



# Oil and Gas Appeal Tribunal

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## DECISION NO. 2017-OGA-003(b)

In the matter of an appeal under section 72 of the *Oil and Gas Activities Act*, S.B.C. 2008, c. 36.

<b>BETWEEN:</b>	Canada Energy Partners Inc.	<b>APPELLANT</b>
<b>AND:</b>	Oil and Gas Commission	<b>RESPONDENT</b>
<b>AND:</b>	BC Hydro and Power Authority	<b>INTERVENER</b>
<b>BEFORE:</b>	A Panel of the Oil and Gas Appeal Tribunal Alan Andison, Chair	
<b>DATE:</b>	Conducted by way of written submissions concluding on August 4, 2017	
<b>APPEARING:</b>	For the Applicant: Benjamin M. Jones For the Respondent: Sarah Gregory, Counsel For the Intervener: Jeff Christian, Counsel	

## APPEAL

[1] Canada Energy Partners Inc. (“CEP”) appeals general order 2017-008 (the “Order”) issued by the Vice President, Compliance Operations, Oil and Gas Commission (the “OGC”). The Order requires CEP to suspend all disposal activities at well WA#22031 (the “Well”). CEP holds the authorization to operate the Well, which is located in northeastern BC. The Well was being used to dispose of produced water, a type of waste water from oil and gas activities, by injecting it into the Baldonnel formation, an underground geological unit.

[2] The OGC issued the Order shortly after BC Hydro and Power Authority (“BC Hydro”) informed the OGC that the Peace Canyon Dam, which is located approximately 3.3 km from the Well, is susceptible to relatively low peak ground accelerations. BC Hydro expressed concern about the potential impact of disposal operations at the Well on the Peace Canyon Dam.

[3] The Oil and Gas Appeal Tribunal (the “Tribunal”) has the authority to hear this appeal under section 72 of the *Oil and Gas Activities Act*, S.B.C. 2008, c. 36 (the “OGAA”). Section 72(6) of the OGAA gives the Tribunal the power to “confirm, vary, or rescind” the determination, or to “send the matter back, with directions”, to the person who made the determination.

[4] In its Notice of Appeal, CEP requests that the Tribunal rescind the Order, or alternatively, provide directions or conditions as may facilitate the continued operation of the Well. If the Tribunal refuses to grant either of those remedies, CEP

proposes, among other things, that the Well be plugged, abandoned, and deemed a “preventative safety expropriation” of private property by BC Hydro, and the financial loss of the Well and its value be borne equally by CEP, BC Hydro, and the OGC.

[5] The hearing of the appeal was conducted by way of written submissions.

## **BACKGROUND**

[6] BC Hydro owns and operates the Peace Canyon Dam. Built out of concrete, it was completed in 1980, and is located on the Peace River downstream from the W.A.C. Bennett Dam, which is associated with the G.M. Shrum power generating station. The Peace Canyon Dam is also approximately six km southwest of Hudson’s Hope, and 3.3 km away from the Well. The reservoir of impounded water behind the Peace Canyon Dam is called Dinosaur Lake. According to BC Hydro’s evidence, the Peace Canyon Dam and its associated power generating station account for approximately 6 to 7.5% of BC Hydro’s total hydroelectric generation capacity. In total, the Peace Canyon Dam with its power generating station, combined with the W.A.C. Bennett Dam with its G.M. Shrum power generating station, account for approximately 31% of BC Hydro’s total hydroelectric generation capacity.

[7] In 2008, the OGC issued a special project disposal order (the “Special Project Order”) authorizing use of the Well for the disposal of produced water into the Baldonnel formation. Disposal activities commenced in December 2008. CEP did not own the Well at that time.

[8] According to the evidence provided by the parties, the Well was drilled to a depth of 1610 metres, and from 2008 to 2010 a total of 99,150 cubic metres of fluid was injected at a depth of 1514 metres.

[9] In or around December 2009, BC Hydro contacted the OGC requesting information regarding the potential impacts of local well fracturing activities and water disposal, with respect to the integrity of the Peace Canyon Dam. According to information provided by the OGC, faulting exists in the area surrounding the Peace Canyon Dam, and the OGC has observed induced seismicity coincident with both hydraulic fracturing and water disposal activities. Also, according to the OGC, induced seismic events have been noted in association with Baldonnel water disposal in the Altares area, which is approximately 40 km north of the Well.

[10] In March 2010, the OGC amended the Special Project Order to include monitoring requirements and a “conservative” (according to the OGC) well injection pressure limit.

[11] In April 2010, disposal operations at the Well ceased voluntarily.

[12] In August 2011, operations at the Well were suspended.

[13] On March 3, 2014, the OGC amended the Special Project Order by adding conditions that had to be met before the Well could be used again for disposal. However, the Well was not re-activated at that time.

[14] Subsequently, CEP acquired the Well. In late 2016, CEP contacted the OGC regarding the requirements for re-activating the Well, and took steps to meet those requirements. On January 10, 2017, CEP re-commenced injection operations at the Well. According to the evidence provided by the parties, a total of 15,768 cubic metres of fluid was injected between January 10, and March 16, 2017.

[15] In or about mid-February 2017, BC Hydro staff noticed construction equipment working on the road access to the Well, and water trucks accessing the Well.

[16] On or about March 12 or 13, 2017, Stephen Rigbey, BC Hydro's Director of Dam Safety, contacted the OGC to request further information about the activity at the Well. Between March 13 and 15, 2017, Mr. Rigbey provided information to the OGC regarding stability issues associated with the Peace Canyon Dam, and its seismic tolerance. He expressed concern about the potential impact of disposal operations at the Well on the stability of the Peace Canyon Dam.

[17] Shortly thereafter, the OGC initiated a technical analysis of the disposal activities at the Well, including a review of technical information regarding the likelihood and magnitude of induced seismic events that may be caused by the disposal activities at the Well, and the potential effects on the stability of the Peace Canyon Dam.

#### *The Order*

[18] On March 16, 2017, the OGC issued the Order to CEP pursuant to section 49(1)(b) of the *OGAA*. The Order states, in part, as follows:

- v. Faulting is known in the area surrounding the Peace Canyon dam. Disposal activities have been known to trigger movement of pre-existing faults resulting in induced events.
- vi. The disposal zone in the Subject Well is the Baldonnel formation. Induced seismic events have been associated with Baldonnel water disposal in the Altares area to the north.
- vii. During the disposal activities occurring between December 2008 and April 2010 at the Subject Well, the Natural Resources Canada regional grid was not sufficient to detect low level seismicity [and] as such there would be no record of whether or not those disposal activities did in fact cause low level seismicity.
- viii. BC Hydro informed the Oil and Gas Commission on March 15, 2017, that the Peace Canyon dam is susceptible to relatively low peak ground accelerations.
- ix. Increased volumes of disposal, including disposal operations at the subject Well, increases the risk of seismic events where faults exist.
- x. There is a risk of an induced event sufficient to generate the peak ground accelerations necessary to cause damage to the Peace Canyon dam. This level of ground motion has already been recorded in association with

induced seismicity in other areas of north east BC. If such an event were to occur the consequences would be severe.

- xi. I am of the opinion that disposal activities must be suspended pending a review of additional technical information, including, if desired, a meeting with Canada Energy Partners Inc. as soon as practicable. In my opinion this action is necessary to mitigate a risk to public safety and to protect the environment.

