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Mr. Richard Slocomb , M.A.Sc., P.Eng.

Vice President, Engineering

BC Oil and Gas Commission

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*Delivery: email / courier*

Dear Mr. Slocomb,

**Re: Well Permit WA#22031**  
**Injection Well near Peace Canyon Dam**

Further to the meetings held on December 13, 2017 and January 15, 2018 between the BC Oil and Gas Commission (OGC) and BC Hydro (BCH), this letter provides an update on the action items as documented by the OGC in an email from you to Mr. Stephen Rigbey dated December 15, 2017. This letter is without prejudice to BC Hydro's views regarding the resumption of injection activities at the subject well as expressed in the letter dated January 10, 2018 from counsel to BC Hydro (Jeff Christian, Lawson Lundell LLP).

For your information, Mr. Rigbey has since retired from BC Hydro and I am honoured to have been named as his successor as BC Hydro's Director, Dam Safety. I look forward to continuing the productive working relationship that has been established between the OGC and BC Hydro—in particular between you and Stephen—and I hope that this letter serves to further that relationship.

### **Action Items Update**

As previously noted, the OGC and BC Hydro concluded the aforementioned meetings by agreeing on a number of action items to be performed by one or both the parties. These action items were summarized in an email from you to Mr. Stephen Rigbey dated December 15, 2017. BC Hydro's update on its activities relating to these action items now follows.

**Action Item 1:** Stephen Rigbey [BC Hydro] to provide water level safety factor rather than current/proposed factor of safety, as water level more definitive.

BC Hydro has now selected threshold piezometric levels under the Peace Canyon Dam that, if surpassed, will trigger BC Hydro to request immediate cessation of all injection activities while the situation is assessed. Piezometric levels could rise for a number of reasons, but regardless of the reason, dam stability becomes a growing concern when the levels on particular bedding planes under particular blocks of the dam reach 1.5m above the level of the drainage gallery. For your records, these threshold stability alarm levels have been established as follows:

Dam Block	Piezometric readings greater than or equal to 454.9m (1.5m above gallery el. 453.4 m)
S2	88-12P1
S3,S4	Average of P29-1A and P30-1A OR Average pf P29-2 and P30-2
S5,S6	Average of 88-3P2, P32-1A, and P33-1A OR Average of 88-3P1,P32-2, and P33-2

It may be necessary to update this instrument list over time as the instruments age and require replacement.

In addition to using the above piezometric levels as triggers to request immediate suspension of well operation, we will also be using the following three indicators:

- Any interruption to both main and backup dam drainage pump operations;
- Any event that requires BC Hydro to declare a Dam Safety Alert; and
- Accelerometer readings that exceed 0.01g, as measured by BC Hydro’s strong motion accelerometer in rock at the site. There has never been any event measured in this particular instrument, so that any measurement would be indicative of a ground motion greater than any background noise, and would be evidence of a “precursor event” such as the OGC believes would occur prior to any large, potentially damaging event.

**Action Item 2:** OGC and BCH to consider ground motion protocols.

A brief summary of the discussions between Dr. Kofi Addo of BC Hydro and Mr. Stuart Venables of the OGC on this topic since the December meeting follows:

- The hazard from induced earthquakes is better characterized by ground motion rather than by magnitude as is currently the case.

- BC Hydro will undertake a three-year initiative to come up with one or two ground motion models suitable for estimating ground motions from induced earthquakes in northeastern BC. This initiative is currently in progress and in the data collection stage.
- There is a need for BC Hydro and OGC executive and senior management support in the quest to obtain available earthquake recordings from the oil and gas operators. Acquisition of these records is critical to the success of the initiative.
- The format for communicating earthquake data between all parties (BC Hydro, OGC and operators) will be the Standard for the Exchange of Earthquake Data (SEED).

**Action Item 3:** OGC and BCH to review feasibility of adding seismograph stations from BC Hydro dams to PGC [Pacific Geoscience Centre] network:

OGC reports that it met with PGC on December 14, 2017 and confirmed that if BC Hydro's instruments can be equipped with telemetry, then they can be streamed to PGC for analysis.

There has been no action on this as yet from BC Hydro's end. I will initiate contact between our lead technologist in the Peace Region, Mr. James Cryderman, our seismic hazard expert, D. Kofi Addo, and the OGC's Mr. Venables in the near future.

**Action Item 4:** OGC to consider mechanism and output to make disposal reviews available to BCH in timely manner.

We would appreciate an update of OGC's considerations on this item. We had questioned why, as equipment is to be capable of real-time monitoring, notifications of any events to the OGC are only to be on a monthly interval. In particular, we noted on page 7 of the OGC decision the following statement:

*"In British Columbia, 100 percent of disposal induced events have exhibited smaller precursor events prior to any Magnitude 3+ event and have not demonstrated repeated events in a short (less than six hour) time span."*

In the context of the referenced six hour time span between repeat—presumably precursor and larger—events, we had questioned how reporting on a monthly basis will provide timely information to the OGC as to whether injection should be suspended prior to a potentially damaging event. Further, we wish to know at what level of event (a potential precursor) injection operations would be stopped.

### **Conditions for Operation of CEP Well**

I'd like now to turn our attention to the December 4, 2017 letter from Ms. Mayka Kennedy, P.Eng., Executive Vice President and Chief Engineer for OGC to Canada Energy Partners Inc. This letter communicated the OGC's decision not to cancel Well Permit WA#22031 subject to a number of conditions being imposed on the injection well operations, as attached to that letter.

In regard to these conditions, we reiterate our comments and requests from the December 13 meeting as follows:

- BC Hydro does not have the technical expertise to comment on conditions a) through m).
- Regarding conditions n) and o) regarding installation of monitoring equipment, we noted that this equipment should be located on or in bedrock.
- Further to the 17 conditions, BC Hydro requested that the injection well operator install an additional instrument to monitor ground motions of the bedrock near the dam, and to inform both BC Hydro and the OGC immediately if a ground motion greater than background is recorded.

I would greatly appreciate any update that the OGC can provide regarding the 2<sup>nd</sup> and comment 3<sup>rd</sup> bulleted items, above.

Again, I look forward to continuing the productive working relationship that has been established between the OGC and BC Hydro. I will certainly update you on any progress that BC Hydro makes in the action items discussed within this letter and I am confident that I can rely on you for the same. I look forward to meeting you personally at some point in the not very distant future. If you have any questions or require additional information at any time, please do not hesitate to contact me.

Yours very truly,  
BC HYDRO & POWER AUTHORITY  
Per:

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cc: Mr. Stuart Venables, P.Geo.  
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