Alberta Energy Regulator

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Via email: [redacted]

The Honorable Justice Rachel Pepper, Chair
RE: Scientific Inquiry into Hydraulic Fracturing in the Northern Territory

Hydraulic Fracturing Inquiry – Information Request

Dear Justice Pepper,

Please see attached the Alberta Energy Regulator's response to your request for input into the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory (the Inquiry). I hope you will find the attached informative as you move forward with the Inquiry's report.

If you would like more information regarding any of the topics covered in our response, please contact my Executive Advisor, [redacted], at [redacted] and she will arrange a response from the appropriate AER subject matter expect.

Kind regards

Carol Crowfoot,
Executive Vice President
Strategy and Regulatory Division

cc: [redacted]

1. Who is the decision-maker with respect to decisions to grant access to tenure if the AER is the one-stop shop? How and where is this decision challenged (i.e. to grant access/tenure to land for the purposes of petroleum activities)?

For most titled land in Alberta there is separate ownership ("split title") of the surface and the subsurface, i.e. mineral rights. The majority (81%) of mineral rights within the province of Alberta are owned and administered by the provincial Crown and managed by Alberta Energy, a ministry of the Government of Alberta. The minority (19%) of privately owned mineral rights are the result of early grants to settlors (prior to 1887) that included both surface and mineral rights, and original grants made to the Canadian Pacific Railway and the Hudson's Bay Company for which the Government of Canada did not except out the underlying mineral rights. Under section 16 of the Mines and Minerals Act, Alberta Energy is authorized to dispose of petroleum and natural gas leases and licenses:

- on application, if the Minister considers the issuance of the agreement warranted in the circumstances;
- by way of sale by public tender conducted in a manner determined by the Minister; or
- pursuant to any other procedure determined by the Minister.

The majority of tenure agreements are issued by way of sale by public tender. The word "sale" is used by tradition, although it is a misnomer, since the Crown always retains title to its minerals. The rights are leased, not sold. The process is an auction in which companies or individuals submit bids and then a Petroleum and Natural Gas (PNG) agreement is issued to the highest bidder for each parcel.

A posting request may be made for all the rights in a spacing unit, or for only a portion thereof. If all rights are available, a request may be made for:

- all rights;
- all rights from the surface to the base of a specified zone; or
- all rights below the base of a specified zone.

If there is an existing agreement in the spacing unit, so that not all of the rights are available, the following configurations are permitted:

- all available rights from the surface or the base of a specified zone to the top of the existing agreement; or
- all available rights

Alberta Energy issues petroleum and natural gas licences for a term of two years when the land is located in the Plains Region, four years in the Northern Region and five years in the Foothills Region. These terms take into account the different geology, climatic conditions, and topography and access restrictions of the three Regions. A licence entitles the holder to drill for and recover petroleum and natural gas granted under the agreement. Each PNG agreement carries with it an obligation to evaluate the rights contained in the licence. This obligation can be satisfied by drilling on the location of the

licence (without the requirement of producing petroleum or natural gas), or by selecting sections of land earned through the drilling of a well on another initial term licence within the specified distance criteria. A licence converts to a five year intermediate term when it is validated. The licence then carries the same obligations as a primary term petroleum and natural gas lease, where it must be either producing or proven productive in order to continue indefinitely.

As an alternative option to a PNG license, the Crown also issues five year PNG leases, which grant the right to drill for and recover petroleum and natural gas from the rights granted in the agreement. When a lease reaches the end of its primary term, or a licence reaches the end of its intermediate term, it expires and is cancelled unless the holder can prove that it is producing or capable of producing petroleum and/or natural gas.

Tenure is sold and continued on a zone basis, which requires the interpretation of subsurface geological units. The Alberta Geological Survey branch of the Alberta Energy Regulator is responsible for creating zone designations. Challenges to these interpretations can be made through Alberta Energy as more information about a zone is collected. It is the responsibility of the Alberta Energy Regulator to resolve differences of opinion in the interpretation of these designations, a common occurrence in areas that are geologically complex.