[underlining added]

*CEP's appeal and application for a stay of the Order*

[19] On March 30, 2017, CEP appealed the Order to the Tribunal. The Tribunal has summarized the grounds for appeal in CEP's Notice of Appeal as follows:

- Contrary to the OGC's mandate, the Order was not fair or timely, in that the OGC issued the Order one day after receiving the complaint from BC Hydro and without giving CEP prior notice or an opportunity for input.
- No information was referenced in the Order as to what level of peak ground accelerations might cause some impact, or whether the impact would be to the integrity of the dam itself or to related operations.
- CEP asked the OGC for empirical evidence of increased seismic activity in proximity to the Well or BC Hydro's facilities, but the OGC advised that it has no empirical evidence of enhanced seismicity associated with the Well or in the immediate vicinity of the Peace Canyon Dam.
- The Well has been used to dispose of water in the past without any adverse effects on BC Hydro's facilities or any increased seismic activity in the vicinity of the Well or the Peace Canyon Dam.
- BC Hydro had no previous objections to the Well's authorization or the March 3, 2014 amendment to the Special Project Order.
- The Order was issued despite the fact that the OGC's 2014 seismic study in the Montney Trend showed that only two out of 104 active water disposal wells recorded seismic events associated with them, and recorded ground motions associated with those events were below the threshold for causing damage to structures, and no injuries or property damage were reported. The induced seismic events recorded at two disposal wells occurred in marginal reservoir quality rock in proximity to existing faults, whereas the Well has good reservoir quality and there is no indication of faults nearby.
- The Order was issued despite the fact that the OGC already required lower maximum injection pressures for the Well compared to other water disposal wells in northeastern BC, and the Well has a large safety factor relative to other disposal wells in the region.
- BC Hydro has publicly declared that their dams are strong enough to endure much stronger earthquakes than those generated by fracking, and the OGC's 2014 seismic study confirmed that the induced seismicity from water disposal is of a lower magnitude than that induced by fracking.

[20] In addition to the remedies that CEP requested regarding the merits of the appeal, which are summarized above, CEP requested an immediate stay of the Order pending the Tribunal's decision on the merits of the appeal.

[21] By a letter dated March 31, 2017, the Tribunal acknowledged CEP's Notice of Appeal, and invited the parties to provide written submissions on CEP's application for a stay of the Order. All parties provided submissions on the stay application.

[22] On June 5, 2017, the Tribunal issued a decision denying CEP's application for a stay of the Order (*Canadian Energy Partners v. Oil and Gas Commission*, Decision No. 2017-OGA-003(a)).

*Further steps by the OGC since the Order was issued*

[23] The Order states that disposal activities at the Well were suspended "pending a review of additional technical information". In its appeal submissions, BC Hydro advises that information gathered during the OGC's technical review was shared with CEP and BC Hydro on June 16, 2017, and the OGC advised that it was considering cancelling CEP's authorization for the Well pursuant to section 26 of the *OGAA*. On June 28, 2017, the OGC concluded a hearing regarding whether to cancel CEP's well authorization.

[24] By a letter dated July 29, 2017, the OGC advised that on July 11, 2017, it initiated a consideration of whether CEP's permit for the Well should be cancelled pursuant to section 26 of the *OGAA*.

*The parties' positions on the appeal*

[25] CEP submits that the Order was issued without statutory authority and contrary to section 49(1)(b) of the *OGAA*, as there is insufficient evidence that the Order was necessary to mitigate a risk to public safety, protect the environment, or promote the conservation of petroleum and natural gas resources. CEP also submits that the Order was issued without due process to CEP, and without proper deliberation. Further, CEP submits that the Order was issued only three months after the OGC provided assurances as to the integrity of the Well's permit, and in the absence of any new empirical evidence of danger since the issuance of the permit. CEP also argues that the OGC failed to conduct proper consultation with CEP and BC Hydro. Moreover, CEP submits that the Order was issued in violation of the OGC's policy of "grandfathering" existing operations within five km of hydro-electric facilities, and was primarily based on "deference" to a substandard dam. Finally, CEP submits that the Order results in the expropriation of CEP's property without compensation, and the Tribunal should order damages.

[26] By a letter dated July 29, 2017, the OGC advised that the Order contains the OGC's reasons for issuing the Order, and that the OGC would be making no submissions on the appeal.

[27] BC Hydro submits that the appeal should be dismissed. BC Hydro argues that CEP has the burden of proving that the operation of the Well poses no relevant risk to public safety or the environment, and it has not met that burden. BC Hydro argues that the Order is an appropriate regulatory response to the real, but difficult to quantify, hazards arising from the operation of the Well. In particular, the Order

mitigates the possibility of damage to the Peace Canyon Dam, and consequential risks to public safety and the environment, based on the recently increased scientific knowledge of induced seismicity, the geology of the Peace Canyon area, and the close proximity of the Well to the Peace Canyon Dam. BC Hydro submits that the financial loss CEP may suffer as a result of the Order is overwhelmed by the public interest purpose that motivated the OGC to issue the Order. In addition, BC Hydro argues that any procedural fairness issues that may have arisen from the Order have been cured by the appeal process, which is in the nature of a trial *de novo* or new hearing of the matter.

## **ISSUES**

1. Whether the Tribunal should rescind the Order due to procedural errors in the OGC's process that led to the issuing the Order.
2. Whether the Tribunal should rescind the Order, or alternatively, issue directions or conditions as may facilitate the continued operation of the Well, because there is insufficient evidentiary or legal basis for the Order.

## **RELEVANT LEGISLATION**

[28] The Order was issued under section 49(1)(b) of the *OGAA*. The parties also refer to section 26 of the *OGAA*. The relevant portions of sections 26 and 49 state as follows:

**26** (1) The commission may

- (a) refuse to issue a permit,
- (b) suspend a permit or a permission specified in a permit,

...

- (6) The commission must give a permit holder an opportunity to be heard before making a decision under subsection (1) (b), (c) or (d) or (5) and must notify the permit holder of its decision under any of those provisions.

...

**49** (1) An official may, in writing, issue to a person carrying out an oil and gas activity or a related activity an order under this section with respect to those activities or any of the person's obligations under the Act or the regulations or the person's permit or authorization, if any, if, in the opinion of the official,

...

- (b) the order is necessary
  - (i) to mitigate a risk to public safety,
  - (ii) to protect the environment, or

- (iii) to promote the conservation of petroleum and natural gas resources.

...

- (3) An order under subsection (1) must
  - (a) name the person to whom the order is addressed,
  - (b) specify the action to be taken, stopped or modified,
  - (c) state the date by which the person must comply with the order,
  - (d) state the reasons for the order,
  - (e) state that the person may request a review of the order under section 70 or appeal the decision under section 72, and include an address to which a request for a review or an appeal may be sent,
  - (f) be dated the day the order is made, and
  - (g) be served on the person to whom it is addressed.

...

- (4) Without limiting subsection (3) (b), an order under subsection (1) may specify any of the following requirements:

...

- (d) that a person suspend or resume an oil and gas activity or any aspect of an oil and gas activity;

...

## **DISCUSSION AND ANALYSIS**

### **1. Whether the Tribunal should rescind the Order due to procedural errors in the OGC's process that led to issuing the Order.**

#### *CEP's submissions*

[29] CEP submits that its rights to due process under the *OGAA* have been violated. In that regard, CEP refers to subsections 26(1)(b) and (6) of the *OGAA*. Section 26(1)(b) of the *OGAA* provides that the OGC may suspend a permit. Section 26(6) of the *OGAA* states that the OGC "must give a permit holder an opportunity to be heard before making a decision under subsection (1) (b) ..., and must notify the permit holder of its decision under any of those provisions." CEP maintains that it was not given an opportunity to be heard before the Order was issued. Rather, CEP was informed of the Order and told to comply with it, on the same day that the Order was issued.

[30] CEP also submits that the Order was issued without proper deliberation, and less than 48 hours after BC Hydro advised the OGC of its concerns regarding the potential impact of disposal activities at the Well on the Peace Canyon Dam. CEP argues that, had there not been a rush to make a decision, a review of further

information from BC Hydro would have revealed that there was no threat to the public.

[31] In addition, CEP submits that the Order was partly based on a failure by the OGC to properly consult with BC Hydro. CEP argues that the OGC has an obligation to consult stakeholders before issuing permits, and the OGC had discussions with BC Hydro dating back to 2009 concerning the Well and potential seismicity. CEP maintains that it relied on the OGC fulfilling its consultation obligations when CEP decided to invest in the Well.

#### *BC Hydro's submissions*

[32] BC Hydro submits that the Order was not made pursuant to section 26(1) of the *OGAA*, and therefore, the hearing requirements in section 26 do not apply.

[33] In any event, BC Hydro submits that the appeal process is in the nature of a hearing *de novo* in which all parties have the opportunity to present evidence, including new evidence that was not before the OGC when it issued the Order, and therefore, any procedural fairness issues that may have arisen before the issuance of the Order are cured by the appeal process.

[34] Moreover, BC Hydro submits that the OGC had no lawful obligation to consult in this case, and even if it did, any such failure is cured by the OGC's technical review process and the appeal process.

