provide evidence directly to the Board.

The Board appreciates that during a lengthy well licensing process, new people may move into an EPZ. However, the Board believes that an applicant should have a reasonable expectation of closure in its preapplication public consultation program. Highpine acknowledged the need to update its ERP, and the Board normally requires this if a well licence is approved (see conditions in Appendix 2). Updating ERPs is a reasonable way to address new persons in an EPZ.

Evidence was presented regarding inaccurate information on specific individuals, despite their having provided the proper information to Highpine or Highpine's ERP consultant. The Board addresses that issue in Section 7.2.3.

With regard to concerns raised by Parkland County, the Board notes that the evidence showed that key county employees were provided with the information and had ample opportunity to engage with Highpine. No concerns regarding ERPs were expressed by the county until the eve of the hearing. It appears that a change of officials resulted in a different county position on these wells. The Board notes that the employees who testified on behalf of the county, including the local fire chief, appeared sincere in their desire to come to resolutions of issues that would be protective of public safety. This is a good foundation for future work in the area.

The Board finds that Highpine has satisfied the requirements of *Directive 056* with respect to its consultation process for these well licence applications. The Board notes that public consultation for an application should be the beginning of a dialogue that continues throughout the life of an energy facility. The Board believes this is clearly in the best interest of all parties and is especially important for sour gas developments. The Board urges both Highpine and community members to continue to invest in building an open and cooperative relationship. Several community members expressed a need and willingness to take sour gas awareness training; the Board, too, believes this is important and might be a good place to continue such a dialogue.

7 PUBLIC SAFETY

7.1 Well Design

7.1.1 Views of the Applicant

Highpine stated that its drilling and completions programs were designed to meet or exceed all applicable ERCB regulations, industry recommended practices, and Workplace Health and Safety standards and guidelines. Highpine further stated that it strove to ensure that its drilling, completions, and workovers had minimal impact on the local community and the environment.

Highpine explained that the subject wells were defined as *critical sour* by ERCB regulations. As such, Highpine follows Industry Recommended Practices (IRP) *Volume 1: Critical Sour Drilling Procedures and Specifications* in all its drilling programs and operations. Highpine further explained that the procedures and specifications of IRP *Volume 2: Completing and Servicing Critical Sour Wells* would be followed for all completions and workover operations. Highpine stated that many of the issues raised by the public during consultation with regard to drilling, completions, and workover operations were addressed by the IRPs.

Highpine explained that the 8-25 and 9-17 were new wells, while the 1-16 was the reentry and deepening of an existing wellbore. Each of the new wells would take 20 to 25 days to drill. About 9 days would be required for non-critical sour operations, and only 4 days would be required for operations in the critical sour category. For the proposed 1-16 deepening, Highpine anticipated that about 10 days would be required to move in the rig and deepen the well to the Nisku target. About 6 of those days would be required for non-critical sour operations and 4 days would be required for critical sour operations.

Highpine stated that each well would have surface casing cemented to below the base of groundwater protection, as required by the ERCB. Highpine would be drilling the surface holes on the two new wells with treated water obtained from a nearby fill station to eliminate the need

to drill potable water-source wells. Aboveground tanks and bins would be used for the storage of all drilling fluids, mud products, and other drilling waste.

Highpine further stated that intermediate casing would be cemented to surface and the production liners would be cemented in place. A smaller casing would be used on the 8-25 well to reduce the potential release rate and corresponding EPZ. As a result, neither the Hamlet of Tomahawk nor the Tomahawk School was within the calculated EPZ for the 8-25 well, although the EPZ adopted for ERP purposes included the Hamlet of Tomahawk.

Highpine explained that all downhole production equipment would be installed with the wellhead on and pressure tested prior to the wells being perforated. Highpine further explained that in the event of an issue arising while running or installing any of the equipment, the reservoir would not yet be open to the production casing. Highpine went on to explain that if an issue occurred after perforating, Highpine could simply shut in the wellbore.

Highpine submitted into evidence a list of 97 well, facility, and pipeline risk control measures it would have in place. These included such items as gas separation equipment with redundancy, a multistage choke manifold, ignition drills, H_2S sensors, mobile downwind monitors, ESD valves, and pressure-sensing equipment. Some of these control measures addressed drilling operations and others addressed production operations.

7.1.2 Views of the Interveners

CCORT was concerned about production operations if the well licences were granted. CCORT believed that the issues around production and future well operations should be considered by the Board at the well-licensing stage. It also believed that there should be opportunity for the public to express their concerns with respect to production and well operations, including an opportunity to review production ERPs.

Parkland County submitted that it had concerns about the drilling and completions portion of Highpine's applications, but did not have the time or expertise to submit a concise argument on the subject. Parkland County stated that it believed that the issue of safety went beyond the drilling and completions stage of the project because there would be risk to the public throughout the life of the wells. An example of its concerns with regard to production operations was the possibility of safety equipment failure. It submitted that even though certain safeguards were put in place for the different stages of operations, Highpine could not guarantee with absolute certainty that nothing would go wrong. Parkland County noted that while there were redundancies in Highpine's systems, it questioned whether these were sufficient. Parkland County also raised concerns about the potential of deliberate sabotage and the bypass of safety systems.

7.1.3 Findings of the Board

The Board is satisfied the evidence presented by Highpine confirms that it has met ERCB requirements and that its applications contain complete drilling programs. The Board notes the extensive list of commitments made by Highpine, many of which exceed ERCB requirements, to further address the safety concerns of members of the public when drilling these wells.

The Board also notes the risk control measures submitted into evidence by Highpine entitled *Highpine Oil and Gas Limited Nisku Well, Facility, and Pipeline Control Measures.* The Board agrees that a number of these additional control measures will further reduce the potential for an uncontrolled release during drilling and completion operations.

The Board is satisfied that Highpine has met the proper well design and control measures to drill and complete these wells safely.

Noting that a number of concerns were raised regarding production, the Board addresses these issues in Section 7.2.3.

7.2 Emergency Response Planning

The ERPs for Highpine's applied-for wells were developed prior to the release of the July 2008 edition of *Directive 071* and therefore followed the 2003 edition of *Directive 071*. It must also be noted that all ERPs were developed in accordance with Highpine's adopted EPZs (the largest EPZs), and not the calculated EPZs, which were smaller, or the July 2008 edition of *Directive 071* EPZs, which were even smaller.

7.2.1 Views of the Applicant

In support of its application and as required by *Directive 071*, Highpine submitted drilling and completion ERPs for each of the well licence applications. Highpine stated that the ERPs provided for public protection in case of an incident during drilling and completions and that they met or exceeded all applicable regulations. Highpine stated that Bissett Resource Consultants, which prepared the ERPs, had the most experience of any company in Alberta. Highpine pointed out that Bissett had extensive experience with emergency preparedness in the Pembina area.

Highpine explained that its ERPs were developed around three principles of preparedness: notification, early declaration of an emergency, and separation of the hazard and the public.

Highpine stated the following: with a level-1 emergency, all residents in the EPZ would be notified of the potential for an incident. Level-1 is the first indication of a potential downhole problem, which would occur long before any sour gas reached the surface. To be clear, a level-1 emergency could occur many hours or days prior to any potential H₂S release from a well. This notification would begin with a call from an automated call-out system, followed by calls from live telephone operators and visits from rovers.

Notification would occur again in a level-2 emergency, when there were deteriorating circumstances but still no gas to surface. At a level-2 emergency under *Directive 071*, mandatory evacuation would begin. Therefore, residents could be notified and evacuated prior to there being a hazard in the area. Highpine also pointed out that in the unlikely event of a release of gas to surface, the release would be ignited within 15 minutes to remove the H₂S hazard from the area.

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² In 2008, the ERCB released revised editions of *Directive 071*. However, all references to *Directive 071* in this section and throughout the report, unless specified "*Directive 071*, July 2008 edition," pertain to the requirements in the 2003 version of *Directive 071: Emergency Preparedness and Response for the Upstream Petroleum Industry, June 2003, Incorporating Errata to April 2005.*

Highpine recognized that the ERPs had not been updated since submission and that there were elements that were now out of date or incorrect. Highpine committed to updating the ERPs if the well licences were granted.

Highpine emphasized that these ERPs were for drilling and completion of the wells only, not for production. Highpine stressed that the production EPZs for these wells would be much smaller than the EPZs for drilling and completion and that the Hamlet of Tomahawk and the Tomahawk School would not be in the EPZs for the wells during production operations.

Highpine understood that it would be required to perform additional consultation for any pipeline or facility applications necessary to produce these wells. It also understood that it would be required to prepare a production ERP for review and approval by the ERCB and that a hearing might be required to deal with unresolved concerns by persons who may be directly and adversely affected by the proposed production facilities. Highpine expected the proposed wells to be incapable of unassisted flow to surface after about three years and that they would require artificial lift to produce at that time.

Highpine acknowledged that at present a call from a resident to 911 about an emergency at one of Highpine's locations would not immediately be transferred to Highpine. Highpine stated that it was fully prepared to work with the 911 call centre and the local authorities to create those protocols. Highpine once again stressed that at this time it was seeking approval for drilling and completion ERPs. It stated that since drilling and completions operations were manned 24 hours a day, seven days a week, it was highly unlikely that an area resident would detect an odour and call 911 without Highpine itself already being aware of the problem.

In response to concerns raised by the Parkland School Division and parents, Highpine committed not to conduct drilling and completions operations in the critical sour Nisku Formation while the school was in session for the 1-16 and 9-17 wells. This commitment would ensure that there were no children in school during Nisku sour operations at these wells and the school would not need to be used for sheltering in place. For the 8-25 well, where the EPZ did not include the Tomahawk School, Highpine committed to placing school buses and drivers on standby at the school when entering the Nisku sour zone during drilling and completions.

Highpine also committed to installing three permanent air monitors around the school that would be incorporated in the Pembina Sentinel Air Monitoring System (PSAMS). Highpine stated that during drilling it would also install temporary air monitors between the wells and the Tomahawk School. Highpine explained that although the shelter-in-place procedures outlined in its ERPs would not be required for the Tomahawk School during drilling as a result of its commitments regarding the timing of Nisku sour drilling and the provision of standby school buses, shelter-in-place procedures were a regulatory requirement for ERPs and must be included.

Highpine stated that it had not been advised of any formal concerns from Parkland County regarding these or any other ERPs until the day before the hearing. Highpine acknowledged the fire chief's concern that the Tomahawk Volunteer Fire Hall was in the EPZs for the proposed wells. While Highpine agreed that this was not an ideal situation, it pointed out that local fire departments did have protocols in place to respond to emergencies in other areas of the county.

Highpine stated that it was familiar with the Buck for Wildlife quarter section where the 9-17 well would be located. It added that it was similar to many other quarter sections in the area used

extensively by people with all-terrain vehicles for hunting and other recreation activities. Highpine stated that it was prepared to respond, taking into account such activities. Given the concerns of local residents about high use of the quarter section, Highpine agreed to post signs at the entrances to the area outlining the hazards and providing self-help options. Highpine added that it would use ground rovers and a helicopter to search the area for recreational users in the event of an emergency.

Highpine stressed its view that education for the community respecting sour gas is very important. It discussed several open houses and H₂S awareness presentations it had conducted for the community. Highpine believed that all persons residing in an EPZ, regardless of age, should be educated on the dangers of H₂S, as well as shelter-in-place procedures and other information that might assist in their understanding of the oil and gas industry in the area. Highpine also stated that area operators had formed the Pembina Area Operators Group (PAOG) to provide mutual aid among operators for emergency response and incident investigation in the Pembina area. Highpine also advised that a focus of PAOG is to ensure that all operators provide the same information to area residents to avoid mixed messages and confusion.