Once tenure is acquired from Alberta Energy, the Alberta Energy Regulator is responsible for issuing licenses to drill for and recover oil and gas and for the physical operations relating to drilling and production. The AER is also responsible for granting access to public lands under the Public Lands Act. If the surface location of the mineral interest is privately owned, the licensee is responsible for obtaining any access rights from the surface owner that are needed for drilling and production operations.

More details on Alberta's tenure system can be found in the attached brochure, and on the Alberta Energy website (http://www.energy.alberta.ca/OurBusiness/tenure.asp).

2. How are conditions placed on titles and, more importantly, who decides what the conditions are?
Other than requirements to validate the mineral rights in a PNG agreement so as to continue the term of the licence or agreement, the grant of tenure does not impose conditions on how, when or where operations can be conducted. Those are imposed by the AER as terms of the licences and other approvals that are required before drilling and production can occur. The AER's authority and discretion to impose such requirements is given to it in the legislation it administers.

2.1 We understand that the Minister (not AER) grants the underlying title in Alberta. To what extent does the Minister consider environmental and operational matters (i.e. non tenure matters) when putting conditions on the title?

Assuming that "underlying title" refers to petroleum and natural gas tenure, the main condition put on a tenure holder by the Alberta Energy (the Minister) is the time allowed for development to occur before the rights to develop revert back to the Crown.

Alberta Energy will also consider matters contained in approved regional plans (e.g., conservation areas), previous government decisions (e.g., environmental protection orders) and possibly certain other policy directions (wildlife range plans), to determine whether lands should be released, but these generally would not result in a condition on the tenure rights.

2.2 Does AER have any role or are conditions of this kind put on activity-based approvals?
The AER's responsibility is to have due regard for regional plans and applicable government decisions and policies, so that the AER does not make decisions or issue approvals that conflict with government plans, decisions or policies. In addition, the AER is required to comply with any Ministerial Order that gives specific instructions to the AER (e.g., Aboriginal Consultation Direction).

3. How does the play-based regulatory framework works in practice?
There are two concepts being applied by the AER. The first is the play-based approach, where regulatory requirements are created for geological 'plays', or geologically similar groups of resource pools and deposits. This allows the requirements to be tailored to the specifics of the geology and the practices used by industry to access resources in those specific geologic formations. The AER used a new regulatory tool, called a Subsurface Order, to create new requirements and modify or waive existing requirements for a geologic play. These orders only applied to the subsurface requirements (such as well spacing), and did not affect any of the surface regulatory requirements, such as safety, environmental or public participation requirements.

Following on the play-based regulation, the AER has been piloting an area-based regulatory approach, which was intended to address the regulatory requirements used on the surface to address local issues such as water use or land fragmentation. Similar to play-based regulation, the area-based approach sought to create local requirements that were tailor made to the environmental conditions and stakeholder values and interests in different areas of the province. The AER conducted an area-based regulation pilot project in one north-western municipality (~33,000 square kilometers) to create a complete, area-level assessment of the subsurface resources and the environmental conditions, and then to work collaboratively with area residents and stakeholders to address an issue specific to the area.

The multi-stakeholder panel, which included the AER and the Government of Alberta (Ministry of Environment and Parks), produced 23 recommendations for regulatory change specific to the use of

water by upstream oil and gas (unconventional) development. The AER is currently working to assess and implement those recommendations, in concert with the government policy makers.
Overall, this means that the AER will be applying local, area-level regulatory requirements that are specific to the subsurface geology, the surface environmental conditions, and local interests and values to the activities occurring in an area. The area-level approach is important to the AER's ability to regulate cumulative environmental impacts occurring in an area as a result of energy sector activity.