#### *The Tribunal's Findings*

[35] The Tribunal finds that the Order was not issued under section 26(1)(b) of the *OGAA*. The Order clearly states that it was issued under section 49(1)(b) of the *OGAA*. The Tribunal further finds that section 26(6) of the *OGAA* expressly provides that the OGC "must give a permit holder an opportunity to be heard before making a decision under subsection (1) (b), (c) or (d) or (5) ...." Therefore, the requirement under section 26(6) to give a permit holder an opportunity to be heard before issuing an order only applies to orders made under sections 26(1)(b), (c) (d), and 26(5) of the *OGAA*. This requirement does not apply to orders made under section 49(1) of the *OGAA*. Furthermore, section 49 of the *OGAA* contains no requirement for the OGC to give a permit holder an opportunity to be heard before issuing an order under section 49(1).

[36] Regarding CEP's argument that the Order was partly based on a failure by the OGC to properly consult with BC Hydro before issuing the Well's permit, the Tribunal finds that the consultation requirements under the *OGAA* regarding permits are not properly before the Tribunal in this appeal, which is against the Order suspending that permit. While certain consultations are required under the *OGAA* before a well permit is issued, the Well's permit is not the subject of the present appeal, and there is no evidence regarding the consultation process that occurred before that permit was issued. Furthermore, there is no requirement under section 49 of the *OGAA* for the OGC to conduct consultations before issuing an order under section 49(1).

[37] In any event, the Tribunal has previously found that its statutory powers and procedures are indicative of a hybrid appeal process that is more like an appeal



*de novo* than a true review on the record before the OGC: *Daniel Kerr v. Oil and Gas Commission*, Decision No. 2011-OGA-005(b), December 12, 2011, at paras. 57 – 58. The Tribunal has also previously found that the appeal process may cure procedural defects in the OGC's process: *Marilyn Gross v. Oil and Gas Commission*, Decision Nos. 2011-OGA-006(b) & 2011-OGA-007(b), March 22, 2012, paras. 109 - 112. In the present case, although the OGC issued the Order without input from, or prior notice to CEP, and only a short time after BC Hydro advised the OGC of its concerns regarding the potential impacts of the Well's disposal operations on the Peace Canyon Dam, CEP has now been accorded a full and fair hearing before the Tribunal. During the appeal process, CEP was given ample time and opportunity to present evidence and arguments, including evidence that was not before the OGC when it issued the Order, and to respond to both the OGC's reasons for issuing the Order and the evidence and arguments provided by BC Hydro.

[38] Given the Tribunal's powers and procedures, and the process by which this appeal was heard and considered, the Tribunal finds that the appeal process has cured any procedural defects that may have occurred in the OGC's process that led to the Order being issued.

**2. Whether the Tribunal should rescind the Order, or alternatively, issue directions or conditions as may facilitate the continued operation of the Well, because there is insufficient evidentiary or legal basis for the Order.**

*CEP's submissions*

[39] CEP submits that the Order was issued without statutory authority, as there are three grounds for issuing an order under section 49(1)(b) of the *OGAA*, and none of those grounds apply in this case. Specifically, CEP maintains that there is insufficient evidence that the Order was necessary to mitigate a risk to public safety, protect the environment, or promote the conservation of petroleum and natural gas resources. CEP argues that the public safety and environmental concerns that are the stated basis for the Order are predicated on the possibility of an induced seismic event damaging the Peace Canyon Dam in a non-catastrophic event which would require a drawdown of Dinosaur Lake and repair to the Dam.

[40] CEP also submits that it is unfair that it has the burden of proving why the Order should be rescinded, given that there was insufficient evidence for issuing the Order in the first place. CEP agrees that the "balance of probabilities" standard is the applicable standard of proof, but CEP argues that the balance of probabilities should be applied to the actual effect on public safety and the environment, as opposed to the risk. In that regard, CEP submits that there is a 99.9% probability that disposal operations at the Well will have no effect on the Peace Canyon Dam with respect to public safety or the environment, and that this probability is much higher than the 51% required by the balance of probabilities standard of proof. Moreover, CEP submits that BC Hydro should have to prove on a balance of probabilities that CEP's operation will adversely affect the Peace Canyon Dam.

[41] Regarding public safety, CEP argues that BC Hydro has repeatedly declared that the Peace Canyon Dam is safe from induced seismicity. In support of that

argument, CEP refers to several publications and statements by BC Hydro officials. For example, CEP refers to a March 27, 2017 media statement by BC Hydro regarding the Peace Canyon Dam which states, in part, as follows:

Our local engineers recently discovered there was a water disposal well within a few kilometres of our Peace Canyon dam.

While there is no immediate public safety risk associated with disposal wells, this discovery raised concerns. Water disposal activity can cause significant ground motion that has the potential to damage our facilities when in close proximity.

BC Hydro engineers promptly recognized this activity and we immediately communicated our concerns to the BC Oil and Gas Commission (OGC). The OGC then decided to take action in the form of issuing a suspension order.

The Ministry of Natural Gas Development previously put restrictions in place so that no new fracking tenures will be issued within 5 kilometres of all BC Hydro's generating facilities. The BC Oil and Gas Commission has also agreed to notify Hydro prior to issuing any new permits for existing tenures.

Disposal wells have been known to cause stronger seismic events over a larger area than those caused by fracking, so a 5-kilometre buffer zone will not be sufficient for these projects.

As a result, it is our understanding that the suspension order will remain in place until the OGC, working with BC Hydro, determines the appropriate course of action.

...

[underlining added in CEP's submissions]

[42] CEP argues that it is disingenuous for BC Hydro to argue that public safety is a key basis for the Order after it has publicly declared that seismic risk is not a public safety issue regarding BC Hydro's dams. Moreover, CEP argues that BC Hydro actually plans to draw down Dinosaur Lake in the future for scheduled maintenance.

[43] CEP also refers to a June 14, 2017 report by Advisian, titled "Induced Seismicity: Effect of Induced Seismic events on the Peace Canyon Dam, Hudson's Hope, BC" (the "Advisian Report"). Advisian is a consulting firm that was retained by the OGC to evaluate the potential for induced seismic events to adversely affect the Peace Canyon Dam. The Advisian Report was prepared by geotechnical engineers, who conducted a review of technical documents and literature that were provided by the OGC. CEP refers to page 7 of the Advisian Report where it states as follows:

We have not identified any compelling reason for induced seismicity to result in significant damage to, or an outright failure of, the PCD [Peace Canyon Dam]. Based on the recorded history of fracking and injection well induced seismic events in north-east BC, and provided that reinjection conditions remain similar to the practice to date, the probability of significant damage or a failure occurring is within expected norms for life safety, based on the

British Columbia Building Code and our present understanding of the stability of the PCD structure.

[44] CEP argues that this conclusion in the Advisian Report supports the proposition that water disposal operations at the Well pose no risk to public safety or the environment in relation to the Peace Canyon Dam.

[45] Regarding protection of the environment, CEP submits that disposal activities at the Well pose no risk of environmental damage in relation to the Peace Canyon Dam and its reservoir. CEP argues that a drawdown of Dinosaur Lake would have no adverse effects arising from dissolved gases in river water, harm to fish, erosion and debris, or damage to Dam structures such as the spillway or the tailrace. CEP argues that the Peace Canyon Dam water level can be drawn down without exceeding historical maximum discharge volumes or rates. In that regard, CEP refers to a 2012 report that BC Hydro prepared as part of the environmental assessment for the Site C Dam proposal, which states that the Peace Canyon Dam “can pass the probable maximum flood, which has an annual probability of exceedance of less than 1 in 10,000. ... Engineering studies have confirmed that the higher tailwater levels would not change the stability or spillway operation of the Peace Canyon Dam.” CEP also refers to the OGC’s April 10, 2017, technical review document, which states that the environmental effects of a drawdown of Dinosaur Lake, in terms of fish, fish habitat, and water quality, “would likely be transitory in nature....”

[46] In addition, CEP submits that if the Order is rescinded, there is a greater than 99% probability that there would be no consequence to BC Hydro, and the only damage would be that BC Hydro would have to complete scheduled maintenance work sooner than was planned.

[47] CEP also submits that the Order suppresses resource development, contrary to the OGC’s mission under the legislation, because natural gas resources in the area cannot be developed without adequate water disposal capacity.