The 9-17, 1-16, and 8-25 wells would be located 4.39, 2.37, and 4.56 km from the Tomahawk School respectively. The well closest to the Hamlet of Tomahawk would be the 1-16 well, about 3.2 km away. Highpine observed that there were sour wells near population centres throughout the province of Alberta and that it was not unusual for a company to apply to drill sour wells near a population centre.

7.2.2 Views of the Interveners

Views of CCORT

The members of CCORT were concerned that the ERPs provided by Highpine did not include any information on emergency response during production. CCORT felt that since the licences, if granted, would be for the life of the wells, the ERPs should also be for the life of the wells. CCORT questioned whether Highpine would be as prepared to respond to an emergency in the future. CCORT expressed concern that it might not have the opportunity to review Highpine's ERPs for any pipelines that may be required, as Highpine may not be required to consult with it at that time and this hearing might be its only opportunity to review ERPs for production operations. CCORT asserted, therefore, that the ERP information provided should have included the production operations phase.

CCORT stated that the ERPs provided were now two years old and much of the information in them regarding the residents in the area was either outdated or incorrect. CCORT stated that there could have been many changes to residents in the EPZs and that the reception centre information had recently been changed and was now incorrect. CCORT also raised concerns that many residents may not remember consultation that took place over two years ago and may now have concerns about Highpine's emergency response procedures. At the hearing, several members of CCORT stated that Highpine had never verified their personal information and asked that their information be provided to them for review. Some members subsequently pointed out that their information was in fact incorrect on the ERP resident contact forms.

CCORT then stated that Highpine had not tested its ability to evacuate area residents and therefore it could not guarantee that the ERPs would work as planned. CCORT stated that for

Highpine to fully test its ability to implement its ERPs, it should conduct an exercise for every single well. Those exercises should be spontaneous and should involve the public.

Two of the members of CCORT had specific concerns regarding rovers and evacuation from their homes. They indicated that they lived on a dead-end gravel road, which sometimes took days to be cleared of snow in the winter. They also stated that they spent large amounts of time in their yards and fields and were therefore not near their phones. Given these circumstances, these members questioned whether Highpine could actually find and evacuate them during an emergency. They stated that they would be willing to work with Highpine to ensure that they and their families would be evacuated safely, but one member questioned whether a solution would be possible given her situation.

Members of CCORT expressed concern regarding Highpine's ability to locate people in the Buck for Wildlife quarter section. They stated that the area was used extensively for year-round recreational activities like hunting, quadding, and snowmobiling. CCORT stated that many hunters walked into the area dressed in camouflage and would be difficult for rovers to find. CCORT also stated that area users might not be able to move away from an H₂S plume if they could not determine wind direction and with dense vegetation blocking their way.

There were many concerns raised by CCORT regarding sheltering in place. Most members stated that the information provided to them was confusing or unclear. They stated that in most cases they would choose to leave the area in spite of instructions to shelter in place, stating that sheltering in place did not intuitively feel right.

Some members of CCORT who were parents raised concerns regarding evacuation of their children from both the Tomahawk School and their homes. One parent stated that she would remove her children from school while the wells were being drilled. Another indicated her family would choose to move if the wells were approved. CCORT parents also stated that when their children and their friends were not in school, they were often away from home playing in yards or neighbouring fields and Highpine would not be able to find and evacuate them.

Additionally, some parents stated that they should not have to educate their children on the dangers of H₂S, and expressed concern about the idea of their children attending H₂S information sessions at the Tomahawk School. They stated that learning more about H₂S could cause fear and increased stress for their children, and would not be helpful.

Views of Parkland School Division

The Parkland School Division stated that it had a legislated responsibility to look after the safety of its students and staff during school hours and while on buses and that the drilling of these wells would compromise its ability to maintain its safety standards.

It was also concerned about the effect an H₂S release might have on students or bus drivers on school buses. The Parkland School Division stated that its buses were not air tight and could not provide an effective barrier against an H₂S plume. It asserted that anything compromising the ability of a bus driver to operate a bus safely posed a significant risk to the students aboard that bus. The Parkland School Division stated that an H₂S plume or a sudden noise from a well site might be a distraction. It also stated that school bus drivers were not trained to deal with a large number of sick or panicked children resulting from driving through an H₂S plume.

The Parkland School Division acknowledged Highpine's commitment to provide buses and drivers on standby for the drilling of the 8-25 well and not to drill the critical sour zones of the 1-16 and 9-17 wells while school was in session. The Parkland School Division's representative explained that prior to this hearing she was unaware of any commitments made by Highpine or any agreements made between Highpine and the Parkland School Division regarding these wells. She explained that she had taken an extended leave of absence and these commitments were made during that time.

The Parkland School Division stated that it still had concerns with the ongoing effect the wells might have on the school once they went on production. The Parkland School Division gave evidence that it took up to 1.5 hours to call in buses and evacuate the Tomahawk School and that a full evacuation was difficult because of the challenges in getting the students organized. It was concerned that there would not be any warning of a release during production operations and therefore not enough time to evacuate the school before the plume reached it.

In a report commissioned by the Parkland School Division, Dr. Ho stated that the Tomahawk School was intrinsically unsafe to use for sheltering in place. The Parkland School Division was concerned that if a release occurred and students could not be immediately evacuated, they would be put at risk. Dr. Ho's report stated that it would cost \$500 000 to update a portion of the school to render it suitable for sheltering in place. Dr. Ho's report also stated that there should be reliable air monitors between the wells and the school, on the school property, and on school buses travelling through an EPZ.

The Parkland School Division asserted that Highpine's ERPs did not take into account either the psychological factors relating to students or sufficiently address the emergency response issues specific to the Tomahawk School and the large number of people within it. The Parkland School Division stated that its bottom line was that the 1-16 well was just too close to the school and that the ERCB should deny approval of that well because of the safety threat it posed to the school, students, and staff, even if the other wells were approved.

The Parkland School Division stated its concern that Highpine did not know the number of ambulances available to transport sick children in an emergency or where they would be transported to. The Parkland School Division was also concerned that the nearest county emergency service—the Tomahawk volunteer fire hall—was located within the EPZs of the wells and might therefore be unavailable to assist during an evacuation.

Views of Parkland County

Parkland County felt that the ERPs provided by Highpine were not comprehensive enough and should have also included production operations. It stated that an ERP should address all hazards for all situations. Additionally, Parkland County stated its belief that the calculated EPZs might not be indicative of an actual H₂S plume behaviour during a sour gas release and that a plume could extend beyond the EPZs.

Parkland County stated that it was mandated by the provincial government to provide for emergency response services within its boundaries. The county stated that it was bound by this legislation whether oil companies had an ERP in place or not, and it would not ignore its legal obligations. The county went on to state that it had procedures in place for responding to emergencies involving toxic gases. It said that its firefighters did not keep copies of oil company

ERPs in their trucks. If they were called to respond to an oil- or gas-related emergency, they would follow their own evacuation procedures, which could result in an evacuation of a larger area than that called for by a site-specific ERP.

Parkland County provided a description of its 911 call centre. It stated that its protocols dictated that if an area resident called 911 to report an oil- or gas-related emergency, the local fire, police, and/or ambulance service would be dispatched. The county explained that it was not the 911 call centre's process to contact local oil or gas companies to inform them of the emergency.

The county stated that once on location, the incident commander would be the one to decide whether to contact the responsible oil company. Parkland County thought that its emergency responders would most likely be called first to respond should an emergency occur once the wells were on production. The county also believed that its resources would be required to assist with evacuation at the Tomahawk School.

Parkland County expressed its concern that in the event of an emergency during drilling and completion of these particular wells, the Tomahawk fire department would be located within the EPZ and would therefore be unavailable to respond to any other emergencies in its area. The county agreed that it was capable of calling upon emergency responders from other areas of the county, but qualified that by saying it would result in a significant delay in response time. It maintained that the county should not be put in a position as result of an H₂S release in which the Tomahawk fire station would be unable to function.

Parkland County admitted that it did not communicate any concerns regarding the ERPs to Highpine until the night before the hearing and agreed that it should probably have done so earlier. The fire chief did state that he had concerns about the ERPs at an earlier date and had forwarded those concerns up the chain of command, in accordance with the protocol of the Parkland County administration. The fire chief agreed that he had not raised concerns about any of Highpine's previous wells, because the EPZs had not previously encompassed the Hamlet of Tomahawk or its school. Parkland County emphasized that it had concerns about Highpine's ability to effectively manage a response in an EPZ that contained Tomahawk and its school, which was already classified as a target hazard by emergency responders. The fire chief expressed concern that a target hazard should not be subjected to additional risks from sour gas.

Views of Other Interveners

Other interveners raised concerns regarding the safety of their children at the Tomahawk School. They stated that the school was unsafe for sheltering in place, and therefore they felt that their children could be at risk from an H_2S plume. They stated that they attended many of the H_2S awareness meetings and open houses held by Highpine and sometimes felt more confused as a result. They stated that they would like Highpine to provide more education to parents and teachers regarding H_2S and what steps they should take during a release.

These interveners were concerned that the ERPs provided did not deal with production operations. The parents questioned whether Highpine would be able to respond to an emergency and evacuate their children from the school as quickly during production as they could during drilling and completions. These interveners stated that there would be no other opportunity for them to scrutinize Highpine's ERPs for the production operations, and they therefore felt very strongly that Highpine should have presented its production ERP in this hearing process.

These interveners asserted that it would be possible for an operator to bypass safety measures and cause an H₂S release. They questioned how Highpine would be prepared to respond to a release if there was no warning. Additionally, their lawyer stated that the duration of a release could be significant if someone took a number of deliberate steps to bypass safety systems during production operations.

These interveners stated that the topography in the area surrounding Tomahawk and its school would have a large effect on how an H₂S plume would travel. Given the topography and varying weather conditions, they questioned whether Highpine's EPZs and understanding of plume dispersion was correct. They also questioned the qualifications of Highpine's ERP writer. They were concerned that the president of the company that wrote Highpine's ERP had no formal emergency management training. They questioned the confidence they could have in an emergency response planner who was unaware of the creek running by the school.

They also raised concerns regarding their personal information collected for the ERP. They felt there should be a verification process in place to ensure that the information collected by Highpine for the purposes of emergency response was accurate.

7.2.3 Findings of the Board

Having considered all the evidence, the Board finds that the ERPs submitted by Highpine, together with the Highpine commitments, will ensure that the public is protected during the drilling, completions, and workover phases of these wells and that Highpine is capable of implementing these ERPs effectively. Notwithstanding the above, the Board has imposed some additional conditions that are outlined below.

Directive 071 and Updating of ERPs

The Board heard concerns that Highpine's ERPs were out of date and were not updated when the July 2008 edition of *Directive 071* was released. When the ERCB released the new edition of *Directive 071*, it specifically considered how to deal with the transition. When *Directive 071* was released in April 2008, the Board also released a companion document which stated that for applications currently before the Board in a hearing process, the decision to require the applicant to recalculate its EPZ using ERCBH2S and rewrite its plan in accordance with the requirements in the April 2008 edition of *Directive 071* would be at the discretion of the Board and considered on a case-by-case basis.

For this hearing, the Board requested that, for information purposes, Highpine recalculate all three EPZs using the ERCBH2S models method in the July 2008 edition of *Directive 071*. The EPZs for all three wells calculated under the July 2008 edition of *Directive 071* were smaller in radius than those adopted by Highpine. The Board felt that asking Highpine to change the EPZ sizes and rewrite the ERPs so close to the hearing could create additional confusion throughout the community. Therefore, the Board allowed Highpine to adopt the larger, more conservative EPZs.

The Board requires Highpine to update its ERPs so that all persons who are within the ERPs have up-to-date information regarding these wells and are able to provide their up-to-date personal information to Highpine. The Board heard evidence that a number of interveners were concerned about the accuracy of their information on the ERP forms. The Board encourages

Highpine to develop a procedure to verify the accuracy of the personal information it has for individuals within the ERPs for these wells. There are a number of methods by which this could be accomplished. For example, Highpine may choose to provide individuals with copies of the information that it has and ask for verification regarding accuracy within a defined period of time.