4. What criteria are used to declare a play?
Formally using plays in regulation, as opposed to only reserves estimation, is a relatively new concept at AER being driven by unconventional development in Alberta. But under the current legislation, plays are not distinguished from conventional development and they are regulated by the same general rules that apply to conventional development. This is for several reasons. One is that the internal play catalogue is still evolving and thus not mature enough to build a stable, legally-binding administrative system on. Second, we have not yet solved how to move the multi-play commingled administrative units into a play-based framework and wells in those units represent a significant part of Alberta's well population. And third, the plays are stacked in Alberta's subsurface so their footprints at the land surface produce cumulative and integrative impacts that need to be managed from a surface perspective. Area-based regulation (ABR) is the effort to learn how we can do this.

In the interim, we have introduced the play concept via a regulatory construct called a Subsurface Order (SO). Subsurface orders are AER regulatory instruments that can create or waive regulatory requirements on subsurface developments on a formation or regional basis. They, and their historical predecessors, are created to address a specific subsurface risk (like play-specific induced seismicity) or to reduce regulatory burden associated with applications that always produce the same answer, i.e., SO's grant all wells the same conditions on well-spacing requirements so applications for regulatory exemption on spacing are not required. We are now using play boundaries to help define the SOs, so that all wells in a play will get the same treatment. We have set subsurface orders for plays in Alberta's Montney Formation and Duvernay Formation plus we have notionally identified future SO's in the Cardium Formation. These plays will progress under SOs in due course.

5. In light of the play-based pilot, what improvements can be made to the play-based regulatory framework?
Through the Area-based Regulation pilot project, the AER tested a few concepts intended to improve how the regulatory system could respond to issues from large-scale (play-level) unconventional development. A few key learnings from Area-based Regulation that may be of use:

1) <u>The regulator should be assessing regional conditions</u>. Normally, the assessment of impacts is completed by the proponent as part of their application, but these application and site-specific impact assessments were not sufficient to be able to track and regulate the impacts occurring over the larger scale associated with unconventional shale development.

2) Good-quality, large-scale geological information and modeling is critical, because it allows an assessment of where surface impacts will occur and the intensity of those impacts. For Area-based Regulation, this geological information was provided by the Alberta Geological Survey and was interpreted and modelled into an assessment of reserves and resources. This became the foundation from which impacts to people and the environment could be determined.
3) Collaborative engagement with local indigenous communities and stakeholders is required. With the intent to create regulatory requirements, the Area-based Regulation project team collaborated with a panel of select stakeholders to determine ways to shift water use away from high-quality, non-saline (fresh) water. The panel produced 23 consensus recommendations, and while not yet implemented into regulatory requirements, the feedback from the panel process was resoundingly positive.
    a. It helps to have integrated sub-surface and environmental information at a regional/sub-regional scale completed and ready to support collaborative discussions.
    b. Collaborative engagement requires a focal issue with a defined scope, but not a pre-defined answer. This makes the engagement process much more impactful, as all parties collaborate to solve the issue.

6. How does risk-based regulation work in practice?

Risk based regulation is an approach that uses information to support making decisions that are justified and transparent.

Regulators look at an event (e.g. fracking a well at shallow depths) and assesses the probability and the magnitude of the impact associated with that event and evaluates the potential to compromise our ability to advance legislative objectives, which we define as social, economic and environmental outcomes; and other strategic and organizational outcomes such as the public's trust and confidence in regulatory systems. We then make a determination to intervene by invoking a regulatory action that compels a regulated entity or the entire sector or market to manage the risk differently.
The process follows a standard ISO-31000 framework – understand the context, assess the risk (which includes assessing existing controls), treat the risk, communicate, monitor and evaluate.
Risk informed decision making is applied to five functional areas of the regulator:

- setting strategic priorities
- authorizing energy activities
- conducting surveillance and managing compliance
- developing regulatory instruments
- communicating and engaging with the public

Setting strategic priorities

- Regulators assess future scenarios that may materialize and understand the risk implications associated with those scenarios and make decisions to prepare for, and position for future success in an uncertain future.