[48] Additionally, CEP submits that the Order was issued contrary to the preponderance of geological and historical evidence. CEP maintains that past disposal activities at the Well have generated no seismicity, and caused no damage to the Peace Canyon Dam. In support of that submission, CEP provided a copy of a March 23, 2017 email from Lance Ollenberger of the OGC, which states, in part:

... the Commission does not have empirical evidence of enhanced seismicity associated with the subject well or in the immediate vicinity of the Peace Canyon Dam. The Commission’s determination was based on seismic events in disposal wells within similar structural settings in Northeast B.C. This information, in conjunction with new information from BC Hydro regarding the seismic tolerance of the Peace Canyon Dam, was the basis for the suspension order. Commission technical staff are currently in discussions with BC Hydro to better understand the specifics of the seismic tolerance of the dam. ...

[underlining added in CEP’s submissions]

[49] Furthermore, CEP submits that according to the OGC, six disposal wells in northeastern BC have had seismic events in proximity to them, but only two were confirmed to be related to water disposal, and both of them occurred in the Devonian geological formation which is much deeper than the Well's disposal activities. CEP also submits that the Well operates at much lower injection pressures than other disposal wells in BC. For example, other wells in the region operate at as high as 14,000 kilopascals (kPa), whereas the OGC has limited the Well to 6,200 kPa, and actual pressure at the Well has never exceeded 5,200 kPa. On that basis, CEP submits that the Well has a large safety factor built into it, relative to other disposal wells in the region.

[50] In addition, CEP submits that the Well is located in a geological zone with significantly less compressive stress, and the Baldonnel formation is relatively stable tectonically in the area of the Well. CEP advises that no fault lines are visible at the wellbore. CEP submits that thrust faults visible in outcrops in the Peace Canyon are shallow detachments that plane out well above the Baldonnel, although the geologic structure is somewhat uncertain due to thick glacial till at the surface which degrades seismic data quality. In support, CEP refers to a 2010 OGC seismicity study which concluded that "There does not appear to be any evidence for a high level of residual tectonic stress in the [Hudson's Hope] area."

[51] Regarding the question of whether seismicity induced by water disposal is greater than that induced by hydraulic fracturing, CEP submits that this is true in Oklahoma but not in BC. CEP argues that Oklahoma is not comparable to BC, because there are much larger disposal volumes and a closer proximity to crystalline "basement" rock in Oklahoma. CEP maintains that according to a December 2014 report by the OGC regarding observed seismicity in the Montney formation in northeastern BC, hydraulic fracturing induced seismic events had a peak seismicity of magnitude 4.4, whereas water disposal induced seismic events had a peak seismicity of magnitude 2.9.

[52] Further, CEP maintains that the Order was issued based on a "discriminatory" safety standard, in that BC Hydro applies a lower margin of safety to its dams in other areas, including dams in coastal BC that are at higher risk of much stronger earthquakes.

[53] In addition, CEP submits that the Order was issued only three months after the OGC issued a public statement that it had reviewed all disposal wells in the province to ensure their ongoing integrity, and in the absence of any new empirical evidence of danger since the issuance of the Well permit.

[54] CEP also argues that the Order was issued in violation of the OGC's policy of "grandfathering" existing operations within five km of BC Hydro's facilities. CEP maintains that it was led to believe that the OGC had adopted an internal policy of allowing companies holding tenures within five km of BC Hydro's facilities to drill and frack. In support of that submission, CEP refers to an August 2016 article by the Canadian Centre for Policy Alternatives which states that there was an unwritten "understanding" between the OGC and BC Hydro that no new oil and gas tenures would be awarded within five km of the Bennett Dam, Peace Canyon Dam, or the new Site C Dam, but companies already holding such rights would "be allowed to drill and frack for gas."

[55] Furthermore, CEP submits that the Order was primarily based on deference to a substandard dam, as the Peace Canyon Dam does not meet modern design practices and has a significantly lower shear resistance than was anticipated when it was designed. In support of that argument, CEP refers to an April 2017 BC Hydro document titled "Peace Canyon Stability Synopsis", which states, in part, as follows:

### **Background**

... The dam is founded on sedimentary rock consisting of siltstone, silty shale and shale, overlying a basal sandstone unit. A number of weaker bedding planes were identified underneath the dam during construction. Some of these exist directly below the dam within the foundation, and shear tests on bedrock core samples indicated shear resistance that was significantly lower than originally anticipated during design. The dam is marginally stable under full uplift considerations, which does not meet modern design practice. Acceptable levels of stability are only achieved by relying on high drainage efficiency. In effect, acceptable factors of safety under normal operating conditions depend on keeping the uplift pressures lower than tailwater by means of pumping from the galleries. ...

Uplift pressures in the foundation are measured using a total of 78 standpipe piezometers, including 43 installed during construction or shortly thereafter, and 35 installed in 1988.

### **Seismic Withstand**

The seismic withstand of the Peace Canyon dam is very sensitive to both foundation shear strength and drainage efficiency assumptions. The 1:10,000 event is calculated to be 0.17g [g = the acceleration due to Earth's gravity], and the dam remains marginally stable with the assumption of uplift pressures being no higher than gallery level. ... Under current conditions of uplift, we likely have a seismic withstand sliding threshold of about 0.2g, however this could be significantly reduced through a temporary loss of the pumping wells. With a loss of about half of the existing drainage efficiency due to any cause, the seismic withstand for the sliding threshold reduces to about 0.07g. This is likely somewhat conservative, due to assumptions of limited support being provided by the rock mass downstream of the dam. In general, the seismic withstand should be considered as in the range of 0.07g to 0.2g.

[56] Finally, CEP submits that the Order results in the expropriation of CEP's property without compensation, which is unfair, and the Tribunal should order damages. CEP submits that if the Tribunal's decision results in the abandonment of the Well, the financial loss that CEP will suffer should be divided equally by CEP, BC Hydro, and the OGC. In that regard, CEP submits that the Tribunal has the authority under section 50(1) of the *Administrative Tribunals Act* to order the payment of money.

### *BC Hydro's submissions*

[57] BC Hydro submits that CEP has the burden of demonstrating that the Order was not necessary to mitigate a risk to public safety, or to protect the environment,

under sections 49(1)(b)(i) and (ii) of the *OGAA*, respectively. BC Hydro submits that the Tribunal has previously held that the appellant has the burden of proof, on a balance of probabilities, which means that CEP must establish that disposal activities at the Well pose no meaningful risk to public safety or the environment.

[58] BC Hydro also submits that sections 49(1)(b)(i) and (ii) of the *OGAA* must be read in light of the purpose of the *OGAA*, based on the modern approach to statutory interpretation as stated by the Supreme Court of Canada in *Re Rizzo and Rizzo Shoes Ltd.*, [1998] 1 S.C.R. 27, at para. 21:

... Elmer Driedger in *Construction of Statutes* (2nd ed. 1983) best encapsulates the approach upon which I prefer to rely. He recognizes that statutory interpretation cannot be founded on the wording of the legislation alone. At p. 87 he states:

Today there is only one principle or approach, namely, the words of an Act are to be read in their entire context and in their grammatical and ordinary sense harmoniously with the scheme of the Act, the object of the Act, and the intention of Parliament.

[59] BC Hydro notes that section 4 of the *OGAA* expressly sets out the purposes of the OGC, as follows:

4 The purposes of the commission include the following:

- (a) to regulate oil and gas activities in British Columbia in a manner that
  - (i) provides for the sound development of the oil and gas sector, by fostering a healthy environment, a sound economy and social well-being,
  - (ii) conserves petroleum and natural gas resources,
  - (iii) ensures safe and efficient practices, and
  - (iv) assists owners of petroleum and natural gas resources to participate equitably in the production of shared pools of petroleum and natural gas;
- (b) to provide for effective and efficient processes for the review of applications for permits and to ensure that applications that are approved are in the public interest having regard to environmental, economic and social effects;

...

[underlining added in BC Hydro's submissions]

[60] Given those statutory purposes, BC Hydro argues that the Tribunal should give little, if any, weight to the adverse financial circumstances that CEP will suffer if the Order is confirmed. Conversely, the impacts on safety and the environment if the Order is rescinded ought to be given significant weight.