Confusion regarding which version of the directive applied was clear in the evidence; the Board acknowledges that an error in one of its letters contributed to this confusion. The Board's concern regarding the evidence on this matter does not stem from the fact that there was confusion about which version of *Directive 071* applied, but rather that a number of individuals testifying on the adequacy of ERPs appeared not to have carefully reviewed the ERPs in question.

When addressing the issue of whether the ERPs are protective of public safety, it is absolutely imperative that one carefully examine the ERPs.

Tomahawk School

The primary reason these three well applications were heard at a separate hearing was the concerns the Board heard from the community about proximity to the Tomahawk School. Some of the main concerns expressed were that children attend the school, that they are bused to school, and that school evacuation would take time and might require shelter in place. While the main concerns centred around the health and safety of the children, there were other concerns about the interruption of education, stress and fear associated with sour gas awareness training, and costs.

The Board believes the operations can be conducted safely with the Tomahawk School inside or outside the drilling and completions EPZs for these wells. The Board agrees with Highpine's conclusion presented in its evidence that considerable time can be anticipated between a level-1 and a level-3 emergency during drilling operations. With many hours' or up to several days' warning, safe evacuation of the school should not present any problem, and the need to shelter in place at the school is highly unlikely. This does not negate the fact that in the unlikely event of an H₂S release, the Board believes the school can be used to shelter students.

The Board notes that through its commitments, Highpine has agreed to avoid Nisku sour operations while the school is in session for the 1-16 and the 9-17 wells and has further agreed to provide standby buses while in the Nisku sour zone for the 8-25 well. It is the Board's view that these commitments adequately address the concerns expressed by interveners. These concerns include shelter in place, ambulance availability, air monitoring systems, and the management of children at school or on buses during a drilling emergency. However, given that these are firm commitments and considering the concerns of the community, in this instance the Board is taking the further step of making those three specific commitments conditions of approval of the applications.

The Board also directs Highpine to sequence the drilling of these three wells so that it is not drilling through the critical Nisku Formation on more than one well at the same time.

As noted in Section 5.3, Highpine must also conduct an appropriate test to ascertain the H₂S concentration in the Nisku Formation from the first successful well and submit these results to

the ERCB prior to entering the Nisku Formation in any subsequent well approved pursuant to this decision. Again, in light of the concerns expressed by the community about having a school inside an EPZ, the Board directs Highpine to drill the 8-25 well first. This may provide additional data prior to penetrating the Nisku Formation for the other wells. Notwithstanding this requirement, the Board is confident that the preapproved H₂S release rates for these wells are conservative.

The Board encourages Highpine to share the results of any testing with the public. The Board believes that early H₂S testing and sharing of these data would improve public understanding and support ongoing dialogue. It is also mindful of the provisions of Section 12.150 of the *OGCR*, which provide an entitlement to hold these data as confidential for a prescribed period. The right to withhold the data from the public domain is laid out in the regulations and must be respected unless Highpine itself chooses to share the data. However, it must again be noted that the submission of the data to the ERCB is not optional, and the public can be assured that these data will be carefully reviewed.

There are numerous examples throughout the province where urban centres and schools are included in ERPs and where the local authorities and energy companies are working closely together to ensure public safety. The Board considers it critical that the Parkland School Division and Parkland County work together with Highpine to build relationships that ensure the safety of the citizens.

Tomahawk Fire Department

Another significant concern expressed was the potential loss of service of the Tomahawk Volunteer Fire Station because it is within the EPZs of the proposed wells. The Board notes that entry of the sour zones in each of the wells is a relatively short duration event of up to four days. This period of time can be planned for and all necessary alternative emergency response resources can be arranged in advance.

The Board notes that the warning time between level 1 and level 3 should provide adequate time to mobilize fire station personnel and equipment for its service to remain available throughout a drilling emergency. The Board also notes that there are processes in place to transfer emergency response resources within Parkland County, if required. The Board encourages Highpine and Parkland County to maintain open lines of communication to ensure that all necessary arrangements are made. The Board is satisfied that having the Tomahawk fire station inside EPZs for the drilling and completions of the proposed wells does not present an insurmountable problem in ensuring that fire service remains available in the Tomahawk area during a drilling emergency. The Board further notes that the Tomahawk fire station will not be within the EPZs for production operations of these wells.

Other ERP Issues

The Board heard confidential evidence from one area resident that family circumstances require further consideration and consultation by Highpine respecting potential evacuation. While the Board believes it is best for these parties to work out options themselves, it appears to the Board that the dedication of a rover or rovers that have developed a relationship with this family would be a potential solution. The Board directs that Highpine conduct further consultation with this family and report back to the Board on the arrangements it arrives at and any changes that must

be made to the ERP in relation to the situation prior to commencing drilling operations at either the 1-16 or 9-17 wells.

The Board also heard concerns about egress issues from two residents who reside on a dead-end road. The concern is particularly acute in the winter, when it can sometimes take several days for the roads to be plowed after a heavy snowfall. In the event that Highpine is conducting drilling and completions operations in the winter on any wells that include these individuals in an EPZ, it must take steps to ensure that this road remains passable.

The Board heard evidence regarding the use of the Buck for Wildlife quarter section and the difficulties that Highpine might encounter in attempting to find individuals within the quarter section. While it may take effort on the part of rovers to locate individuals in the Buck for Wildlife area, the Board is convinced that Highpine will be able to evacuate the area in the event of an emergency.

The Board does not believe that 911 issues are of any concern during drilling and completions, when the well sites will be manned 24 hours a day. The Board is convinced that a system can be developed to ensure that there is an effective 911 protocol in place linking Highpine and other companies operating in the area with local emergency responders, in order to ensure a well-informed and effective response in the event of an emergency during production.

ERP Implementation

With regard to the drilling and completions, some interveners expressed concern about Highpine's ability to implement their ERPs. Given all the evidence in this proceeding, the Board is satisfied that Highpine will be able to effectively implement its drilling and completions ERPs.

In addition to the evidence heard in this proceeding, the Board makes note of requirements in place to ensure that company responders are familiar with their ERPs and have the capability of implementing them. For all wells, there is Board a requirement that within 96 hours of drilling, the operator (Highpine, in this case) must conduct a meeting that identifies any hazards associated with the operation and review the site-specific ERP. All persons who have a response role in the ERP are required to attend this meeting.

In addition, for critical wells such as these, Highpine must conduct an additional meeting prior to entering the Nisku zone. At this meeting roles and responsibilities within the ERP would once again be verified and EPZ information be discussed. ERCB field staff attend these critical well meetings and will ensure that Highpine responders have a full understanding of the ERP prior to allowing them to continue.

Highpine is also required, through *Directive 071*, to hold a major exercise every three years on its production ERPs. Highpine has committed to holding a major exercise every year in this area, which exceeds ERCB requirements. The Board notes that an ERP exercise was held by Highpine following the hearing in October 2008.

Given the above, the Board is satisfied that Highpine could not proceed with drilling without demonstrating that it is capable of implementing its drilling, completions, and workover ERPs.

Production ERPs

The Board understands that many of the interveners share the view that production ERPs should be addressed at the well-licensing stage. Indeed, some interveners took the position that the risk to the public is greater during production than during drilling and completions. This position appears to be based on the fact that drilling is a short-term event, while production is ongoing. Further, drilling and completion operations are manned 24 hours a day, with emergency response resources mobilized, while production operations are remotely monitored and operator inspected, with reliance on automated ESD equipment and on emergency response resources that would have to be mobilized after a malfunction or release were detected. The critical drilling operation is a short-duration event, and therefore it is not unreasonable to have emergency resources on standby. The concern expressed is that a production release would come without warning, and it would take longer to mobilize emergency response resources.

Production operations might thus appear to be given less attention. There are, however, significant differences between drilling and completions operations and production. At the outset, the well results permit the design of facilities and ERPs for production operations that are reflective of actual data. As a result of the cautious approach taken in estimating those data for drilling and completions, it is highly likely that a lower release rate would be supported for production operations, absent any other controls.

As well, there are other significant controls in place. Any of these wells equipped for production will have a subsurface safety valve installed that will close if the SCADA system detects anomalous pressures or the presence of H₂S. In the event of the SCADA system or other instrumentation malfunctioning, the subsurface safety valve will fail safe, which means it automatically closes. All of these features significantly reduce both the likelihood and magnitude of any prolonged release.

Similarly, pipelines are equipped with automatic ESD valves along the pipeline, as well as sensors to limit release volumes from a pipeline rupture. A sudden decline in pipeline pressure would close ESD valves along the pipeline, allowing only that gas present between ESD valves to escape. By strictly limiting the volumes that could escape, the hazard is dramatically reduced relative to drilling.

The fact remains that one cannot fully assess a production ERP until the well data are obtained and the production facility options examined. The best approach is to make conservative assumptions based on the worst-case H_2S release rate. In this case, the Board notes that in applying the worst-case production release rate, the Tomahawk School and Hamlet are not going to be within the production EPZs for any of these wells.

The Board heard evidence provided by a witness for CCORT who was exposed to sour gas from a production facility. This evidence reinforced the need for comprehensive control measures to prevent a release, a production ERP to prevent exposure in the event of a release, and greater public understanding of H₂S issues.

The Board appreciates that the witness took time to attend this hearing and provide compelling information regarding her experience. However, in the context of this particular application and hearing, it must be noted that the witness spoke regarding a different facility operated by a different company and located about 250 km from the applications under consideration.

For all of the reasons set out above, the Board requires that sour production facilities have their own application process, with appropriately calculated EPZs, public consultation, and ERPs. If the Board hears evidence during an application for drilling and completions that makes it clear that such a well cannot be produced safely, this would justify a denial of the application at the drilling and completions stage.

7.3 Hazards and Risks

A hazard is a substance, object, or activity that can cause harm. In the sour oil and gas industry, the main hazard is H₂S. Risk is a measure of human injury from a hazard in terms of likelihood and magnitude.

Hazard and risk assessments are not a standard requirement in support of sour well applications to the ERCB. This is because the Board is aware that H₂S is a hazard and imposes risk and has therefore designed its sour gas development process to address this. In this case, the Board asked Highpine to conduct the hazard and risk assessment for information purposes, because it was done for earlier applications and in light of the specific concerns from interveners about the Tomahawk School and Hamlet.

A hazard and risk assessment consists of three parts: a hazard analysis, a risk analysis, and a risk assessment.

When calculating the hazard, dispersion modelling is used to predict ground-level H_2S concentrations. The calculation of the risk takes into account the probability and frequency of the circumstances that could lead to exposure to the calculated hazard. A risk assessment is the process of determining the acceptability of the calculated risk and comparing these to standards and guidelines, such as those of the Major Industrial Accidents Council of Canada (MIACC).

Hazard and risk assessments are difficult concepts, and there are different perspectives on the acceptability of risk.

7.3.1 Views of the Applicant

Highpine submitted that it had completed a thorough risk assessment for the proposed applications and that it had fulfilled the Board's request for this work. Highpine noted that this type of assessment was not a regulatory requirement. Highpine's consultant stated that it had ample experience in hazard analysis but this was its first risk assessment.

Highpine asserted that none of the interveners put forward expertise to refute the hazard and risk assessment. Highpine submitted that the assessment was properly completed. It stated that the probability data for a well blowout used in the risk calculations were not used previously but were representative of current ERCB data.

It was Highpine's view that the main hazard associated with these applications was an uncontrolled release of H_2S and that other hazards, such as SO_2 and radiant heat, which would only occur if the release were ignited, would be insignificant by comparison. It was Highpine's position that although H_2S is heavier than air in its pure gaseous form at standard conditions, the total gas mixture would be lighter than air.