Authorizing energy activities

- Regulators use risk information to review and assess applications to conduct energy activity in the following ways:
  - Understand cumulative impacts of a project – social, environmental and economic – throughout the entire lifecycle of a project
  - Make a determination if existing controls are suitable, if not, reject application or provide conditional approval that is proportionate to the risk

Managing surveillance and compliance assurance

- Regulators use risk information such as operator performance, environmental sensitives, scale and size of projects, technical hazards, etc. to make decisions regarding allocating scarce regulatory resources to perform surveillance of oil and gas activities.
- Regulators also use risk information to understand the nature and magnitude of non-compliance events to determine the type of enforcement action that is proportionate to the type of infraction

Developing Regulatory Instruments

- Regulators use risk information to design new or modify existing regulations to justify if new regulations are warranted, understanding the causal factors creating an unacceptable level of risk, select the type of intervention and approach that is proportionate to the nature and magnitude of the risk, setting limitations and thresholds for environmental pollutants (e.g. waste water effluent) and other hazards.

Communicating and engaging with the public

- The regulator uses risk information when engaging with the public to raise awareness and mitigate conflict.

7. What is the "one application, one decision approach" and how does it work in practice?

The "one application, one decision approach" is the submission of a single application for multiple activities that would traditionally be applied for individually and a single decision on all activities applied for. Instead of many applications/decisions on separate items, operators will submit multiple applications as one, single application (e.g., for a project) and the AER will make one decision.
When the AER was created in 2013, the intent was to improve Alberta's competitiveness by building a modern, efficient, performance-based system that maintains the province's commitment to environmental management, public safety and responsible resource development. As the single regulator for Alberta's energy development activities, the AER was expected to build a risk-informed system that looked at the entire lifecycle of an energy development. The goal was to provide operators and stakeholders with a one-application, one review, one-decision system. This isn't about cutting

corners. It's about looking at energy developments from a broader perspective—from beginning to end— and making decisions about energy projects with all of the information up front. It helps Albertans and indigenous communities understand the connection between activities being proposed in their community.

Today, operators might have to submit 10–30 applications for a single well development. This also means that those interested or potentially affected would look at 10-30 applications. Reducing that number to one comprehensive application will give Albertans and indigenous communities a better idea about what is proposed in their community.

Single applications will:

- include all elements that will be needed to complete an energy development—from start to finish, including all construction plans and details about how the development will operate and how the operator plans to eventually close down the development and reclaim the land; and
- be for a broad range of activities, from a single well to a pipeline, a facility, or a larger, more complex project.

What is different is that Albertans will be able to see the entire application at once, looking at all the different elements as a project rather than reviewing them one at a time over many months or years. This process will let you know, up front, all the activities being applied for including such things as any water use, number of wells, well pads, roads, the impact of the project on the landscape and how reclamation and remediation may occur.

Albertans and indigenous communities will still have an opportunity to have a say about these developments, including the ability to file a statement of concern with the AER. In fact, with all of the information available through this process, it will be easier to identify concerns associated with a particular project. We expect industry to continue to engage with Albertans so concerns are addressed before the single application is submitted. Industry will be expected to engage with people and groups that may be affected by the proposed project throughout the life of the project.

Once we receive the single application, AER technical experts will review the application with the same rigor we use for all energy applications. We will examine any risks associated with the project. We will look at the kind of activity and where it is located, and we'll examine the operator's history before making any decisions. We will also examine how the operator has engaged with the community, landowners, and First Nations or Metis affected by the proposed development and review any Statements of Concern filed in response to the application.

Once we have completed our review, we will make a single decision. If the application meets all AER requirements, we can issue an approval for the project to proceed. The approval gives the operator the authority to do all the work it has applied for, such as drilling wells, accessing roads, building pipelines, etc. And our work doesn't stop once an approval is granted. Once the project is underway, the AER will

continue to monitor the project at every stage, including when construction starts, when the project is operating, and when the project is ready to close.

But not all applications are approved. In some cases, we place conditions on the approval that an operator must meet. We may monitor the continued engagement with Albertans and indigenous communities that is required of an operator as a project progresses through various stages. If the single application does not meet our requirements, it may be rejected or sent back for more work. Also, the AER may hold a hearing on an application, if required.

