
From: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs [CEAA\ACEE]
Sent: June 20, 2017 2:03 PM
To: Natalie Gallimore<email address removed>
Subject: RE: OPG's Deep Geologic Repository (DGP) - comments on the Deep Geologic Repository Project for Low and Intermediate Level Radioactive Waste

Dear Ms. Gallimore,

Thank you for your correspondence of June 15, 2017.

In completing its review, the Joint Review Panel was satisfied with the level of detail regarding hydrocarbon extraction and risks related to fracking by the proponent, participants, and expert federal authorities. The Joint Review Panel also issued the recommendations noted previously to manage potential residual risks. Based on the work conducted by the Joint Review Panel and its recommendations, the Agency would not require further investigation on this topic as part of the environmental assessment for the Project.

We note that additional regulatory requirements apply to the proposed Project. In order to obtain more information on precise activities required to address the Joint Review Panel's recommendations and beyond, we encourage you to participate in the licensing process that would be required should the Project proceed. In that case, a licence for preparation and construction would be completed by the Canadian Nuclear Safety Commission. A licence to operate would later be required, prior to placement of any waste, at which time a question such as yours would further inform the process during public hearings. For specific licensing questions, you may contact Ms. Karina Lange at the Wastes and Decommissioning Division of the Canadian Nuclear Safety Commission (karina.lange@canada.ca).

You may also contact the proponent through dgrinfo@opg.com; as they may have more detail pertaining to this issue since it was last considered during the Panel review process.

Sincerely,

Deep Geologic Repository Project
Canadian Environmental Assessment Agency / Government of Canada
160 Elgin Street, 22nd Floor/ Ottawa/ ON
CEAA.DGRProject-Projet.DGR.ACEE@ceaa-acee.gc.ca

From: Natalie Gallimore <email address removed>
Sent: June 15, 2017 5:22 PM
To: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]
Subject: RE: OPG's Deep Geologic Repository (DGP) - comments on the Deep Geologic Repository Project for Low and Intermediate Level Radioactive Waste

Thank you for your report and the September 2013 transcripts from public consultations. I found that the NR Can written submission (DEAR #1256, page 15-16) does not address fracking even though other scenarios were addressed including contemporary earthquake shaking hazard, longer-term seismic hazard, earthquake-generated tsunami hazard, and faulting hazard: no fracking.

From the September 18, 2013 transcript, as you pointed out there is a pertinent on page 90,

“MEMBER ARCHIBALD: Sorry, there 25 were conclusions made in your slides concerning hydrocarbon resource potential that stated firstly, commercial viable deposits do not exist; secondly, potential is low and; thirdly, there is an absence of hydrocarbon accumulation. These were Slide 15, Slide 8, just for identification. There is considerable variability in your conclusions for potential hydrocarbon existence and I was wondering if you would care to close out on some of these?”

MR. JENSEN: Mark Jensen, for the record. We looked at natural resource potential for petroleum hydrocarbons. We considered the results of the site-specific investigations; one, that indicated that some of the lowest permeability rocks measured in the world existed at the site and only trace amounts of oil existed, certainly within areas of this rock and 19 fractures are porous -- portions of the rock. And it appeared that that was created in situ and because of the permeabilities and the low amount of hydrocarbon observed we established at the site that the potential was low. Certainly, historical oil and gas drilling indicates that oil deposits or oil 1 reservoirs are not available within the region generally. The three that do exist that are beyond 40 kilometres for the site are gas related. So we assumed that based on historic drilling and what we observed at the site that the potential was low. For shale gas deposits, clearly, there's only one horizon. It's less than a metre thick where organic concentrations are as high as 1 percent, perhaps 2, in a zone that's about 10 centimetres thick. Given the observations of the low organic content, the lack of burial history that would be consistent with the formation of shale gas and the lack of natural hydraulic fracturing as discussed by Terry Engelder at Penn State in the analog report that we submitted, we suggest that shale gas potential, certainly within this area, the Michigan Basin is low.”

The above is for conventional resource plays however because starting on page 95 in the same transcript OPG is very clear that is has NOT done an evaluation for oil shale. It is oil shale exploration and extraction that requires fracking, not conventional oil as per the above response from Mr. Jensen. Please read the following exchange which is most critical to my questions and concerns.

THE CHAIRPERSON: Dr. Muecke?

MEMBER MUECKE: I'd like to follow up a little bit on Dr. Archibald's question. One of the hottest plays in the hydrocarbon business these days is shale oil, and so my question is, have you evaluated or are you planning to evaluate the potential of the site for shale oil?