Highpine's consultant stated that it used the ERCBH2S model to calculate the hazard. It asserted that it considered all the appropriate parameters for the modelling and appropriate release times. It claimed that ignoring stable conditions with low wind speeds or calm atmospheric conditions was consistent with the findings and direction of the ERCB. It also claimed that it had considered the LC-50 end point, which was the appropriate end point for lethality as specified by the ERCB for risk assessments.

Highpine's consultant felt that the hazard and risk assessment was very conservative, as it did not consider all the mitigation measures that Highpine would be implementing if the wells were drilled and produced. These measures would include the successful implementation of an ERP, the use of thick-walled pipe, and the critical well factor (a risk reduction factor used to account for the extra safety requirements for critical sour wells).

Highpine's consultant stated that individual risk predictions were compared to the MIACC landuse guidelines. Societal risk predictions were compared to the United Kingdom Health and Safety Executive criteria. It was Highpine's position that the Tomahawk School was not in a zone of unacceptable risk from an individual or societal risk standpoint.

Highpine's consultant recommended that Highpine implement mitigation measures to further reduce the risks to the public. Highpine supplied a list of 97 risk control measures that it had in place to protect human health and reduce the risks to the public.

Highpine asserted that the position of the interveners that the children of the school should not be exposed to any amount of involuntary risk and that there should not be sour wells within 7 km of a school were not positions based on science and reason. Highpine argued that if oil and gas development was to take place in Alberta, the Board must base decisions on facts. Highpine submitted that it could drill and complete these wells safely and protect the safety of the children at the Tomahawk School. Highpine stated that it was not uncommon or unusual for sour wells to be located close to urban centres.

7.3.2 Views of the Interveners

Views of CCORT

CCORT stated that the Board should not just look at each project individually, but needed to examine the cumulative development in the area when considering the risks to the public. CCORT claimed that the risks during production were more significant than during drilling and completion and needed to be adequately defined and managed.

CCORT's expert was of the view that a release of sour gas would be denser than air and therefore the release would stay close to the ground initially. He stated that as the gas mixed with air, it would become less dense and eventually become the same density as ambient air. CCORT's expert asserted that as the gas moved downwind, it was likely that the H₂S concentrations would continually decrease and gas would not collect and increase in concentration. He stated that flow of a dense gas like H₂S was complex and difficult to predict and might act similarly to the movement of fog. He stated that H₂S could follow the flow in valleys, which could inhibit its dispersion.

CCORT's expert stated that there were a number of deficiencies in the hazard modelling using ERCBH2S for determining the size of the EPZs and for use in risk assessment. He claimed that the ignition times used by Highpine were at the lower limit allowed by the ERCB and therefore Highpine should justify how the chosen ignition or release times would be achieved. He argued that the ERCBH2S model was not the proper tool to evaluate the hazards for a risk assessment.

CCORT's expert asserted that low wind speed and stable atmospheric conditions (known as F1 and F1.5) should be considered in determining EPZ sizes and in hazard and risk assessments. CCORT stated that minimum turbulence in the atmosphere would occur in these conditions and, hence, the ability of the atmosphere to disperse pollutants would be at a minimum.

CCORT expressed concern about the frequency data for blowouts that Highpine used in the hazard and risk assessment. It argued that it was lower than what had been used in the past and that the predicted risks could be underestimated. CCORT claimed that the assessment should have considered SO₂ from an ignited blowout and that the Board and Highpine should not overlook this hazard in emergency situations. Due to the deficiencies noted, it was the view of CCORT's expert that Highpine should recalculate the assessment.

CCORT stated that in this case it was unreasonable for people to accept the risks imposed on them, regardless of the magnitude or whether the levels could be considered acceptable. CCORT was of the view that the potential hazard presented by these wells was too great.

Views of Parkland School Division

Parkland School Division was of the view that the risks posed by these wells were unacceptable because they were imposed by a third party on the children at the Tomahawk School. It maintained that no amount of imposed incremental fatality risk was tolerable. The Parkland School Division took no comfort that the Tomahawk School was predicted to be outside a zone of unacceptable risk.

The Parkland School Division acknowledged that the Tomahawk School would not be in any of the production EPZs for these wells, but it believed the school was sufficiently close that the concerns remain for the safety of the children. The Parkland School Division submitted that if the oil industry wanted to have sour wells close to the Tomahawk School, it should develop systems to contain harmful substances at well sites.

It also stated that even an odour from the wells, which may not require evacuation of the school, would be distracting to the students and could interrupt their education. The Parkland School Division took the position that its students had a right to attend school without fearing harm from an H₂S release.

Views of Parkland County

Parkland County argued that the maximum duration of flow from the producing well that Highpine assumed in its hazard modelling was too short and could be longer if an incompetent licensee assumed control of the facilities. Parkland County asserted that the ERCBH2S model had not been properly peer reviewed. As a result, Parkland County expressed concern that the risks might be far worse than predicted.

Parkland County argued that many things could go wrong and cause a release of sour gas.

Parkland County questioned the credibility of the witness doing the hazard and risk assessment and suggested the Board should weight his evidence accordingly.

Views of other Interveners

It was the view of the other interveners that regardless of the calculated risks, it was not tolerable to subject the children of the Tomahawk School to any level of risk, even if such risks were mitigated and were very low. The other interveners were not opposed to oil and gas development per se, but believed the proposed wells to be located too close to the school.

The other interveners believed that the local meteorological conditions were complex, due to the topography and weather patterns, and were worried that a release of H₂S would not disperse as effectively as predicted.

7.3.3 Findings of the Board

Hazard and Risk Assessments

The Board notes that for critical sour operations like the ones examined in this proceeding, risks are managed through regulations such as setbacks, ERPs, and specific requirements outlined in *Industry Recommended Practices (IRP) 1: Critical Sour Drilling* and *IRP 2: Completing and Servicing Critical Sour Wells*. The Board notes that Highpine provided a list of 97 risk control measures, which include requirements and commitments designed to mitigate risks associated with these wells.

Given these significant risk control measures in place, a multitude of overlapping failures, over a period of many hours or even days, would have to occur before a release of H₂S during drilling and completion operations. The potential for such an occurrence is extremely unlikely.

Notwithstanding the very low probability of a release, the Board requires site-specific ERPs, which must include surface developments, such as schools or other community facilities, to ensure that the public will be protected.

The Board recognizes the key community concern that the Tomahawk School would be within the drilling and completion EPZs for two of these wells. However, the Board does not accept that in this particular case the risks associated with the presence of the Tomahawk School cannot be satisfactorily mitigated.

In addition to following Board requirements for the design of the ERPs, Highpine has taken a further step and made a commitment that it will not conduct Nisku sour drilling and completion operations for the 1-16 and the 9-17 well while school is in session. This effectively removes the school from the drilling and completions EPZ for those two wells. The commitment to provide standby busing for the school while drilling in the Nisku sour zone for the 8-25 well will ensure an effective mode of evacuation of students should an incident occur. As noted in Section 7.2.3, given that Highpine has made these firm commitments and taking into account the concerns of the community, in this instance the Board makes these three commitments conditions of approval.

The Board finds that hazard and risk assessments submitted in this and previous hearings only serve to emphasize the importance of ERCB regulations and requirements in regard to sour gas development.

Hazard and risk assessments that do not incorporate all mitigative measures do not accurately reflect the risks imposed on the public. As a result, if the findings of a hazard and risk assessment are not communicated along with an explanation of how relevant mitigative measures will reduce the risks, persons in an EPZ may be left with an unrealistic and inflated view of the real risks imposed. While it is important for the community to be aware of sour gas activities and to be cognizant of potential dangers, inflated views of the real risks are not helpful to anyone.

The Board recognizes that its own requirements to plan for a worst-case scenario may also contribute to public anxiety; however, to plan for anything less would be irresponsible.

Other Specific Concerns Raised by Interveners

The Board notes that during an uncontrolled release from a critical sour gas well, there are other hazards in addition to H_2S and SO_2 . However, the Board is satisfied that these two are the main hazards and is convinced that others (such as radiant heat) will be confined to the well site and that the public will be protected.

The Board appreciates that both H_2S and SO_2 can be harmful to humans, livestock, and the environment at certain concentrations and that exposure to either of these substances needs to be eliminated or minimized by all reasonable means. In the event of an uncontrolled release, ignition creates additional plume rise as a result of the heat of combustion, which increases dispersion. When sour gas is ignited or combusted, H_2S is converted to SO_2 ; the decision to ignite the release is not based on the relative toxicity of the substances, but rather on increasing plume dispersion.

The Board would also like to provide some information about the properties and behaviour of sour gas in order to clarify some common misconceptions:

- In the atmosphere, sour gas is not necessarily heavier than air. Pure or 100 per cent H₂S is indeed heavier than air, but when dealing with a sour gas release the molecular mass of the entire gas mixture must be considered. In some cases sour gas could be heavier than air, but for the subject wells the overall composition indicates that the gas will be lighter than air. This is because the major component of the gas is methane (62 per cent), which is lighter than air.
- Sour gas in a reservoir or in a pipeline is under pressure. When released to the atmosphere, which is at a lower pressure, it will quickly expand and cool. If the sour gas cools enough relative to the outside temperature, it may initially be heavier than air. As the sour gas mixes with air, it will take on the characteristics of ambient air.
- Although H₂S itself is heavier than air, it will not separate from the sour gas mixture. Consequently it will not settle in low-lying areas. This is difficult concept to explain, as it requires a discussion of thermodynamics. However, a simple analogy is to carbon dioxide (CO₂), which is heavier than H₂S and air. CO₂ exists in the atmosphere at a concentration of

350 parts per million (ppm), yet it does not separate out of the atmosphere and settle on the ground.

• There are limited circumstances under which sour gas may flow downhill. For these wells, with a 16 per cent H₂S sour gas mixture, if the mixture is initially heavier than air, as discussed above, or there is downslope wind flow, it may move downhill. It is important to understand that the gas will continually mix with air, dispersing and diffusing to lower concentrations as it moves.

Highpine used the ERCBH2S model for the hazard analysis in support of its risk assessment. The Board is satisfied with this method for hazard modelling, which is specified in the July 2008 edition of *Directive 071*. CCORT's expert was of the opinion that calm and low wind speeds in stable atmospheric conditions result in the worst case for dispersion. The exclusion of wind speeds lower than 2 m/s is consistent with the approach adopted in the ERCBH2S model for the determination of EPZs. From field measurements, the ERCB found that for wind speeds less than 2 m/s, the dispersion coefficients used in models understate turbulence and overpredict ambient concentrations. These findings are discussed in the technical documentation of the ERCBH2S model.³ The Board is satisfied that the ERCBH2S model properly accounts for wind speed and stability class combinations. The Board notes that while CCORT's expert did not participate in the development of ERCBH2S, he is now prepared to submit a report to the ERCB outlining his concerns about its approach.

The Board notes the interveners' claim that the local topography is complex and unique and would somehow limit the dispersion of a sour gas release. The Board found no compelling evidence to suggest that the area around the proposed wells is unique or any more complex than many other areas in the province. The Board understands that topography can affect airflow and turbulence and, therefore, how a plume disperses. These effects can be beneficial (terrain can increase turbulence, which increases dispersion) or detrimental (a very narrow steep valley could limit dispersion). The ERCBH2S model does not explicitly incorporate terrain. It assumes a release at ground level, emitted horizontally, flowing parallel to the terrain that will only rise if there is sufficient buoyancy. These model conditions effectively remove the need to separately model topography.

The Board is satisfied that the ERCBH2S model provides a reasonable estimate of the hazard from a sour gas release that could occur anywhere in the province that is protective of public safety.

The Board notes the interveners' claim that the ERCBH2S model has not been properly peer reviewed. The Board makes all efforts to ensure that ERCB regulations are technically accurate, justifiable, and defensible, and the efforts put toward developing ERCBH2S are no exception. The Board considers the process of consultation and technical input for the model development to have been extensive. The model was in development for over four years before it became a part of *Directive 071*. However, the Board always welcomes input from technical experts if there are concerns.