8. How are land access agreements with landholders/owners negotiated?
In Alberta, land is owned by private individuals, the Province (called public or Crown land), or the Federal Government (military installations, Indian reserves, federal parks, post offices).
To access private land for an energy development, individual companies negotiate with the land owners, often using licensed land agents. These agents negotiate and acquire interest in lands for the client companies who are undertaking the development. In developing the agreements, land agents may address such issues as environmental controls, damages, road use agreements, reclamation activities or preparing reports.

When an agreement cannot be reached or if disputes arise, the Alberta Surface Rights Board has authority as a quasi-judicial tribunal to resolve issues relating to compensation. It also has authority to grant a right-of-entry order to allow operators to access private lands when an access agreement is not in place or landowners deny entry.

For Crown land, the companies apply to the Alberta Energy Regulator for a disposition under the *Public Lands Act*. The disposition sets out the conditions by which the operator may use Crown land, including management throughout the development and reclamation requirements.

9. In respect of some legislation, for example, the *Water Act*, the AER shares jurisdiction with other agencies and departments. Who has overall responsibility? That is to say, what is the mechanism to ensure that overall (with other competing uses) there is no over allocation?
The *Responsible Energy Development Act* (REDA) establishes the AER and sets out our mandate, structure, powers, duties and functions. Regulations under REDA provide more details about the legislative framework of the AER, and transfer to the AER some of the government's jurisdiction and authority under the specified enactments. Specified enactments are the acts and regulations that the AER shares with government in order to regulate energy resource activities. These include the *Environmental Protection and Enhancement Act*, the *Public Lands Act*, the *Water Act*, and the *Mines and Minerals Act* (Part 8).

The *Alberta Land Stewardship Act* (ALSA) is the legal basis for land-use planning in the province, and the integration of provincial policies at a regional scale. The legislation and policy created in regional plans provides for coordination of decision-making that enables sustainable development by responding to cumulative effects. Environmental management frameworks, which form part of each regional plan, are intended to provide context within which decisions about future activities and management of existing activities occur through confirmation of regional objectives related to air, water, land and biodiversity, and establishing ambient environmental limits and triggers.

The Government of Alberta's Integrated Resource Management (IRM) System is founded on the principles of cumulative effects management and is the means by which the province achieves the environmental, social and economic outcomes Albertans expect from the management of our natural resources. The IRM System includes the ministries of Alberta Environment and Parks, Energy, Indigenous Relations, Agriculture and Forestry, Health, and the AER. The AER's role in the system is to implement government policy by developing and enforcing rules and regulations around energy development - this includes environmental management frameworks – and consideration of Government of Alberta policy direction in our regulatory decisions.

The AER is developing a Cumulative Effects Management Framework (CEMF) that is intended to fulfil the regulator's role under the Province's Cumulative Effects Management Approach. The AER's areas of responsibility include the conservation and management of water related to energy development in Alberta. Under the CEMF, in areas of the Province with completed regional plans and environmental management frameworks, the AER's objective is to ensure that environmental impacts of energy resource development stay below environmental thresholds set by the Government of Alberta. In areas without regional plans or environmental management frameworks the AER's objective is ensure that environmental impacts of energy resource development stay below regulatory levels set by the AER. The overall objective of the CEMF is to ensure that regulatory decisions across the full lifecycle of energy sector are informed by cumulative effects information.

In cases where a threshold or a regulatory level is being exceeded or is forecast to be exceeded based on resource development potential scenarios, measureable progress to remedy the situation will be pursued. Area Based Regulation (ABR) is a collaborative stakeholder engagement approach developed by the AER as a mechanism to establish regionally specific regulatory requirements to address current or forecast exceedances.

10. Does the AER have a mandate to consult with other agencies and departments in making its decisions, issuing directives etc? If so, are these consultations published?