[61] Regarding the nature and degree of risk that is relevant when issuing an order under section 49(1)(b) of the *OGAA*, BC Hydro submits that the hazards to public safety and the environment that arise from the possibility that the Well's operations could damage the Peace Canyon Dam are real but difficult to quantify.

BC Hydro submits that its evidence, which is further discussed below, demonstrates that the operation of the Well could significantly increase the seismic hazard at the Peace Canyon Dam. In particular, the largest seismic event to date from water disposal was a magnitude 5.7 event in Oklahoma, and the largest event from hydraulic fracturing was a magnitude 4.6 event in BC, which suggests that the possibility of a large seismic event may be greater for water disposal than for hydraulic fracturing. BC Hydro maintains that its evidence shows that, if an event of a similar magnitude to that which occurred in Oklahoma occurred within 5 to 10 km of the Peace Canyon Dam, it would result in a hazard equivalent to a 1:10,000 risk for acceleration at the Dam spillway's fundamental frequency. According to BC Hydro, a risk level for catastrophic failure corresponding to a 1 in 10,000 year event is the industry standard recognized in the Canadian Dam Safety Association's *Dam Safety Guidelines*, and anything less than that risk level is unacceptable to BC Hydro. BC Hydro further submits that risks to public safety can be small (i.e., 1:10,000) yet significant (e.g., the risk of a fatality), and need not be quantifiable or imminent to be relevant and supportive of orders that have financial consequences for individuals: *Madaninejad v. North Vancouver (District)*, 2015 BCSC 895.

[62] Regarding the evidence provided by CEP, BC Hydro submits that CEP has primarily filed argument and opinion evidence authored by the principle of CEP, Benjamin Jones, who lacks the qualifications to offer such opinion evidence, and therefore, his opinion evidence should be given negligible weight.

[63] Furthermore, BC Hydro submits that it has provided affidavit evidence from five employees who are engineers or scientists with expertise on the subject matter of their affidavits: Stephen Rigbey, Director of Dam Safety, who oversees a team of approximately 35 engineers, technologists, scientists, and support staff engaged in the ongoing assessment of BC Hydro's dams; Darren Sherbot, Manager of Operations Planning of Generation, who holds an engineering degree and has worked for BC Hydro since 1996; Alf Leake, Fish and Aquatics Team Lead, who is a professional engineer and has worked for BC Hydro for over 20 years; Thomas Stewart, Landslides and Reservoir Slope Specialist, who is a professional engineer and has worked for BC Hydro since 1991; and Dr. Osmar Penner, a professional engineer who has worked for BC Hydro since 2006 and is part of the structural engineering team that specializes in seismic analysis of concrete dams. According to BC Hydro, their evidence establishes that:

- BC Hydro has a legitimate concern with respect to operations that could cause damage to the Peace Canyon Dam;
- the consequences of seismic-induced damage to the Peace Canyon Dam could be severe;
- the impacts of seismic-induced damage would require an immediate and significant drawdown of Dinosaur Lake; and
- the result of a drawdown of Dinosaur Lake would cause consequential environmental and electricity load-serving impacts.

[64] Regarding the design and construction of the Peace Canyon Dam, and how it could be structurally affected by a seismic event, BC Hydro refers to Mr. Rigbey's

affidavit evidence. Mr. Rigbey states that the Dam's spillway is founded on sedimentary rock, and a number of low angle bedding planes were identified below the Dam during construction. These bedding planes have low shear strength. In order to achieve acceptable sliding safety factors for the Dam, mitigation steps were taken during construction, including infilling between the powerhouse and the intake, increasing the Dam's base where possible, and installing an enhanced drainage system including two galleries (one upstream and one downstream) with a pumping system to keep the water levels in the galleries below tailwater (i.e., the water immediately downstream of the Dam). High drainage efficiency must be maintained at the Dam to control uplift pressure as water seeps through the bedrock underneath the structure.

[65] In addition, Mr. Rigbey states that when the Peace Canyon Dam was built, the design criteria was for peak ground acceleration (i.e., the maximum value of acceleration of the ground movement during an earthquake) of  $0.1g^1$  and a "safety factor" of 1.5. This safety factor means that the resisting forces in the Dam's construction (e.g., the weight of the concrete) are 1.5 times larger than the driving forces against the Dam, such as uplift pressure and the horizontal pressure of the water in the reservoir. However, the Dam's seismic withstand is very sensitive to both foundation shear strength and the effective operation of the high drainage efficiency system.

[66] Mr. Rigbey explains that an earthquake creates ground acceleration that adds to the driving forces against the Dam, which reduces the safety factor. If the ground acceleration is large enough, the resisting forces may be exceeded, the safety factor is reduced to less than 1.0, and the Dam will begin to slide along its foundation. Larger magnitude seismic events produce larger peak ground accelerations, and typically last longer than smaller seismic events. In addition, the closer the Dam is to the seismic event, the larger the peak ground acceleration. If the peak ground acceleration from an earthquake exceeds the critical ground acceleration value for a long enough period of time, there may be catastrophic failure of the Dam. If the drainage of the Dam's foundation is compromised and full uplift pressure came into effect, the Dam would only be "marginally stable". In particular, Mr. Rigbey states that under full uplift conditions, the critical ground acceleration for the Dam is  $0.07g$ , at which point the Dam would begin to slide, whereas the critical ground acceleration is  $0.2g$  under drained conditions with the pumps fully operational. Thus, BC Hydro considers that the onset of damage to the Dam would be somewhere between  $0.07g$  and  $0.2g$ . He states that it is virtually impossible to definitively ascertain the seismic withstand of the Peace Canyon Dam, and BC Hydro does not know how large of a seismic event could actually result from water disposal at the Well. BC Hydro does not want to jeopardize the safety of the Dam and risk to the environment given the uncertain level of risk.

[67] In response to CEP's submissions citing studies on the risks associated with induced seismicity, Mr. Rigbey attests that those studies date from 2010 and 2014, and no longer reflect the most up-to-date knowledge regarding the hazard posed by induced seismicity. Mr. Rigbey states that with the increased development of that knowledge, the Ministry of Natural Gas Development and/or the OGC established a

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<sup>1</sup> g = the acceleration due to Earth's gravity



five km buffer zone around BC Hydro's power facilities in which no new oil and gas tenures would be issued. However, Mr. Rigbey states that a larger exclusion zone may be warranted for water disposal activities. In that regard, he refers to reports dated March 18, 2016, and February 2017, by Dr. Gail Anderson, Professor of Earth Sciences at Western University, which indicate that based on the largest magnitude seismic event recorded in Oklahoma from water disposal versus the largest magnitude seismic event recorded in BC from hydraulic fracturing, water disposal may cause larger seismic events than those caused by hydraulic fracturing, and the area of impact for a disposal well is greater than for a hydraulic fracturing well.

[68] In response to CEP's submissions citing past statements by BC Hydro officials, including Mr. Rigbey, regarding the risks that induced seismicity may pose to its facilities, he attests that his comments were with regard to the risks associated with hydraulic fracturing, and not water disposal.

[69] Regarding the steps that BC Hydro would need to take to assess the nature and extent of damage to the Peace Canyon Dam due to a seismic event, Mr. Rigbey states that Dinosaur Lake would need to be drawn down so that the Dam and associated works could be inspected and repaired. Lowering the water level in Dinosaur Lake would require constant spilling of water from behind the Dam, and/or a shutdown of the G.M. Shrum generating station at the W.A.C. Bennett Dam upstream of the Peace Canyon Dam, depending on how low the water level needed to be.

[70] According to Mr. Sherbot's affidavit, an extended period of spilling to lower the water level in Dinosaur Lake would damage the spillway, particularly the downstream plunge pool where additional bedrock scouring or erosion may occur. A shutdown of the G.M. Shrum generating station would result in significant power loss for the Province, which could lead to short-term power outages and/or importing power from Alberta and the Pacific Northwest. Mr. Sherbot estimates that the opportunity costs associated with importing power would be \$20 million to \$190 million.

[71] Further, according to Mr. Leake's affidavit evidence, a drawdown of over 24 hours would cause adverse impacts on fish. Some fish would die from exposure to increased gas pressure in water flows, and fish would be stranded in pools and dewatered shoreline areas. Also, increased numbers of fish would become entrained in turbines and spillways. A drawdown of one to three months would increase the adverse effects on fish, as tributary access may be blocked due to lower water levels, and increased erosion would increase water turbidity.