 $http://www.ercb.ca/docs/public/sourgas/eubmodelsdraft/Volume1_ERCBTechnicalReference_200807.pdf-Section~7.5.1.$

³ Found on the ERCB Web site at

After reviewing the hazard and risk assessment and related cross-examination, the Board considers that the approach used by Highpine's consultant to calculate risk levels was not clearly presented. However, as noted earlier, hazard and risk assessments are not an ERCB requirement. The Board is confident that any risk posed by the drilling and completions of these wells is adequately addressed by the regulations and the additional commitments made by Highpine.

For the Board to approve a sour gas application, it must be satisfied that a proponent has minimized the risks to the public and considered all potentially relevant issues. The Board has specific additional safety requirements for drilling critical sour gas wells that are intended to prevent a release, all of which Highpine has included in its drilling plans. When these are combined with the other commitments and mitigation measures in place, the Board is satisfied that Highpine has taken appropriate steps to minimize the risk to the public associated with the drilling and completion of the proposed wells.

7.4 Flaring

Flaring is the controlled burning of natural gas. The ERCB regulates flaring through performance and reporting requirements, permits, and data collection, as detailed in *Directive 060*.

7.4.1 Views of the Applicant

Highpine stated that the dispersion modelling reports for well test flaring were submitted for technical completeness and that they were consistent with ERCB regulations. Highpine stated that if the wells were approved, it would formally apply to the ERCB for a flare permit prior to completion operations. Highpine indicated that it would endeavour to limit flaring at each well to eight hours or less but there might be circumstances when it would need to flare longer. Highpine noted that it would be monitoring for H₂S and SO₂ during flaring and committed to provide the data on line so concerned residents could view them.

7.4.2 Views of the Interveners

Views of CCORT

CCORT asserted that it was unclear about the commitment made by Highpine regarding flaring. CCORT noted that Highpine committed to restrict itself to eight hours of nonconsecutive flaring on each of these wells, but that in direct evidence Highpine said that if it needed to flare more than eight hours, it would. CCORT argued that this was unacceptable because some residents might not have objected or might have removed their objection on the understanding that Highpine would not flare for more than eight hours.

CCORT's expert reviewed the flaring assessments submitted by Highpine. He found that the modelling done by Highpine's consultant was unacceptable because the screening data used were not representative of actual site conditions. He claimed that Highpine should have used a meteorological data set more representative of the area.

CCORT's expert performed dispersion modelling for the proposed flaring scenarios and found that flare management plans were required according to ERCB regulations, which was contrary to the findings of Highpine. CCORT recommended to the Board that Highpine be required to

submit flare management plans so that exceedances of the ERCB low-risk criteria and the 24-hour SO₂ Alberta Ambient Air Quality Objective could be avoided.

CCORT's expert acknowledged that Highpine would still have to apply formally to the ERCB for permits to flare during testing of the wells. He asserted that CALPUFF was the best dispersion model for this area due the terrain and the Board should require Highpine to use CALPUFF for the flaring assessments when it made its formal application.

7.4.3 Findings of the Board

The Board notes that while Highpine provided flare modelling, it did not apply for well test permits. It is premature at the well licence application stage for the Board to make a determination on well test flare permits.

The Board expects companies to limit flaring; eight hours is a common duration. The Board accepts that there are situations when extended flaring is necessary to ensure that well cleanup is properly accomplished and to obtain reliable well performance data.

The Board notes that CCORT suggested there were deficiencies in Highpine's flaring assessments and that flare management plans should be required. Under ERCB regulations, Highpine must file well test flare applications and satisfy the well test requirements in *Directive 060* respecting dispersion modelling and flare management before it can flare at these wells.

7.5 Human Health

A common way of determining the potential impacts on human health from industrial activity is to perform a human health risk assessment (HHRA). The term "risk" in an HHRA differs from the concept of risk, as outlined in Section 7.3. An HHRA describes the potential health effects that a person could experience if exposed to a hazard at varying concentrations.

7.5.1 Views of the Applicant

Given the community's concerns about production operations, Highpine submitted an HHRA to address the potential health impacts on the public. The report examined three production release scenarios: a production well blowout and two pipeline failures. Highpine stated that predicted H₂S concentrations were determined from dispersion modelling using ERCBH2S.

The HHRA used a number of conservative assumptions. For one of the pipeline failure scenarios (a guillotine rupture near the wellhead), it was assumed that there would be an uncontrolled release for a period of one hour. Another scenario assumed a release of sour crude (in the amount of 5 per cent of the flow rate from the well) for a period of up to twelve hours. All mitigative measures normally put in place to prevent such releases were deliberately ignored, in order to examine the very worst cases.

In addition to the assumptions set out above, it was assumed that any person exposed would be directly downwind of the release in the centre line of the plume and would remain outdoors, unable to seek shelter, throughout the entire release. It also assumed the worst-case meteorological conditions, limiting dispersion of the plume.

Using such assumptions, the HHRA predicted outdoor concentrations ranging from 1 to 27 ppm at the Tomahawk School. Highpine's expert stated that at those predicted levels, respiratory tract irritation would be the main impact. Highpine's expert acknowledged that children with preexisting health conditions might be more susceptible to H₂S exposure. He also acknowledged that it was possible that a mass psychogenic response could occur. At the residences closest to the wells, the HHRA predicted outdoor concentrations up to 285 ppm stemming from the guillotine pipeline rupture with an uncontrolled release of one hour.

Highpine stated that it was well known that exposure to H_2S could cause serious health effects, depending on the concentration. Given the conservative assumptions in place, Highpine's expert emphasized that the occurrence of adverse health impacts like those described in the report would be remote. However, in light of the seriousness of the health impacts, Highpine's expert stated that it was crucial for mitigative measures to be in place. Highpine confirmed that the mitigative measures referred to by the expert in his report were implemented by Highpine for production operations.

Highpine asserted that educating people about sour gas and the sour gas industry would be a good way to alleviate some of the public's fears. Highpine offered to assist the Parkland School Division in this endeavour.

7.5.2 Views of the Interveners

Views of CCORT

CCORT argued that educating the public about sour gas would not be effective and would not ease its concerns. It was CCORT's view while Highpine submitted a health assessment, there was no consideration of risk. CCORT was concerned about the high levels of H₂S predicted at residences closest to the wells, particularly under the pipeline guillotine rupture scenario.

CCORT asserted that the health effects from H_2S could be estimated but there was no real way of knowing how a person would be affected. CCORT argued that one of its witnesses who had been exposed to H_2S suffered health impacts that were inconsistent with the levels indicated in the scientific literature.

Views of Parkland School Division

The Parkland School Division believed that the credibility of the educator was important in educating the population about hazards of H_2S . It argued that there should be consistency in the information used related to the issue of H_2S and its exposure levels and effects on people, because inconsistencies caused confusion. It stated that perhaps Highpine, the ERCB, or some other third party could provide assistance.

The Parkland School Division expressed concern that Highpine did not examine the health impacts that could occur during a drilling and completions incident.

The Parkland School Division expressed concern that during an emergency, teachers or bus drivers might be exposed to H_2S and would not be able to help the students. It was of the view that involuntarily risk could create anxiety, which itself was a health impact.

The Parkland School Division's expert generally agreed with the potential health effects outlined in the scientific literature. The Parkland School Division was concerned that health effects studies were done on adults and maintained that there was no way of knowing how children would be affected by exposure to H₂S.

Views of Parkland County

Parkland County expressed concern that the health effects on children at the school might be far worse than predicted. It argued that the HHRA only looked at production, but the health effects would be greater for an incident during drilling or completions.

Views of Other Interveners

Other interveners were concerned about the potential health effects and stress to which their children might be subjected. They were of the view that the information package about H₂S given to them by Highpine was not adequate. They stated the desire to be trained in H₂S awareness to the same level as the operators and wanted to be given the opportunity to take the H₂S Alive course.

7.5.3 Findings of the Board

All parties agree that H₂S is a toxic gas that can have adverse impacts on human health at certain concentrations. The Board also notes that there is no significant disagreement among the experts on the health effects associated with a range of H₂S concentration levels.

The Board notes that almost all parties expressed greater concerns about production operations than drilling and completions operations. The HHRA that Highpine commissioned therefore dealt with various production scenarios.

The Board took note of the predicted levels of H₂S at the school and nearby residences under each of the three scenarios set out in the HHRA. The evidence before this panel is that the potential for the occurrence of the human health impacts outlined in the HHRA is extremely remote, given the very conservative exposure assumptions.

The Board is satisfied that the consideration of potential health effects is built into ERCB requirements specifically designed to prevent releases of sour gas and to limit their duration if they do occur. The Board notes that all the safeguards listed in Highpine's consultant's report to mitigate the potential for these health impacts are in place during the normal course of its production operations. Most of these safeguards are ERCB requirements.

The Board again notes that any pipeline will be subject to a further application process.

8 OTHER ISSUES

8.1 Compliance History

8.1.1 Views of the Applicant

Highpine explained that like all other operators in the industry, it had had incidents during operations of some of its projects. Highpine stated that it was taking ongoing steps to improve and that these had already resulted in better performance. Highpine gave some examples of steps it was taking to correct previous issues. In one case, a particular contractor that had created several of the compliance issues for Highpine had been replaced. In another, it had hired a third-party service provider to conduct thorough inspections prior to drilling. Highpine stated that the processes it had implemented throughout its company over the last year had resulted in a pass rate of 100 per cent for the last 11 wells that had been inspected.

Highpine submitted that it was now above the industry average with respect to compliance. Highpine believed its compliance record did not constitute a basis for the Board to deny the subject applications.

8.1.2 Views of the Interveners

Views of CCORT

CCORT cited compliance examples relating to the remote choke on a manifold of a drilling rig once drilling had commenced, blowout preventer stacks, off-lease odours, and faulty products and machinery. CCORT stated that these were significant issues.

8.1.3 Findings of the Board

The Board notes that Highpine had some compliance issues and that a company's compliance record is relevant. The Board believes that a company's ability to demonstrate improvement is equally relevant.

The Board is satisfied that Highpine has demonstrated that it has taken these matters seriously and has taken active steps to address these issues, such that its record now stands above the industry average.

8.2 Property Values and Future Development

8.2.1 Views of the Applicant

In argument, Highpine submitted that an appraisal report submitted by CCORT had serious flaws.

8.2.2 Views of the Interveners

Views of CCORT

CCORT presented evidence by an appraiser who concluded that properties located in close proximity (800 m or less) to sour wells and facilities would have a reduction in value of 10 per

cent. The appraiser presented a number of case studies in support of that conclusion. Those case studies included evidence that he provided at a previous hearing, as well as a review of sales of large agricultural holdings, vacant acreages, mobile home acreages, and large home acreage sales in the greater Drayton Valley area.

8.2.3 Findings of the Board

The Board does not have jurisdiction over land compensation issues. Notwithstanding this, the Board provides the following comments regarding the appraisal evidence presented.

The Board does not accept the findings of the CCORT expert's appraisal report. The few sales provided for some of the case studies show mixed results, with sales both higher and lower than the average. Definitive trends were not apparent from the limited data provided. In addition, no adjustments were made to deal with other variables that might have an impact on sale price. The appraiser did not personally inspect the properties used for the comparison.

It is clear that many factors could affect the sales data, including the age of the homes in question, the size of the parcels, the quality of the lands, and the quality of the improvements on the properties. Apart from excluding unusual properties from the analysis, the appraiser did not make any adjustments or control in any way for other relevant variables.

Given the sparse data presented and the fact that conflicting conclusions could be drawn from those data, the Board does not accept the validity of the analysis in this appraisal report. The Board finds that the evidence presented by this appraiser does not support any conclusion regarding the impact of sour gas facilities on land values.