MR. JENSEN: Mark Jensen, for the record. We have not done an evaluation for shale oil. The evaluations were done for shale gas. Certainly I think shale oil has been known to occur near surface where it might be more economically viable. Certainly the formations that would be potentially useful here, the Collingwood formation, is only seven metres thick and at a depth of 650 metres.

MEMBER MUECKE: You're probably aware that fracking has been used for shale oil these days, and so even fairly thin horizons can provide a good play. And in the future, this might be more so.

MR. JENSEN: Mark Jensen, for the record. I'm aware of shale gas and fracking used to release the shale gas. I think our position would be that, given the observations at the site, the organic content, lack of hydraulic fracturing, the thermochronology of the site, that shale gas and fracking in this particular area would not be commercially viable. Certainly the target horizons with it -- typically, shale gas

deposits require a minimum of six percent total organic content, and certainly the sediments we see have one or less. And the horizons are extremely thin, probably less than a metre thick.

MEMBER MUECKE: **I was actually referring to shale oil again.** Are there **any plans of investigating that and providing some data on it?**

MR. JENSEN: **Currently there are no plans to evaluate shale oil at the Bruce nuclear site in the Collingwood formation.**

Further to that, from the September 19 transcript that you provide starting on page 228,

THE CHAIRPERSON: Mr. Bourgeois?

MR. BOURGEOIS: Thank you. My question concerns the New Madrid fault line and all the fracking that has occurred in the oil fracking and gas fracking in the countryside north of it. And I wondered whether -- if that New Madrid fault line should produce a major earthquake could it lead to either uplifting in the Grenville zone of the Michigan Basin or even orogenic activity in that area? Thank you.

DR. ADAMS: John Adams, for the record. I'll tackle that question in a few parts. The New Madrid seismic zone is a region in the centre of the U.S. basically close to Memphis, Tennessee that had a couple of -- sorry, three Magnitude 7.5 to 8 earthquakes in 1811-1812. There has been, in some cases, a suggestion that those earthquakes lie on the trend that would join up with the St. Lawrence River. We know in a tectonic sense that the faults along the St. Lawrence River take a dogleg down towards New York City, pass underneath the Appalachian Mountains and that the New Madrid zone is actually an arm off that, so that's the relationship to those. **You asked a question about fracking, which is a very hot topic in the media. And there's no doubt that oil operations have been causing small earthquakes in the eastern part of the United States.** There are two aspects to that. One is the fracking itself, which can cause small earthquakes, and the other is fluid disposal through pumping waters into the basal sandstones, usually, which cause larger earthquakes. **The cluster of earthquakes on the south shore of Lake Erie may have an origin a bit like that.** As for the relevance to the Bruce DGR, I don't -- this sort of comes back to institutional concerns. **If no one is going to be disposing of large volumes of fluid close to the DGR, this is not a problem. If human-related activity which could cause seismic activity close to the DGR is an issue, then it would need to be addressed.** Thank you.

THE CHAIRPERSON: Thank you, Dr. Adams.

In summary from the above provided September 2013 transcripts:

- Oil shale potential in SW Ontario was not researched nor was it investigated at the DGR site. Note that in addition to the increased risk associated with fracking to oil shale, oil shale has different thermal responses that effect permeability and the radioactive waste will generate heat which the oil shale cap rock must cope with and not react by becoming more permeable.
- Fracking was not investigated therefore a 'no-fracking' perimeter [which must include Michigan] was not established around the DGR to prevent the known and acknowledged fracking-induced earthquakes.

This is significant. In science ONE CAN NOT EXCLUDE EVIDENCE because one may not like the results. DGR's are first and foremost scientific investigations – the geology must be correct, it must come first – and the engineering and public acceptance must follow. Oil shale has been excluded from the investigation, as such, so has fracking and fracking induced-earthquakes. It is questions from the public during September 2013 when this was brought up.

OPG's March 2011 report Geosynthesis written by the Canadian Nuclear Waste Organization <http://www.opg.com/generating-power/nuclear/nuclear-waste-management/Deep-Geologic-Repository/Documents/Submission/25.Geosynthesis.pdf> , on page viii, states:

“Natural Resource Potential is Low: commercially viable oil and gas reserves are not present