[72] In response to some of CEP's other submissions, BC Hydro submits that the maintenance and upgrade work it plans to do on the Peace Canyon Dam does not require a drawdown of Dinosaur Lake, and it has no plans to drawdown Dinosaur Lake in the foreseeable future. Regarding the allegation of a discriminatory safety standard, BC Hydro submits that it applies equivalent risk factors to all of its dams, and it will upgrade dams to mitigate risks, including seismic risks, if possible. If BC Hydro is unable to mitigate such risks to an acceptable level, it considers other options such as purchasing properties downstream to remove people from the area of potential hazard. Regarding the alleged policy of "grandfathering" existing operations within five km of BC Hydro facilities, BC Hydro argues that no policy can

lawfully bar the OGC from exercising its statutory authority under section 49(1)(b) of the *OGAA*. Doing so would amount to an unlawful fettering of discretion.

[73] Regarding the Advisian Report, BC Hydro submits that it should be given little weight. In that regard, BC Hydro refers to Dr. Penner's 15-page memo dated July 12, 2017, which is attached to his affidavit. Dr. Penner is a professional engineer with a Ph.D. in civil engineering specializing in structural and earthquake engineering. His memo was reviewed by two other professional engineers who are part of BC Hydro's structural engineering team.

[74] In his memo, Dr. Penner explains that according to the Dam Safety Guidelines of the Canadian Dam Association, and under the *Dam Safety Regulation*, B.C. Reg. 40/2016 (a regulation under the *Water Sustainability Act*), the Peace Canyon Dam has a "very high" dam failure consequence classification, which is associated with a population of up to 100 people at risk of loss of life in the event of a dam failure.

[75] Dr. Penner states that the Canadian Dam Association recommends that such a dam must be able to withstand earthquake ground motions having an intensity with a mean annual exceedance frequency of 1:10,000, equivalent to a 1 in 10,000 year earthquake. He also explains that the Peace Canyon Dam's spillway is located on sedimentary rock, and a number of weaker bedding planes were identified under the Dam during construction. Dr. Penner states that a Spillway Performance Investigation Report prepared by BC Hydro in June 2015 found the spillway to "marginally" satisfy safety requirements for the earthquake load case, and to be "substantially deficient" for the post-earthquake load case.

[76] In addition, Dr. Penner's memo identifies numerous inaccuracies, incorrect assumptions, and omissions in the Advisian Report, including the following:

- the Advisian Report relies solely on recorded history and precedent events, and does not consider the possible impact of a future event that is larger than those observed to date;
- the Advisian Report did not consider links between injection operations and average reservoir pressure to either the likelihood of triggering an event or the size of the event, which are critical to assessing whether induced seismicity may result in damage to the Peace Canyon Dam;
- without consideration of those links, it is unclear how Advisian can conclude that it has "not identified any compelling reason for induced seismicity to result in significant damage to, or an outright failure of, the PCD [Peace Canyon Dam]."

[77] BC Hydro also submits that Dr. Penner's memo demonstrates that if an event similar to that which occurred in Oklahoma (magnitude 5.7) occurred within 5 to 10 km of the Peace Canyon Dam, it would result in a hazard equivalent to the 1:10,000 event for the Peace Canyon Dam's spillway. In his memo, Dr. Penner uses data from the magnitude 5.7 event caused by a water disposal well in Oklahoma, and assumes that a similar event could occur at the base of the Well (at a depth of 1620m) and a distance of 3.25 km from the Peace Canyon Dam. He

charts the predicted horizontal acceleration (g) at various periods (seconds) for events of magnitude 5.2, 5.7, and 6.2. At the median level of the ground motion prediction equations, the predicted spectral accelerations for all three scenarios exceeded the 1:10,000 uniform hazard spectrum at the Peace Canyon Dam for frequencies at or above the first mode of the spillway. At page 12, Dr. Penner states that "This simple deterministic hazard assessment suggests that operation of the subject disposal well could significantly increase the seismic hazard at the Peace Canyon Dam."

[78] At page 14, Dr. Penner's memo concludes as follows:

The potential for induced seismicity due to the operation of the subject disposal well imposes a new – that is, previously non-existent – hazard at PCN [Peace Canyon] dam. Given:

1. the marginal stability of PCN dam considering only natural seismic hazard;
2. that operation of the subject disposal well would increase the total seismic hazard; and
3. that uncertainty associated with the induced seismic hazard,

It is concluded that an earthquake induced by operation of the subject disposal well could cause ground motion at PCN dam of sufficient intensity to negatively affect the stability of the dam. Taking into account the unacceptable consequences of damage to the dam, an avoidance-dominated strategy to managing the induced seismic hazard at the site should be considered.

[79] Finally, regarding CEP's allegation that the Order amounts to expropriation of the Well and that the Tribunal should award damages to CEP, BC Hydro submits that the Tribunal has no authority to award damages or other compensation in consideration for an order under section 49(1)(b) of the *OGAA*, or otherwise. In particular, BC Hydro submits that section 50 of the *Administrative Tribunals Act* does not empower the Tribunal to award damages; rather, it specifies the conditions that must be met in situations where the Tribunal otherwise has the power to make orders for the payment of money, such as the power to award appeal costs under Part 6 of the *OGAA*.

#### *CEP's reply submissions*

[80] In reply, CEP submits that BC Hydro's risk assessment, and Dr. Penner's memo in particular, is based on data from Oklahoma, an area that is demonstrably different from northeastern BC, and the Advisian Report is more relevant to the present circumstances. CEP also submits that Dr. Penner's memo fails to comment on the probability that an earthquake could cause ground motion at the Peace Canyon Dam sufficient to negatively affect the spillway. In addition, CEP argues that the Advisian Report is objective and unbiased, whereas Dr. Penner is an employee of BC Hydro. CEP maintains that no conclusions should be drawn from Dr. Penner's memo.

[81] In support of its reply submissions, CEP refers to a three-page memo by Dr. Kyle Murray, who has a Ph.D. in geological engineering and is employed as a hydrogeologist with the Oklahoma Geological Survey. In his memo, Dr. Murray states that he reviewed seismicity and operational data from the Montney Trend (i.e., the Montney geological formation) in BC, compared it to Oklahoma's area of interest for seismicity, and found that the two areas have substantial differences. For example, the number of earthquakes of magnitude 3 or more occurring from January 1, 2012 to April 10, 2017 was 51 in BC's Montney Trend, versus 2,228 in Oklahoma, and the water disposal rate in BC's Montney Trend is 3.3 barrels per day per square km, versus 63.4 barrels per day per square km in Oklahoma.

[82] In his memo, Dr. Murray also advises that the two regions have different geological conditions that affect relationships between operations and seismicity. For example, he states that most water disposal in Oklahoma occurs in wells that are completed at a median depth of about 2 km, while earthquake epicentres have a median depth of about 5.5 km. Those wells are completed in the Arbuckle Group geological formation, which consists of six heterogeneous formations of fractured carbonates, shales, and sandstones that are in direct contact with basement rock. He explains that there is no hydraulic barrier for pressure to move downward from the water disposal wells towards a critically-stressed fault. Dr. Murray states that, in contrast, the disposal zone in BC appears to be far removed and hydraulically isolated from basement rock. Based on those differences, he states that "Dr. Penner's transference of the seismic hazard in Oklahoma to the Peace River area [of BC] is scientifically irresponsible and indefensible. ... An accurate seismic hazard in B.C. would have to be based on seismic history in B.C...."

#### *BC Hydro's sur-reply submissions*

[83] The Tribunal granted BC Hydro an opportunity to make a sur-reply with respect to Dr. Murray's memo, because CEP's reply contained new evidence (i.e., Dr. Murray's memo).

[84] In sur-reply, BC Hydro submits that Dr. Murray's memo should be given no weight. BC Hydro argues that, although Dr. Murray is held out as an experienced hydrogeologist, there is no indication that he has expertise in assessing or managing risks to public structures, or dam safety issues, or has knowledge of the unique circumstances of the Peace River Dam. BC Hydro also submits that Dr. Murray's memo does not state which documents he reviewed before reaching his conclusions, does not contain a scientifically rigorous analysis or explanation for his conclusions, and fails to address Dr. Penner's specific criticisms of the Advisian Report.