8.3 Animal Compensation Issues

8.3.1 Views of the Applicant

Highpine advised that it was a leading member of PNOG, an organization that comprises a majority of the companies active in the Pembina Nisku field. In this capacity, Highpine contributed to the implementation of a Livestock Compensation Protocol and, more recently, the establishment of a network of permanent air monitors in the area.

Highpine stated that the protocol was negotiated between Highpine and the Pembina Agricultural Protection Association (PAPA). Highpine advised that it would extend to the subject wells and any associated facilities and would be used to facilitate the payment of compensation to livestock owners in the event of a major release during the life of the wells that damaged livestock.

In addition to the permanent air monitors installed in the area, Highpine advised that there would be detection equipment at the well sites and any associated facilities. In the event of a release, data from that equipment could be used to support any claim for compensation, together with data from other locations in the area. Readings from these facilities would be made available to residents through Internet access.

Highpine advised that it would work with livestock owners to resolve any compensation issues in the event of a release that caused harm to animals.

8.3.2 Views of the Interveners

CCORT questioned whether the protocol would assist livestock owners in obtaining compensation in the event of a major release that harmed animals. CCORT called a witness from Big Valley, Alberta, who testified that her cattle and horses were exposed to H₂S originating from a battery near her home in October 2007 and had suffered health effects as a result. The witness described efforts she undertook to have the former provincial animal health investigation unit assist her, to no avail. She advised that the cost of pursuing a claim was high and that her family was not in a position to pay for the animal testing required.

CCORT also called as a witness a veterinarian who had been an animal health investigator between 2001 and 2007 and had completed 15 investigations in that capacity. In 6 of those, he concluded that oil or gas production activity had caused an animal health issue, two of which were attributable to H₂S. He confirmed that the cost of such investigations was high.

His main criticism of the process under the former animal health investigation unit was insufficient funding to do investigations. He recommended that a stable source of funding be provided for such investigations and that such a fund be established jointly by the oil and gas and livestock industries.

8.3.3 Findings of the Board

The Board notes that *Informational Letter (IL) 2002-04: Animal Health Investigation Memorandum of Understanding* (MOU) is no longer in effect and that it was rescinded because of minimal use and process deficiencies. The process deficiencies were confirmed by the veterinarian called by CCORT who had participated in investigations under the MOU.

The Board reviewed the Livestock Compensation Protocol developed in consultation with PAPA. Highpine stated that it would be prepared to discuss compensation with livestock owners in the event of a release, and the Board accepts this evidence and believes that Highpine will make a sincere effort to resolve such issues. The Board notes that the Livestock Compensation Protocol provides a potential framework for dealing with issues of livestock compensation and views this as a positive development.

The Board notes the existence of the air monitoring network to aid in the function of the protocol and that there will be further permanent and temporary monitors installed near the proposed wells.

8.4 ERCB Jurisdiction over Human and Animal Health

8.4.1 Views of the Applicant

Highpine did not make any submissions regarding jurisdiction of the Board to hear these applications.

8.4.2 Views of the Interveners

An issue regarding the ERCB's jurisdiction to hear these well applications was raised by counsel for CCORT. CCORT presented a letter written by an ERCB staff member from the Red Deer

Field Centre pursuant to an investigation of releases from a facility located near Big Valley. The letter concluded with the following statement:

We reiterate that it is beyond ERCB jurisdiction or expertise to draw any conclusion regarding impact in relation to animal or human health.

CCORT submitted that this letter amounted to an acknowledgement by the ERCB that it did not have jurisdiction to deal with issues that are vital to this application, namely the potential for impacts on human and animal health. CCORT also submitted that the Board lacked any expertise to deal with such issues.

8.4.3 Findings of the Board

The Board clearly has jurisdiction to review human and animal health and, indeed, has a statutory obligation to do so when there is evidence presented in the course of an application that puts such matters at issue. In the case of this particular hearing, there were expert reports relating to human health filed by both Highpine and interveners. As a result, the Board retained persons with expertise in toxicology to assist the Board.

The letter written by the Red Deer Field Centre does not accurately set out the jurisdiction of the ERCB. In that case, the Board was facilitating an appropriate dispute resolution process dealing with compensation. While the Board has jurisdiction to examine matters of human and animal health, it does not have any jurisdiction over compensation.

9 CONCLUSION

For all the reasons set out above, the Board approves these applications subject to the conditions in Appendix 2.

Dated in Calgary, Alberta, on December 30, 2008.

ENERGY RESOURCES CONSERVATION BOARD

B. T. McManus, Q.C. Presiding Member

G. E. Eynon, P.Geol. Board Member

W. A. Warren, P.Eng. Acting Board Member

APPENDIX 1 HEARING PARTICIPANTS

Principals and Representatives (Abbreviations used in report)	Witnesses
Highpine Energy Ltd. (Highpine) G. S. Fitch D. J. Farmer	D. Humphreys J. Broughton T. Kraychy A. Fritz C. Venardos R. Kay K. Chow D. Davies R. Brown, of Bissett Resources Consultants Limited
Parkland School Division A. Lavergne	Panel 1 M. Campbell K. Mann B. Hauptman Panel 2 D. Ho H. Hoffman
Parkland County K. Wilson	A. Berger D. Henning L. Strocher T. Melnyk J. Ostashek S. Armstrong J. Phalen
Concerned Citizens of Rural Tomahawk (CCORT) J. Klimek D. Bishop	Panel 1 T. Lavoie M. Crowhurst G. Petrunia Panel 2 S. Blatkewicz A. Pearton S. Dorigo
	Dr. S. Du Dr. R. Kennedy B. Gettel L. Thurston

Energy Resources Conservation Board staff

- L. Berg, Board Counsel
- R. Reid
- R. Connery
- J. Schlager
- K. Siriunas, P.Eng.
- I. Mitchell, of

Meridian Environmental Inc.

APPENDIX 2 SUMMARY OF CONDITIONS AND COMMITMENTS

The Board has approved Applications No. 1520574, 1521704, and 1521626 subject to the conditions below. Conditions generally are requirements in addition to or otherwise expanding upon existing regulations and guidelines. An applicant must comply with conditions or it is in breach of its approval and subject to enforcement action by the ERCB. Enforcement of an approval includes enforcement of the conditions attached to that licence. Sanctions imposed for the breach of such conditions may include the suspension of the approval, resulting in the shut-in of a facility. The conditions imposed on the licence are summarized below.

The Board notes throughout the decision report that Highpine has undertaken to conduct certain activities in connection with its operations that are not strictly required by the ERCB's regulations or guidelines. These undertakings are described as commitments and are summarized below. It is the Board's view that when a company makes commitments of this nature, it has satisfied itself that these activities will benefit both the project and the public, and the Board takes these commitments into account when arriving at its decision. The Board expects the applicant, having made the commitments, to fully carry out the undertaking or advise the ERCB if, for whatever reasons, it cannot fulfill a commitment. The ERCB would then assess whether the circumstances regarding the failed commitment warrant a review of the original approval. The Board also notes that the affected parties also have the right to request a review of the original approval if commitments made by the applicant remain unfulfilled.

CONDITIONS

- The Board directs that Highpine update its ERPs.
- The Board directs that Highpine conduct further consultation with one specific family and report back to the Board on the arrangements arrived at and any changes that must be made to its ERPs prior to commencing drilling operations for the 1-16 and 9-17 wells.
- The Board directs Highpine to sequence the drilling of these three wells so that it is not drilling through the critical Nisku Formation on more than one well at the same time.
- The Board directs Highpine to drill the 8-25 well first.
- The Board directs that for the 8-25 well, standby busing will be provided during critical sour operations.
- The Board directs that Highpine must also conduct an appropriate test to ascertain the H₂S concentration in the Nisku Formation from the first successful well and submit these results to the ERCB prior to entering the Nisku Formation in any subsequent well approved pursuant to this decision.
- The Board directs that Highpine not conduct critical sour operations for the 1-16 well while the Tomahawk School is in session.
- The Board directs that Highpine not conduct critical sour operations for the 9-17 well while the Tomahawk School is in session.

HIGHPINE COMMITMENTS

TOMAHAWK SCHOOL

1. To reduce risks and enhance safety, Highpine will conduct drilling and completion operations of the Nisku portion of the 9-17 and the 1-16 wells when the Tomahawk School is not in session. (Page 144, Line 14-16)

Commitments made to Parkland School Division #70 for 9-17, 1-16 and 8-25-51-6W5M

- 2. During any level of emergency, during production operations, the cost for buses on stand-by, or utilized for evacuation of the Tomahawk School, will be covered by Highpine. (Page 697, Line 1-5)
- 3. Highpine will agree to pay evacuation costs incurred by the Parkland School Division (the "PSD" or "Parkland") in the event of an emergency. (Page 696, Line 12-13)
- 4. Highpine has committed to incorporate the Tomahawk School into its Emergency Response Plans ("ERP") even if the school remains outside of the prescribed hazard zone or Emergency Planning Zone ("EPZ"). (Page 142, Line 10-13)
- 5. Highpine has committed to notify the PSD at any level of emergency. (Page 142, Line 14-15)
- 6. Highpine has installed three air monitors in the vicinity of the Tomahawk School as a commitment to the community and to the PSD. (Page 142, Line 16-19)
- 7. Highpine has included the Tomahawk School in a full scale ERP exercise planned for October, 2008. (Page 142, Line 20-21)
- 8. Highpine has revised its area pipeline proposal to take area production further away from the Tomahawk School. The new proposed pipeline is depicted in the Tomahawk/Highvale Area Nisku Development Plan. (Page 144, Line 24 to Page 145, Line 2)
- 9. Highpine commits to consider engineering controls to eliminate or reduce noise in the event that noise related to Highpine activities disrupts classes and students at the Tomahawk School. (Page 745, Line 14-17)

Commitments made to Parklad School Division #70 for 9-17 and 1-16 (Points 10 through 43 are from the evidence provided by C. Venardos on September 25th, 2008)

- 10. Highpine will inform Parkland of its intended drilling dates for the wells, as soon as this information is available. Parkland understands the dates upon which actual drilling takes place are subject to change. Highpine will and complete the wells during the above timeline. (Page 693, Line 10)
- 11. Highpine commits to providing notification of its activities to Parkland as identified below:
 - a. notification at least 24 hours prior to drilling into the sour zone;
 - b. notification that sour drilling operations are complete;
 - c. notification at least 24 hours prior to sour completion and testing operations;
 - d. notification at least 24 hours prior to flaring (unless an emergency requires immediate flaring);
 - e. notification that sour completion and testing operations are complete; and
 - f. notification as soon as Highpine is aware of a servicing need during production.