Section 22 of Responsible Energy Development Act (REDA) states that unless otherwise directed, the AER is required to provide the Minister written notice at least 120 days prior to introducing a new rule, or changes to a rule. The Section 22 process is designed to provide assurance to Alberta Environment

and Parks (AEP) and to Alberta Energy (AE) that any rule change contemplated by the AER will be communicated in a timely fashion and those ministries will be given sufficient opportunity to understand the scope, timelines and intent of rules changes such that each department can advise on policy implications. This requirement only applies to new or amended rules. If changes to legislation are required (Specified Enactments, Energy Enactments, REDA or regulations under REDA), Alberta Environment and Parks and Alberta Energy are responsible for the process and required documentation. The AER's Stakeholder & Government Engagement Division, Alberta Government Engagement Branch interfaces with the appropriate government department lead(s) to facilitate work with AER staff to create an understanding of the proposed amendment, as described by AER. This engagement is critical in order for departments to undertake drafting instructions and shepherd the change through the approval process.

To ensure that any policy implications are identified and appropriately addressed, the AER will also ensure meaningful engagement with other government organizations (i.e. Alberta Agriculture and Forestry, Alberta Indigenous Relations, Alberta Health) or other departments that may be impacted by a rule change. Even though the AER is accountable to Ministers of AE and AEP, through AER's commitment to early and meaningful engagement other departments will be given equal opportunity for participation should they identify relevant policy implications.

The section 22 process does not apply to technical projects that do not have rule or regulation changes (such as amendments to directives or manuals). Technical projects may engage with Government of Alberta to ensure that unintended consequences are avoided, policy gaps are identified, the changes align with policy, and to ensure general awareness. This is initiated early in the project development process and could include technical briefings, general updates and a report on the final result and release of the project deliverables.

If so, are these consultations published?
These consultations are not published.

11. How is water use monitored and by whom?
Companies apply for water allocations under the Water Act. For hydraulic fracturing, the majority of water allocations are issued as Temporary Diversion Licences (TDLs) issued by AER and Alberta Environment and Parks, who both input the licensed allocation into a common database, the Environmental Management System. Companies request allocation volumes which are in excess of their actual water use, and the latter is voluntarily reported. Approximately 15% of licensees report their actual water use into an online reporting tool, the Water Use Reporting System, administered by Alberta Environment and Parks.

12. How is water quality monitored and by whom?

Water quality is monitored by:

- Industry directly or via consultants, if the monitoring clause is included in their application and pertains to site-specific water quality,
- Alberta Environment and Parks, Environmental Monitoring and Science Division monitors water quality throughout the province,
- Joint Federal and Provincial monitoring as part of the Oil Sands Monitoring program, but this does not pertain specifically to hydraulic fracturing.

13. How are fugitive emissions monitored and by whom?

Fugitive emissions are not routinely monitored from hydraulic fracturing. There are particulars in the accounting methods that separate venting from fugitives. Initial estimates are that not much venting is occurring. We have capability to monitor with truck-mounted laser to see if fugitive emissions are occurring, but an estimate of emissions is not calculated from this. 'Green' completions have emissions sent to flare until the gas produced is of quality to send to a gas processing plant. Estimates of fugitives can be calculated from industry averages for facility/well types and multiplied by the number of facilities/wells.

14. Are limits set on the amount of permissible fugitive emissions? If so, how are they calculated?

Limits are not set for fugitive emissions. Overall ambient air quality is measured at regional ambient air quality stations, and similar to the water quality monitoring, projects with certain types of approvals may have site-specific monitoring requirements that are administered by the company. Venting is not considered a fugitive emission under our accounting methods. Fugitives would be from faulty equipment, and there are currently no requirements to monitor these. During fracturing, diesel generators produce emissions but these are not considered as fugitive. We are currently completing studies that will give estimates of vented gas which goes to flare. There is some uncertainty about the efficiency of burned gas during flaring, but again is not considered fugitive. Likewise high-bleed venting is not counted as fugitive. Compressor seals, faulty vents, and other faulty equipment or well construction are considered as fugitive emissions. We do however estimate fugitive emissions, for example with methane releases, based on average emission rates for facilities.

15. How is compliance with any limit ensured?

Because there are no limits identified for fugitive emissions, we do not require compliance.