[85] In addition, BC Hydro submits that Dr. Murray's memo only challenges one aspect of Dr. Penner's memo; namely, its alleged reliance on the magnitude 5.7 event in Oklahoma, yet Dr. Murray does not directly challenge the conclusions and considerations on page 14 of Dr. Penner's memo. Moreover, BC Hydro submits that Dr. Penner's conclusions are not based on "transference" of Oklahoma's seismic risk to northeastern BC, nor does he attempt to compare the geological setting or seismic hazard in Oklahoma to that in northeastern BC; rather, Dr. Penner's conclusions are based on the uncertainty regarding the induced seismic hazard

posed by the operation of the Well. Moreover, BC Hydro maintains that Dr. Murray's memo does not explain or cite studies in support of his assertion that the depth to, and hydraulic isolation of, basement rock is a relevant factor, and he does not say that the presence of basement rock is a pre-condition to significant seismic events. In conclusion, BC Hydro notes that Dr. Murray's memo cautions that induced "seismicity is a very complicated topic that is not fully understood, even by those of us that are fully invested in data collection ...." BC Hydro submits that this challenge in characterizing the risk of induced seismicity with respect to the Peace Canyon Dam actually supports the Order.

### *The Tribunal's Findings*

[86] Regarding the burden of proof in an appeal, the Tribunal has previously held that the appellant has the burden of proving, on a balance of probabilities, the facts that the appellant relies on to support its arguments: *Bell v. Oil and Gas Commission*, Decision No. 2012-OGA-003(b), December 12, 2013, at paras. 44 – 46, 53, and 75. This burden of proof is not unique to appellants; rather, it applies equally to all parties in an appeal. Each party has the burden of proving, on a balance of probabilities, the facts that it relies on to support its arguments.

[87] Although CEP argues that it is unfair for it to have the burden of establishing that the Order should not have been issued and is not necessary to protect public safety or the environment, because the OGC issued the Order based on information from BC Hydro without giving CEP an opportunity to be heard, the Tribunal finds that there is no reason to apply a different evidentiary burden to CEP as compared to other appellants or any other party that appears before the Tribunal. Although CEP argues that the circumstances that led to the Order were unfair, the Tribunal has already held that the appeal process has cured any procedural flaws in the process that led to the Order being issued. CEP has now had a full opportunity to present evidence and arguments, respond to the BC Hydro's evidence and arguments, and respond to the OGC's reasons for issuing the Order.

[88] The Tribunal has considered CEP's argument that the burden of proof should apply to the likelihood that the Well's operations will actually affect the Peace Canyon Dam with respect to public safety and the environment, as opposed to the risk that the Well's operations may affect the Peace Canyon Dam with respect to public safety and the environment. The Tribunal finds that the language in section 49(1)(b)(i), which is discussed below, expressly authorizes the OGC to issue an order under that section "to mitigate a risk to public safety" or "to protect the environment" [underlining added]. This language provides that the focus of such orders is not on the likelihood of actual harm to public safety or the environment; rather, the focus is on the proactive protection of the environment and reducing risks to public safety. As such, in assessing the merits of the Order, it is relevant and appropriate to consider whether the Order was necessary to mitigate a "risk" to public safety or to "protect" the environment due to the possibility that the Well's operations could cause an induced seismic event that could affect the Peace Canyon Dam.

[89] Regarding the statutory authority for the Order, the Order itself states that it was issued under section 49(1)(b) of the *OGAA*, which is re-stated for greater certainty and provides as follows:

49 (1) An official may, in writing, issue to a person carrying out an oil and gas activity or a related activity an order under this section with respect to those activities or any of the person's obligations under the Act or the regulations or the person's permit or authorization, if any, if, in the opinion of the official,

...

(b) the order is necessary

(i) to mitigate a risk to public safety,

(ii) to protect the environment, or

(iii) to promote the conservation of petroleum and natural gas resources.

[underlining added]

[90] As set out in the Background to this decision, the Order states several reasons why it was issued. Among other things, the Order states that "Increased volumes of disposal, including disposal operations at the subject Well, increases the risk of seismic events where faults exist." It also states:

There is a risk of an induced event sufficient to generate the peak ground accelerations necessary to cause damage to the Peace Canyon dam. This level of ground motion has already been recorded in association with induced seismicity in other areas of north east BC. If such an event were to occur the consequences would be severe.

[91] The Order states that the official who issued it was of the opinion that disposal activities must be suspended "pending a review of additional technical information", and that this action was "necessary to mitigate a risk to public safety and to protect the environment."

[92] Based on the language in the Order, the Tribunal finds that the OGC's reasons for issuing the Order were "to mitigate a risk to public safety" and "to protect the environment" pursuant to subsections 49(1)(b)(i) and (ii), based on information from BC Hydro regarding the risk that a seismic event induced by disposal activities at the Well could damage the Peace Canyon Dam, pending the OGC's technical review of the matter. The evidence shows that the particular risks that induced seismicity may pose in relation to the Peace Canyon Dam were not known to the OGC before mid-March 2017, and the OGC needed some time to collect more technical information in order to better assess the risk before it came to any final conclusions regarding the risk posed by the Well's operations. In the face of new information that the Peace Canyon Dam could be de-stabilized by an induced seismic event caused by disposal operations at the Well, the OGC quickly decided to take action to mitigate that risk by suspending disposal operations at the Well.

[93] In assessing whether the Order should have been issued, it is important to consider those particular circumstances, and to bear in mind the temporary nature of the Order. The Order does not cancel CEP's authorization to operate the Well; rather, it mitigates a newly discovered risk by temporarily suspending the oil and gas activity that could trigger an event that would pose a risk to public safety and the environment, pending the results of the OGC's technical review. In issuing the Order, the OGC sought to mitigate that potential risk while the OGC gathered more information in order to better understand and assess the risk.

[94] In this sense, the Tribunal finds that the Order reflects a cautious approach by the OGC to mitigating a newly identified, but poorly understood, risk. The Order is preliminary, proactive, and temporary in nature. The Order is not, and need not be, based on final conclusions about the seismic risk posed by the Well's operations. The fact that section 49 of the *OGAA* does not require the OGC to offer a permit holder an opportunity to be heard before suspending or cancelling a permit shows a legislative intent to provide the OGC with the discretion to act quickly and proactively in response to a risk to public safety and/or the environment. If the OGC's technical review, and the opportunity to be heard that it offered CEP, results in the OGC deciding to cancel CEP's Well permit under section 26 of the *OGAA*, that is a separate matter from the temporary suspension of the permit under section 49(1)(b), and would be an appealable decision on its own accord.

[95] Turning to the merits of the Order, the Tribunal finds that the information before the OGC when the Order was issued indicated that there was a real, but poorly understood, risk to public safety and the environment arising from the potential for disposal activities at the Well to cause an induced seismic event that could de-stabilize the Peace Canyon Dam. Moreover, based on the evidence provided to the Tribunal during the appeal process, including evidence that was not before the OGC, the Tribunal finds that there is a low likelihood that disposal activities at the Well will cause an induced seismic event that could de-stabilize the Peace Canyon Dam, but the likelihood is still poorly understood. However, it is clear that activities such as underground water disposal and hydraulic fracking do increase the likelihood of induced seismic events occurring. The 2017 report by Dr. Atkinson explains at pages 1 to 3 that there remains a degree of uncertainty regarding the ability to predict an induced seismic event that would damage infrastructure:

Felt earthquakes are being triggered in western Alberta and eastern B.C. by hydraulic fracturing and wastewater disposal. No significant damage has occurred to date in Canada from such induced earthquakes. However, the increased rate of seismicity in some locations, and the potential for strong shaking from very shallow events, poses an increased hazard to critical infrastructure such as major dams – particularly for older facilities in areas of previously-low seismicity. The likelihood of damage depends on numerous factors including the likelihood of induced events, their statistical characteristics, strength of shaking, and the seismic strength of the infrastructure. ...

... the basic mechanism of induced seismicity is widely agreed-upon: it is caused by a change in pore fluid pressure and/or a change in the state of

stress, which may cause reactivation of existing faults or fractures. However, currently we cannot predict the likelihood or magnitude of such events from specific planned operations (in a deterministic sense) because we do not have enough data on the complex natural rock systems, nor do we have validated predictive models.