(Page 693, Line 10-11)

INFORMATION

12. Highpine is prepared to provide information to the students and staff of Parkland and Tomahawk School related to oil and gas development and critical sour wells. Parkland and Highpine will work cooperatively to satisfy each of their interests to determine timing, and the type and mode of information related to the wells, which will meet the needs of Parkland and Tomahawk School. (Page 693, Line 11)

EMERGENCY PREPAREDNESS & PLANNING

- 13. Prior to the commencement of sour drilling, completion servicing and/or testing operations, Highpine will review its ERCB/EUB approved ERP and evacuation procedures with the PSD. Highpine's ERP shall comply with all applicable laws, regulations and the ERCB directives. (Page 693, Line 12-19)
- 14. Highpine's site specific ERP for sour drilling, completion, servicing and testing operations will include each Parkland bus route within the EPZs, as well as the name of the school bus driver assigned to each route. Students' names are listed in the ERP according to the school they attend. Prior to commencement of sour drilling, completion, servicing and testing operations, Highpine will confirm this information with the Tomahawk School and a designated representative of Parkland. Highpine will get approval from Parkland prior to implementation of any changes to the ERP. (Page 693, Line 20)
- 15. Parkland agrees to have school buses and drivers available on stand-by during the period of time in which drilling, servicing, completion and/or testing activities take place with connection to any sour zone if school is in session. It is

acknowledged that Highpine's completion operations will not necessarily immediately follow drilling operations. Highpine will compensate Parkland for all reasonable costs or expenditures incurred in relation to stand-by busing. (Page 693, Line 20)

16. Highpine has provided Parkland with its most up to date EPZ and ERP. Highpine will keep Parkland informed of any revisions to its EPZ and ERP and provide copies of any updates or changes to Parkland within 10 days of such revisions or changes known to Highpine. (Page 693, Line 20-21)

TRAFFIC DURING BUSING HOURS

17. Traffic associated with Highpine's activities will be advised to take extra precaution during school bus hours (7:00 a.m. to 9:00 a.m. and 3:00 p.m. to 5:00 p.m.). Highpine and equipment contractors will endeavour to minimize the number of heavy and over-size vehicles using local roads during these periods. (Page 693, Line 21)

EMERGENCY RESPONSE

- 18. In the event of an emergency during sour drilling, completion, testing or servicing operations, Highpine will contact the Tomahawk School and the designated representative of Parkland directly by telephone to provide notification, discuss the location of buses, and provide detailed instructions about recommended response procedures and in a timely manner furnish the necessary supplies and resources at Highpine's cost. Parkland's designated representative would then communicate directly with the buses. (Page 693, Line 21-22)
- 19. Highpine states that appropriate air monitoring is essential for its emergency plans related to the wells. During drilling, servicing, completion and testing of the wells, Highpine will use three forms of air monitoring related to its emergency plans, and such results will be provided to Parkland in a timely manner:
 - a. One functional satellite-feed internet accessible stationary air monitoring unit is to be placed between the well and Tomahawk School. All Highpine personnel using the foregoing shall be qualified and trained in the use of such units;
 - b. Mobile air monitoring units will be provided, as stated in the ERP;
 - c. Rover hand-held air monitoring units will be used, as stated in the ERP. (Page 693, Line 25 to Page 694, Line 14)
- 20. Highpine shall provide Parkland with the name of its key contact person(s) and 24 hour contact information. (Page 694, Line 15)
- 21. Prior to drilling, completion, testing and servicing of the wells and during production, Highpine will review its EPZ and ERP with Parkland. The EPZ and

ERP of Highpine must comply with or exceed all legislative and ERCB requirements and be to the satisfaction of Parkland. (Page 694, Line 15)

LEVEL ONE EMERGENCY

- 22. A Level One Emergency is as defined in applicable ERCB directives which are in effect from time to time. At a Level One Emergency, the following, at a minimum, will be done by Highpine:
 - a. Tomahawk School and Parkland will be notified in-person via telephone directly by Highpine emergency response personnel;
 - b. Rovers will be utilized as stated in the ERP;
 - c. A Highpine Rover will lead a school bus when it is in the EPZ. A Highpine Rover will make contact with the driver of any bus which is in the EPZ;
 - d. Additional air monitoring units will be used, as stated in the ERP;
 - e. An emergency will be declared by Highpine prior to the uncontrolled release of sour gas. In a timely manner, Highpine will provide notification to a designated representative of Parkland and to the Tomahawk School regarding an uncontrolled release of sour gas;

(Page 694, Line 16 to Page 695, Line 1)

LEVEL TWO EMERGENCY

- 23. A Level Two Emergency is as defined in applicable ERCB directives, which are in effect from time to time. At a Level Two Emergency, the following, at a minimum, will be done by Highpine:
 - a. Additional Rovers will be dispatched as stated in the ERP;
 - b. Highpine manned roadblocks will be established to isolate the EPZ and school buses would not be permitted to enter the EPZ. If inside the EPZ, a Rover would lead the school bus and would escort it out of the EPZ using a safe evacuation route. The Rover travelling with the school bus has the ability to monitor air quality and the ability to communicate directly to Highpine's command centres by radio thus ensuring the safety of the bus passengers and the bus driver;
 - c. Tomahawk School and Parkland will be re-notified in person via telephone directly by Highpine;
 - d. An emergency will be declared by Highpine prior to any uncontrolled release of sour gas. In a timely manner, Highpine will provide notification to a designated representative of Parkland and to the Tomahawk School regarding an uncontrolled release of sour gas.

(Page 695, Line 2-9)

LEVEL THREE EMERGENCY

- 24. A Level Three Emergency is as defined in applicable ERCB directives, which are in effect from time to time. At a Level Three Emergency, the following at a minimum will be done by Highpine:
 - a. If one of the wells is experiencing an uncontrolled release of sour product, Highpine will ignite the release within fifteen minutes of such a release occurring. The On-Site Well Supervisor has the ultimate authority to ignite the well. If time permits, he will do so in consultation with the appropriate government agencies including the ERCB and Highpine's Calgary head office. In such event, Highpine will notify the Tomahawk School and Parkland as soon as reasonably practicable;
 - b. Highpine Rovers, using personal safety practices, will complete a sweep of the area to confirm that the EPZ has been evacuated. If it is necessary that the Tomahawk School has to be evacuated, a Highpine Rover will complete a sweep of the Tomahawk School and the Tomahawk School grounds to confirm evacuation;
 - c. Highpine manned roadblocks will remain in effect as long as a Level Three Emergency continues.

(Page 695, Line 11-17)

SHELTER IN PLACE

- 25. In the case of an emergency, Highpine agrees the Tomahawk School will not be used as a shelter in place. (Page 695, Line 18)
- 26. Parkland, upon consultation with Highpine, may decide to evacuate the Tomahawk School in the event of an emergency and/or release. All costs related to such evacuation will be paid by Highpine. (Page 695, Line 18)
- 27. Highpine will not use the Tomahawk School as a gathering point for area evacuation. (Page 695, Line 18)

AIR QUALITY

- 28. Highpine has committed to minimizing its flaring operations in the Tomahawk and Highvale area. Highpine commits that wherever operationally possible, Highpine will restrict flaring to eight hours; four hours of clean-up flaring and four hours of flow testing the well to determine commercial viability. (Page 145, Line 16-21)
- 29. Highpine states there will be no continuous flaring of produced gas. (Page 695, Line 22)
- 30. Highpine agrees that if placed into production, the wells and any associated pipeline and accessories will be a closed system. Highpine will make all reasonable efforts to comply with all applicable legislation and directives in effect from time to time, to eliminate emissions and off-site odours. (Page 695, Line 22)

- 31. As uninterrupted education at the Tomahawk School is important to Parkland, at its own cost, Highpine will take all reasonable steps to ensure that any foul odours from the wells do not reach the Tomahawk School. In the event foul odours from the wells are disrupting educational services or activities at the Tomahawk School, Highpine will work cooperatively with Parkland and will take steps at Highpine's own cost to reduce such foul odours to a level satisfactory to Parkland. (Page 695, Line 22)
- 32. Highpine does not expect or tolerate any smells or odours from its operations and will promptly investigate reported odours to determine the source and correct the problem if it relates to its operations. Highpine encourages that any suspicious odours be reported to it. (Page 695, Line 22-23)
- 33. During sour drilling, completion, testing, and servicing operations, Highpine, at its own cost, agrees to install one temporary stationary monitor equipped with H₂S and SO₂ sensors between the wells and the Tomahawk School. In at timely manner, the results of such monitoring shall be provided to Parkland at Highpine's cost. Highpine further agrees to place two mobile down-wind airmonitoring units equipped with H₂S and SO₂ monitors on stand-by during sour drilling, testing, servicing and completion operations. Should a Level 1 Emergency be declared, one additional mobile air monitoring unit will be positioned in the area. In the event of a Level 2 or Level 3 Emergency, Highpine shall install additional temporary stationary monitors equipped with H₂S and SO₂ sensors as stated in the ERP. In a timely manner, the results of such monitoring shall be provided to Parkland at no cost to Parkland. Such monitoring units shall be functional and shall continuously monitor the air 24 hours per day and 7 days per week. (Page 695, Line 24 to Page 696, Line 9)
- 34. In the event it is necessary for Parkland to have to modify or replace its heating-ventilation and air-conditioning (HVAC) system at the Tomahawk School due to environmental contaminants caused by Highpine's activities in the area, Highpine will compensate Parkland for all reasonable costs or expenditures incurred, including consulting and legal costs. (Page 696, Line 10)
- 35. At no cost to Parkland, prior to production, Highpine shall install three functional stationary air monitoring units near the boundaries of the Tomahawk School to monitor contaminants and hazardous substances from the wells on an ongoing basis. These monitors will be incorporated into the Pembina Sentinel Air Monitoring System. Such stationary air monitoring units will remain in place until the wells are no longer operational and reclamation has been completed. The stationary air monitoring units are to be operational 24 hours per day and 7 days per week. Highpine, at its own cost, will provide Parkland with the records, reports, analysis and findings of the stationary air monitors. As a result of the information obtained from the stationary air monitors, at its own cost, Highpine will take all reasonable steps related to the wells to ensure satisfactory air quality is achieved and maintained at the Tomahawk School. Satisfactory air quality is

good quality breathable air for humans, which does not have contaminants or harmful substances in it that hampers or compromises the safety and health of humans, including students, teachers, staff and bus drivers. (Page 696, Line 10)

AIR DISPERSION MODELLING

36. Highpine has conducted ERCBH2S air dispersion modelling related to the wells to predict air quality and to identify potential H₂S concentrations in the air near the Tomahawk School and on buses travelling in the EPZ. Highpine has shared the results of its air dispersion modelling with Parkland in a timely manner. As a result of information obtained from air dispersion modelling, at its own cost, and with Parkland's agreement, Highpine will take all reasonable steps related to the wells to ensure satisfactory air quality is achieved and maintained at the Tomahawk School. Satisfactory air quality is good quality breathing air which does not compromise the health and safety of the students, staff, guests, and bus Highpine has, at its own cost, conducted another appropriate air dispersion modelling and receptor exposure risk assessment related to the wells for prediction of long term health and safety impacts to Tomahawk School users and on Parkland's operations. Highpine will provide, in a timely manner, the results of such modelling to Parkland and rectify any perceivable problem at its own cost. (Page 696, Line 11)

ELIMINATION OF HAZARDS

- 37. Highpine agrees to take reasonably practicable steps, at its own cost, to protect the safety of persons at the Tomahawk School and on buses in the EPZs by eliminating hazards related to the wells, which affect the safety of persons at the Tomahawk School and persons on buses in the EPZ. Such steps to be taken by Highpine are:
 - a. Use of engineering controls to eliminate or control the hazard;
 - b. Use of administrative controls to eliminate or control the hazard to as low a level as is reasonably achievable;
 - c. A combination of foregoing if there is a greater level of safety achieved by using a combination of them.