16. Several key stakeholders have noted to the Inquiry Panel the exemplar status of the AER. Given that the Northern Territory could embark on a possible major development of shale gas industry, under very sensitive environmental and community, including Indigenous (Aboriginal) concerns, and with limited experience at such a major development, what are

the some of the key learnings that the NT could take from the experiences of the AER?

Regulatory Design and Delivery:

- A clear understanding of the roles and responsibilities of policy development and policy assurance within the jurisdiction.
- Clearly defined outcomes (environmental, social and economic) and accompanying performance architecture that enables the objective evaluation of whether outcomes are upheld throughout the entire lifecycle of the unconventional development. Using outcome performance to drive regulatory changes where necessary.
- A clear understanding of the options for regulatory tools/actions and conducting proper regulatory impact analysis to identify the most appropriate (effective and efficient) tools/actions that drive industry behaviour during all stages of the lifecycle of unconventional development. A risk informed, performance based and outcomes focused approach.
- Embed retrospective analysis into regulatory processes to ensure the effectiveness of regulatory tools is evaluated over time. Use this analysis to make adjustments regularly to ensure ongoing and continuous delivery of outcomes through effective and efficient regulatory actions that remain current and relevant to how development changes over time (e.g. technology changes, different frac fluids etc).
- Make best (fully) informed decisions around unconventional development and the use of hydraulic fracturing that take into account the interaction between the environment, people and the economy.

Science, data and Information:

- Fully informed decisions require access to quality science and data that enables the regulator to understand the subsurface (geological), surface and atmospheric conditions across the landscape. In Alberta's case the diversity of our hydrocarbon resources, unconventional plays, surface and atmospheric conditions vary regionally.
- Modeling patterns of development allows for an assessment of where surface impacts may occur and the intensity of those potential impacts.
- Site specific impacts are not sufficient to track and regulate impacts occurring over the large scale associated with unconventional development.
- Utilize external sources of quality science, data and information, including local stakeholders and Indigenous peoples.
- Keep knowledge current with unconventional development practices/technology etc.

Stakeholder Engagement

- Build relationships with stakeholders beyond the transactional decision making on an application for development by involving stakeholders in the design of regulatory controls for unconventional development.
- Understand the spectrum of engagement from "inform" to "collaboration or co-creation" and know where and when it is appropriate to use different levels of engagement. The AER has

capitalized on opportunities to collaboratively engage with local Indigenous peoples and stakeholders with the intent to create regulatory requirements around unconventional development (regulatory design) not just in transactional development decisions (regulatory delivery). For example, the AER's area based regulation project collaborated with a panel of select stakeholders to determine ways to shift water use away from high-quality, non-saline (fresh) water. The panel produced 23 consensus recommendations, and while not yet implemented into regulatory requirements, the feedback from the panel process was resoundingly positive.

c. It helps to have integrated sub-surface and environmental information at a regional/sub-regional scale completed and ready to support collaborative discussions.
d. Collaborative engagement requires a focal issue with a defined scope, but not a pre-defined answer. This makes the engagement process much more impactful, as all parties collaborate to solve the issue.

Addendum to Answers for NT Inquiry into Hydraulic Fracturing

The AER has regulatory instruments that protect the resource and the environment from harms potentially associated with hydraulic fracturing. These instruments are usually in the form of rules in an AER Directive and Subsurface Orders.

The following Directives and Orders have been developed to respond specifically to accommodate the growth of hydraulic fracturing in horizontal wells in Alberta.