- **No commercial oil hydrocarbon accumulations were encountered during site characterization.** No structural, lithological, chemical or hydrological evidence suggests that the Bruce nuclear site is proximal to an ancient HTD reservoir system.
- *The results of petroleum well drilling, the coring and testing of the deep boreholes at the Bruce nuclear site coupled with knowledge of the geologic setting strongly suggest that viable commercial oil and gas reserves do not exist within 40 km of the Bruce nuclear site.*
- **An average total organic carbon content of the Upper Ordovician shales of less than 1.0%, the recognition of low thermal maturity** throughout the regional study, and the absence of natural gas shows during drilling of the DGR boreholes argues against the likelihood of commercial accumulations of either thermogenic or biogenic shale gas beneath the Bruce nuclear site.
- *Lateral traceability between the Bruce nuclear site boreholes and other proximal dry wells (e.g., Union Gas #1 and Texaco #6) demonstrates that locally around the Bruce nuclear site (~7 km radius), no pockets of oil or gas hydrocarbon are likely to exist.*
- *A transition from fresh to saline groundwater is recorded through the shallow and intermediate hydrogeological systems with saline groundwater dominating below depths of ≈200 mBGS. The porewater at the repository depth (680 mBGS) is not potable (TDS > 200 g/L) and the carbonate bedrock permeability is extremely low (hydraulic conductivities < 10-14 m/s). This combination of extremely high salinities and low hydraulic conductivities at the proposed repository depth would discourage deep drilling for groundwater resources.*
- *No commercially exploitable base metal accumulations were encountered during site characterization activities.*
- *The Salina salt does not represent a commercial resource because it has been dissolved and removed beneath the Bruce nuclear site through natural processes in the Paleozoic.”*

Firstly, it is acknowledged by OPG in the September 18, 2013 transcript that the above statement is for traditional gas plays, not for oil shale which has more potential in SW Ontario.

Furthermore, the use of the word “average” and the claim of ‘low thermal maturity’ in the above report are important because of findings in the March 2011 Intera report entitled Descriptive Geosphere Site Model.

http://www.ceaa.gc.ca/050/documents_staticpost/17520/49820/site_model.pdf

From Intera's hydrocarbon section, 3.7.4.2, which begins on Page 45,

“The observations of hydrocarbon occurrence made in [boreholes] DGR-1 and DGR-2, which were corroborated in DGR-3 to DGR-6, identified the need for a Phase 2A program to examine the organic geochemistry of the Ordovician shales (see TR-08-29) that form the caprock above the proposed

repository. This work included studies of clay mineralogy (see Section 3.7.1.1) and the **testing of 19 DGR-3 and DGR-4 cores for total organic carbon (TOC) and by Rock-Eval pyrolysis**, a standard test method to determine the basic organic geochemical parameters that characterize the thermal maturity of the sedimentary organic carbon or kerogen within the shales.”

“The average TOC values for the Ordovician shales increase with depth from 0.11% in the Queenston, to 0.25% in the Georgian Bay to **0.90% in the Blue Mountain, and up to 2.5% in the Collingwood Member of the Cobourg Formation** (Figure 3.15). **The degree of thermal maturity of the kerogen correlates with this TOC trend.** Figure 3.17 indicates that the **peak pyrolysis temperatures at which the kerogen produces hydrocarbon gas – Tmax – increase with depth through the shales towards the lower Blue Mountain Formation and the Collingwood Member of the Cobourg Formation.**”

Additionally from the March 2011 Cap Rock study by Dr. Terry Engelder, http://www.opg.com/generating-power/nuclear/nuclear-waste-management/Deep-Geologic-Repository/Documents/GSR/4.1.13_Analogue-Study-of-Shale-Cap-Rock-Barrier-Integrity.pdf , page 51,

“Regionally, the Collingwood Member contains organic matter with up to 11% TOC (Armstrong and Carter 2010) and has likely sourced oils which are reservoired in Cambrian and Ordovician traps. **Barker (1984) found that this unit contains 1-10% TOC** with the upper 2-10 m hosting the richest yields, this is the portion thought to have been eroded from the Bruce nuclear site. TOC is thought to generally increase northward based on samples from the Georgian Bay region consistently yielding higher values than those from the Toronto area (e.g., Obermajer et al. 1999). The overlying lower part of the **Blue Mountain yields a TOC content of 1-5%** (Barker 1984). “

According to the American Association of Petroleum Geologists, www.aapg.org, the Identified quantities of TOC, reiterated within Dr. Engelder’s Cap Rock study, make both the lower Blue Mountain and Collingwood members ‘very good to excellent’ oil shales for fracking.

Guidelines for assessing richness

The table below gives guidelines for assessing the richness of source rock intervals.