[underlining added]

[96] Regarding the threshold at which an induced seismic event could damage infrastructure, the Advisian Report states at page 3 that the results of 2016 research on induced seismicity in northeast BC reveals that a peak ground velocity of 5 cm/sec would be expected for a magnitude 4 event at a distance of 1 kilometre from the source. The Tribunal notes that a magnitude 4 event would be lower in strength than the magnitude 5.7 event associated with water disposal in Oklahoma, and an induced seismic event of magnitude 4.6 has been recorded in association with fracking in northeastern BC. The Tribunal also notes that although the Well is located 3.3 kilometres away from the Peace Canyon Dam, the water injected underground at the Well may extend outwards horizontally from the Well. The Advisian Report concludes by stating that “The potential damage threshold is considered to be in the range of 5-10 cm/sec. [peak ground velocity]”, and recommending that particle velocities be monitored within 5 kilometres of the Peace Canyon Dam. Similarly, the 2016 report by Dr. Atkinson also recommends a 5-kilometre buffer zone around critical infrastructure, based on the damage threshold being in the range of 5 to 10 cm/sec for peak ground velocity.

[97] Regarding the maximum magnitude of induced events that may occur in northeastern BC, Dr. Atkinson’s 2017 report explains that there is also a degree of uncertainty, but induced seismic events over magnitude 4 have occurred in northeastern BC and their likelihood increases as triggering activity increases. She also explains that for water disposal operations, the maximum magnitude may not be limited by the cumulative volume of fluid injected into the area.

[98] Similarly, the Tribunal finds that Dr. Penner’s conclusions are based on the risks and uncertainty regarding the induced seismic hazard posed by the Well’s disposal operations. He concludes that “an earthquake induced by operation of the subject disposal well could cause ground motion at PCN [Peace Canyon] dam of sufficient intensity to negatively affect the stability of the dam” [underlining added]. He recommends an “avoidance-dominated strategy to managing the induced seismic hazard at the site”, taking into account the consequences of damage to the Dam.

[99] The Tribunal has reviewed Dr. Murray’s memo and his expertise, and notes that his experience is in geological engineering and hydrogeology in the Oklahoma area, and not in northeastern BC. In his memo, Dr. Murray acknowledges that the two regions have different geological conditions that affect relationships between operations and seismicity. The Tribunal finds that his memo is of little assistance, as he does not have expertise in the effects of induced seismicity on infrastructure, or the geology and seismicity of northeastern BC. Moreover, Dr. Murray’s memo does not cite studies in support of his assertion that the depth to, and hydraulic isolation of, basement rock is a relevant factor in induced seismic events.



[100] The Tribunal finds that if water disposal activities at the Well triggered an induced seismic event that was strong enough to adversely affect the Peace Canyon Dam, such an event would not cause catastrophic failure of the Dam, but it may cause movement or slippage of the Dam, or parts of the Dam, which would reduce the Dam's ability to withstand further seismic events, and would require a drawdown of Dinosaur Lake. According to BC Hydro's submissions, such an event may result in the Peace Canyon Dam sliding a few millimetres to a few centimetres, which could cause excessive leakage, damage and/or gate problems. If gallery pumping capability was lost, the water level in the galleries would rise after a couple of days to a level that would reduce the seismic withstand of the Dam to 0.07g, which means that the Dam's safety factor would be reduced. In other words, a series of events following an induced seismic event caused by water disposal may reduce the Dam's ability to withstand a future seismic event of 0.07g, which is lower than the original seismic design criteria when the Dam was built for peak ground acceleration of 0.1g. To prevent that from happening, BC Hydro would need to draw down Dinosaur Lake to inspect and repair any damage to the Dam's structures. Although CEP claims that BC Hydro plans to draw down Dinosaur Lake in the coming years to do planned maintenance, BC Hydro has provided evidence that this is not so.

[101] Based on the evidence, the Tribunal also finds that lowering the water level in Dinosaur Lake would require constant spilling of water from behind the Dam, and/or a shutdown of the G.M. Shrum generating station at the W.A.C. Bennett Dam upstream, depending on how low the water level would need to be. The Tribunal accepts Mr. Sherbot's evidence that an extended period of spilling would damage the spillway, particularly the downstream plunge pool where additional bedrock scouring or erosion may occur. A shutdown of the G.M. Shrum generating station upstream of Dinosaur Lake could lead to short-term power outages and/or importing power from Alberta and the Pacific Northwest. Mr. Sherbot estimates that the costs associated with importing power would be \$20 million to \$190 million.

[102] Further, the Tribunal accepts Mr. Leake's evidence that a drawdown of over 24 hours would cause adverse impacts on fish. Some fish would die from exposure to increased gas pressure in water flows, and fish would be stranded in pools and dewatered shoreline areas. Increased numbers of fish would become entrained in turbines and spillways. An extended drawdown of one to three months would increase the harm to fish, as tributary access may be blocked due to lower water levels, and increased erosion would increase water turbidity.

[103] The Tribunal has also considered that if an initial induced seismic event large enough to de-stabilize the Dam was followed by a further induced seismic event, while the Dam's seismic withstand level was compromised, the consequences could be even more serious. In that regard, the Tribunal notes that Dr. Penner's memo explains that the Peace Canyon Dam has a "very high" dam failure consequence classification according to the Dam Safety Guidelines of the Canadian Dam Association and under the *Dam Safety Regulation*, which is associated with a population of up to 100 people at risk of loss of life in the event of a dam failure. Under Schedule 1 of the *Dam Safety Regulation*, this classification also corresponds to:

- significant loss or deterioration of
  - (a) critical fisheries habitat or critical wildlife habitat,
  - (b) rare or endangered species,
  - (c) unique landscapes, or
  - (d) sites having significant cultural value, and restoration or compensation in kind is possible but impractical
- very high economic losses affecting important infrastructure, public transportation or services or commercial facilities, or some destruction of or some severe damage to residential areas.

[104] Given the significant consequences in terms of the risk to public safety and the potential for harm to the environment if disposal activities at the Well triggered a seismic event that adversely affected the Dam, the Tribunal finds that it was prudent to suspend disposal operations at the Well to mitigate those risks, until the OGC could gather more information and better assess the nature and level of the risk posed by disposal activities at the Well.

[105] In addition, although CEP claims that BC Hydro has publicly stated that fracking poses no threat to BC Hydro's dams, the Tribunal finds that BC Hydro has publicly stated that it has concerns about underground water disposal within close proximity to its facilities. For example, BC Hydro's March 27, 2017 media statement states that "Disposal wells have been known to cause stronger seismic events over a larger area than those caused by fracking, so a 5-kilometre buffer [which was set by the OGC for fracking operations] will not be sufficient for these projects" [underlining added].

[106] CEP submits that the Order was issued only three months after the OGC issued a public statement that it had reviewed all disposal wells in the province to ensure their ongoing integrity, and that the Order was issued in violation of an OGC policy of "grandfathering" existing operations within five km of BC Hydro's facilities. The Tribunal finds that any public statements or policies that the OGC may have made did not limit or prevent it from exercising its statutory authority under section 49 of the *OGAA*.

[107] Finally, CEP argues that the Order amounts to an unfair expropriation of the Well, and that the Tribunal should award damages to CEP. The Tribunal finds that it has no authority to award damages or other compensation arising from a decision of the OGC in an appeal under the *OGAA*. Unlike the BC Supreme Court, the Tribunal has no inherent powers or authority. As an administrative tribunal, the Tribunal only has the powers that the legislature has bestowed upon it under its enabling legislation. Under section 47 of the *Administrative Tribunals Act*, the Tribunal has the power to order costs in connection with an appeal, but not damages or compensation for financial losses. Section 50 of the *Administrative Tribunals Act* does not empower the Tribunal to award damages or compensation. Rather, it specifies the information that must be included in a decision if the Tribunal makes an award of costs as part of its decision.

**DECISION**

[108] In making this decision, the Tribunal has considered all of the relevant documents and evidence, whether or not specifically reiterated herein.

[109] For the reasons provided above, the appeal is dismissed.

A handwritten signature in black ink, appearing to read "C. A. Andison". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Alan Andison, Chair  
Oil and Gas Appeal Tribunal  
August 21, 2017