- *Directive 059: Well Drilling and Completion Data Filing Requirements*. This directive requires reporting of water source, use, and chemical composition of fracturing fluids as well as completion details of each well. This Directive asserts the authority of the AER to collect microseismic data collected during hydraulic fracturing activities as AER views this data as well data under Alberta's Oil and Gas Conservation Rules, but in practice the AER does not exercise this authority, accepting plots of microseismic event-hypocentres from operators instead, if needed.
- *Directive 080: Well Logging*. This directive sets forth the requirements for downhole petrophysical well logging for all energy wells in Alberta. It was modified to incorporate horizontal wells and pad drilling. All vertical wells require logs to be run for determination of lithology, porosity, and fluid composition. All horizontal wells require at least a gamma-ray log for lithology and correlations. All pads require at least one well to be logged by gamma ray to surface, including the surface-casing interval, and a neutron porosity-log to 25 metres below surface. These requirements balance the technical challenges and expense of logging horizontal wells plus avoiding collection of redundant data with the need to have accurate geology to understand the subsurface and, in the case of the shallow-interval logging requirements, identify local aquifers in case of a subsurface leak or spill.
- *Directive 083: Hydraulic Fracturing Subsurface Integrity*. This Directive specifies how operators must take steps to properly construct wells that will experience hydraulic fracturing plus steps that must be taken to reduce the risks of inter-wellbore communication, adverse effects on non-saline aquifers, adverse effects on water wells, and adverse effects on shallow bedrock. This Directive defines how operators will perform risk assessments to reduce these risks plus how and when to notify AER of pending fracturing activities. Notification is required but not application for hydraulic fracturing under Directive 083. Directive 083 also stipulates how AER is to be immediately notified of any hydraulic fracturing event that causes an adverse effect.
- *Subsurface Order No. 2*: This order stipulates the requirement for site-specific monitoring of induced seismicity by operators performing hydraulic fracturing. This applies only to one particular area of one major shale-gas play in Alberta because it has experienced seismic activity clearly associated with hydraulic fracturing activity. This Order implements the "traffic light"

system for this zone for response to induced seismicity events. When no events are observed within a 5 km radius of activities, hydraulic fracturing operations continue as usual. If an event of Richter local magnitude greater than 2 is recorded, then the operator must notify AER and invoke their seismic mitigation plan as also required under this Order. If an event greater than Richter local magnitude 4 is observed within the 5 km radius, the operator must safely cease operations and contact AER for further instruction.

- Subsurface Order No 1A, 3, and 5: These orders are specific to plays and parts of plays where multistage hydraulic fracturing of horizontal wells is now the norm for development. These orders remove requirements that are designed to conserve conventional oil pools through instruments like rate limits and spacing requirements. The onus is still on AER to ensure that subsurface development is still orderly and not wasteful, but now this will be done for these plays through monitoring reports *post facto* rather than rule-based applications because the risk is deemed low as operators generally desire the same outcomes as the Regulator for optimal subsurface recovery.

Regulatory instruments and responses at AER are science-based. The AER produces and sponsors studies and research into shale-gas development and control of risks. Areas of internal strength that supports good regulation of hydraulic fracturing include:

- Seismic Monitoring: The Alberta Geological Survey of the AER (AER|AGS) operates a regional seismic monitoring network. This network complements national networks operated by the federal government and research networks belonging to universities. Together they now create a near-continuous record of seismic events in Alberta with a tolerable level of accuracy on event epicentres and magnitude. This network is used to backstop the industry monitoring required under Subsurface Order No. 2 and also to assist AER and research partners to understand if and where other plays in Alberta may experience induced seismicity under future developments.
- Groundwater Mapping: The AER|AGS conducts shallow geological and regional groundwater mapping and resources inventory for the Province of Alberta and AER. One of the outputs of this program is Alberta's Base of Groundwater Protection, a regulatory instrument used to define the level of protection for aquifers by depth during drilling and completion operations, e.g., in Directive 083.
- Resource Appraisal: The AER|AGS conducts regional and formation-scale appraisals of in-place hydrocarbon resources. These reports on our endowment inform regulation and policy development as they indicate why development occurs where it does and where it may go in the future.
- Reserves Determination: The AER reports reserves of oil, natural gas, and bitumen to the Province and Albertans on an annual basis. The reserves administration and reporting system is being modified to reflect the nature of production from horizontal wells completed with hydraulic fracturing. The first report specific to reserves produced by hydraulically-fractured

wells was produced in 2016 by AER for the Duvernay Formation in the Fox Creek play. Such reports will perform the monitoring requirement on conservation as required under Subsurface Orders 1A, 3, and 5.