(Page 696, Line 12)

WELL PERFORMANCE ENHANCEMENT

38. Highpine will minimize the use of pressurized fluid injection for performance enhancement of the wells. In the event Highpine uses pressurized fluid injection for performance enhancement of the wells, Highpine will take all reasonable steps to minimize any risks associated with release of any harmful substance that may impact any Parkland operations, including those related to the Tomahawk School and busing to and from the Tomahawk School. (Page 696, Line 12)

FUTURE PROJECTS AND CUMULATIVE EFFECTS

- 39. Highpine commits to consulting with Parkland regarding all of its future sour activities in the Tomahawk area. This area is defined as an 8 kilometre radius from the Tomahawk School. (Page 696, Line 13)
- 40. Highpine commits to working proactively with other Tomahawk area operators to coordinate activities, minimize the proliferation of pipelines and surface facilities, and manage the cumulative effects of their respective operations. Such other operators include, but are not limited to: Highpine Oil & Gas Limited., West Energy Ltd., Silverwing Energy Ltd., Burlington Resources Canada Ltd., ConocoPhilips Canada and their related companies, divisions, joint ventures, successors and assigns. (Page696, Line 13)
- 41. Highpine shall comply with all applicable statutes, regulations, by-laws, directives from governmental bodies or governmental agencies and licensing requirements in effect at any time. (Page 696, Line 18-21)

REASONABLE STEPS

42. Having regard to Highpine's operations related to the wells, Highpine will take reasonably practicable steps to protect the health and safety of persons at the Tomahawk School and persons on buses travelling to and from the Tomahawk School. (Page 696, Line 22)

FUTURE DEVELOPMENTS

43. These commitments only cover Highpine's present applications before the ERCB for the wells as described above. They do not cover any future applications to the ERCB or future oil or gas developments which Highpine may have which are in the area of the Tomahawk School. (Page 696, Line 22)

EMERGENCY RESPONSE COMMITMENTS

44. Highpine is committed to conduct a full scale ERP exercise on an annual basis. (Page 59, Line 11-13)

COMMITMENTS TO PARKLAND COUNTY

- 45. Highpine will mobilize a representative to the Parkland County EOC, located at Stony Plain, Alberta. (Page 139, Line 9-10)
- 46. Highpine will incorporate into its ERP establishing the reception centre in Spruce Grove, Alberta, at the Tri-leisure centre. (Page 139, Line 11-13)
- 47. Highpine and the area Nisku operators' group will be conducting a full scale exercise in Parkland County in October 2008. (Page 139, Line 19-21)

- 48. Highpine will install a temporary air monitoring unit between the well and a population density at the request of Parkland County. (Page 139, Line 22-24)
- 49. Highpine, and the area Nisku operators' group, has and will continue to conduct H₂S awareness sessions in the area. (Page 139, Line 25 to Page 140, Line 1)
- 50. Highpine and the area Nisku operators' group will continue to include Parkland County in our presentations and reviews of emergency response planning. (Page 140, Line 2-4)
- 51. Highpine and the area Nisku operators' group will continue to meet with Parkland County and area stakeholders on a regular basis to discuss and address issues and concerns. (Page 140, Line 5-8)

COMMITMENTS TO RESIDENTS

- 52. Highpine has committed to relocate several area residents with stated health concerns. Relocation is determined on a case by case basis. (Page 145, Line 5-6)
- 53. Highpine has committed to conduct water well testing before and after drilling for several area residents, upon their request when the resident is within 1000m of the well. (Page 145, Line 7-9)
- 54. Highpine has also established a voluntary 500 metre setback from existing residences in the area as compared to the ERCB setback of 100 metres. Highpine will not locate a well within this self-imposed setback radius without the expressed consent of the owner of the residence. (Page 145, Line 10-15)
- 55. Highpine has committed to minimizing its flaring operations in the Tomahawk and Highvale area. Highpine commits that wherever operationally possible, we will restrict flaring to eight hours; four hours of clean-up flaring and four hours of flow testing the well to determine commercial viability. (Page 145, Line 16-21)
- 56. Highpine has incorporated a self-imposed speed limit of 40 kilometres an hour for all Highpine employees and contractors during the drilling and completion phase of the operation on the road utilized to enter the wellsite location. (Page 145, Line 22-26)
- 57. Highpine has committed to several area residents to notify them in any level of emergency even if they reside outside of an EPZ. (Page 146, Line 1-4)
- 58. Highpine commits to uphold its livestock compensation protocol with area residents and livestock owners in the event of a major release. (Page 414, Line 15-25)

59. Highpine has also committed to some area stakeholders and area residents to either install temporary air monitoring units on their property or allow them access to information from nearby monitors. (Page 146, Line 8-11)

9-17-51-6W5M COMMITMENTS

- 60. During sour operations, the ERP is going to contemplate, just prior to and during sour operations, that:
 - a. There will be signage at the trails into the Buck For Wildlife. That signage will include a notice to the public that they could be entering or they will be entering an area that sour gas operations are ongoing;
 - b. Highpine's 24-hour emergency number will be on the signage;
 - c. There will be a map of the area with a blowup of the area of the Buck For Wildlife on that map;
 - d. Additionally, on that poster will be some self-help procedures for the public;

(Page 503, Line 13 to Page 504, Line 2)

61. Highpine commits to drill this particular well with 5-and-a-half-inch casing as suggested by the interveners and if approved by the ERCB. (Page 192, Line 20-23)

8-25-51-6W5M COMMITMENTS

62. Highpine will have school busses on stand-by during drilling through the Nisku and completion of the Nisku if this occurs while the Tomahawk School is in session. (Page 639, Line 25 to Page 640, Line 2)

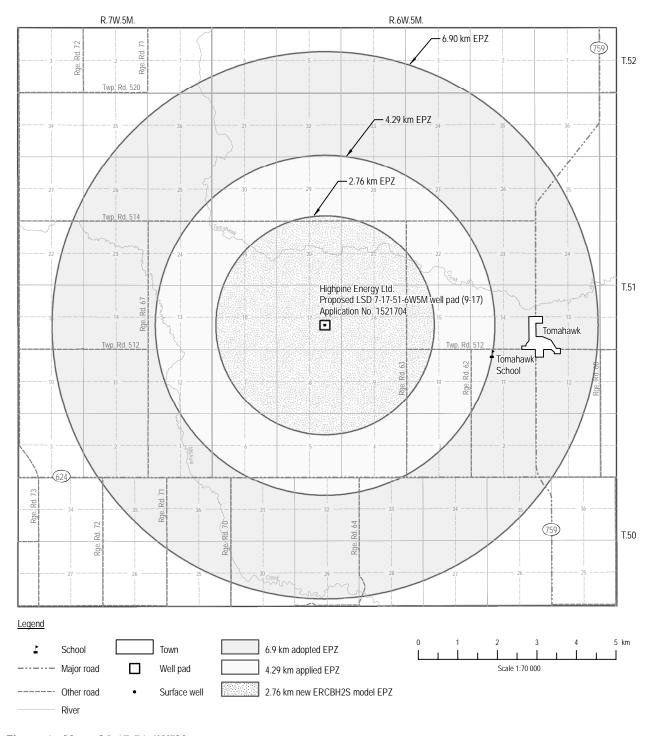


Figure 1. Map of 9-17-51-6W5M

Table 1.EPZ summary for the 9-17-51-6W5M well

EPZ calculations	H ₂ S release rate & assumptions	EPZ radius	School relative to EPZ boundary	Hamlet relative to EPZ boundary
Highpine adopted	 5.0 m³/s 30 % H₂S 177.8 mm casing Directive 071 nomograph 	6.9 km	2.51 km <u>inside</u>	1.70 km <u>inside</u>
Highpine application	 2.5 m³/s 16 % H₂S 177.8 mm casing Directive 071 nomograph 	4.29 km	0.10 km outside	0.91 km outside
Panel requested modelling <i>Directive 071</i> , 2008 edition	 2.5 m³/s 16 % H₂S 177.8 mm casing ERCBH2S 	2.76 km	1.63 km outside	2.44 km outside

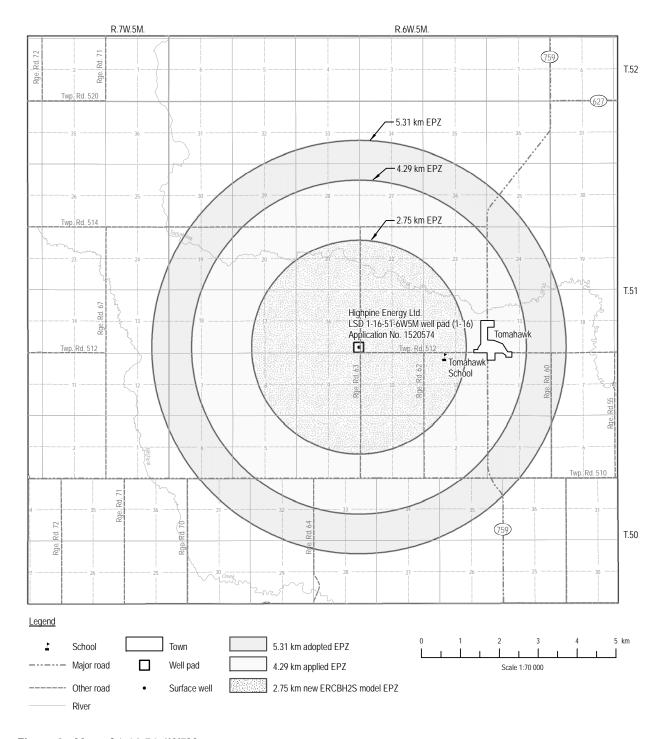


Figure 2. Map of 1-16-51-6W5M

Table 2. EPZ summary for the 1-16 -51-6W5M well

EPZ calculations	H ₂ S release rate & assumptions	EPZ radius	School relative to EPZ boundary	Hamlet relative to EPZ boundary
Highpine adopted	 3.42 m³/s 21.97 % H₂S 177.8 mm casing Directive 071 nomograph 	5.31 km	2.94 km <u>inside</u>	2.11 km <u>inside</u>
Highpine application	 2.5 m³/s 16 % H₂S 177.8 mm casing Directive 071 nomograph 	4.29 km	1.94 km <u>inside</u>	1.09 km <u>inside</u>
Panel requested modelling <i>Directive 071</i> , 2008 edition	 2.5 m³/s 16 % H₂S 177.8 mm casing ERCBH2S 	2.76 km	0.39 km <u>inside</u>	0.44 km outside

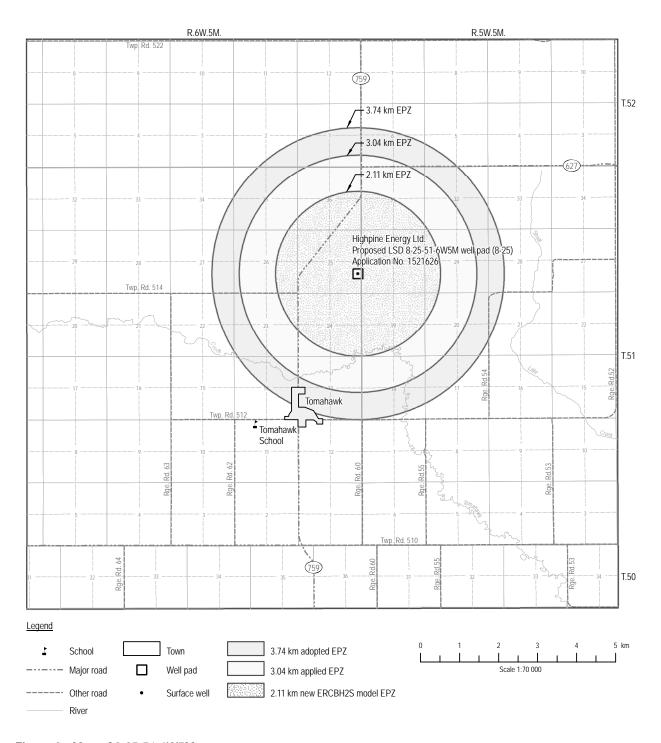


Figure 3. Map of 8-25-51-6W5M

Table 3. EPZ summary for the 8-25-51-6W5M well

EPZ calculations	H ₂ S Release rate & assumptions	EPZ radius	School relative to EPZ boundary	Hamlet relative to EPZ boundary
Highpine adopted	 2.04 m³/s 21.76 % H₂S 139.7 mm casing Directive 071 nomograph 	3.74 km	0.82 km outside	0.44 km <u>inside</u>
Highpine application	 1.51 m³/s 16 % H₂S 139.7 mm casing Directive 071 nomograph 	3.04 km	1.52 km outside	0.26 km outside
Panel requested modelling <i>Directive 071</i> , 2008 edition	 1.51 m³/s 16% H₂S 139.7 mm casing ERCBH2S 	2.11 km	2.45 km outside	1.19 km outside