Generation potential	Wt % TOC, shales	Wt % TOC, carbonates
Poor	0.0-0.5	0.0-0.2
Fair	0.5-1.0	0.2-0.5
Good	1.0-2.0	0.5-1.0
Very Good	2.0-5.0	1.0-2.0

Excellent	> 5.0	> 2.0
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AAPG, [http://wiki.aapg.org/Total_organic_carbon_\(TOC\)](http://wiki.aapg.org/Total_organic_carbon_(TOC))

But we know from OPG's admission within the September 18, 2013 transcript that oil shale was not assessed either on the DGR property or in the greater-vicinity. Since the hydrocarbons are within oil shale, they would be extracted by fracking, which could and would induce manmade earthquakes in the DGR region. This is a risk and should have been assessed when oil shale was assessed. If one has two possible sources of hydrocarbons -- conventional gas and unconventional/oil shale -- how can one, how can OPG, only research and risk assess for one-half of the equation??

An inquiry that discriminates against evidence runs a very high-risk of producing a falsehood: an action like this is counter to the principals of scientific inquiry. All "truths" in science are subject to reconsideration based upon 'new' evidence. There should be no consideration of finality; especially with something as important as a DGR.

Yet pages 90 & 91 of the Cap Rock study discount the risk of reported hydrocarbons in the Task summaries and do read as 'final'.

"Task III: Investigate the occurrence of shale gas within the Michigan and Appalachian basins to constrain the potential for commercial shale gas within the Ordovician Shales in the Bruce area of Ontario.

The likelihood of commercial shale gas at the Bruce nuclear site is low for two reasons. First, the TOC peaks in the darkest shale at ~2.5% and in general is < 1% at the Bruce nuclear site. When this observation is combined with the low thermal maturity around the Bruce Peninsula, there is little chance of encountering petroleum or natural gas that is generated in situ. There is, however, some small chance that migration has allowed small accumulations in the vicinity of the Bruce Peninsula. Industry-related drilling and the Bruce nuclear site boreholes have shown there is no evidence for commercial occurrences of gas at the Bruce nuclear site.

Task IV: Utilize data from the DGR drilling program, which includes porosity and permeability data, TOC measurements, pore pressure data and pore fluid compositions for assessment of Ordovician shales in the RSA as a potential commercial source of unconventional hydrocarbons.

*Each of these source rock characteristics (porosity data, TOC measurements, pore pressure data and pore fluid compositions) were examined in detail in this report. The combination of these source rock characteristics **will not yield a rich unconventional gas play** in the seal rocks of the Bruce nuclear site. The major reason is not a failure of one of these characteristics so much as it is the lack of thermal maturation that leads to low prospects for commercial gas in the seal rocks of the Bruce nuclear site."*

Dr. Engelder does, briefly, in the above statement address 'oil shale' where I've bolded within Task IV. Please note his word "rich" that qualifies the words 'unconventional gas play' which is a synonym for oil shale.

You must know that what is considered as 'rich', i.e. extractable and profitable, for hydrocarbons in particular changes over time – often very short periods of time whereas the DGR must operate and be secure for a very long time.

As new technologies come on-stream, hydrocarbon resources that 60-80 years ago would not have been extracted are now appealing, extractable, and yes profitable. This includes the heavy oil up in Fort McMurry and it includes oil shale reserves which are being accessed via fracking in Canada's west, in the central and eastern US, in the UK and elsewhere around the world. These hydrocarbon resources would not have even been considered in the 1950s because the technology had not been developed to permit its extraction in a cost-effective manner. This is one reason why the international community does not consider oil shale a suitable cap rock for geological nuclear waste repositories, as costs decrease and technology improves they will become extractable.

In the early 2000's Switzerland made it clear that hydrocarbons near their potential DGR was unacceptable, see page 11, <http://www.nagra.ch/display.cfm/id/100188> From the August 2016 Elements http://www.elementsmagazine.org/archivearticles/e12_4/e12_4.pdf shale (clay-based formations) as nuclear waste repositories are discussed in the article that runs pages 239 through 245. Oil shales as depositories are discounted in the second paragraph of the Introduction on page 239.

Even above, OPG's Geosynthesis report of 2011 rules out hydrocarbon rich deposits in their introduction on page viii (that is conventional hydrocarbon plays since OPG did not investigate oil shale on their property or in the region of SW Ontario which mean they did not need to investigate fracking as the means by which to extract the resource from oil shale).

Therefore, I thank you for all of the detailed documents that you provided today. They do answer my initial questions.

Oil shale was not researched by OPG nor was fracking researched, assessed or addressed for risk. Because there was no risk assessment for fracking, there had been no inquiry or discussions of methods of risk mitigation - such as a no-fracking perimeter that would require Michigan to be on-board.

I would like to know, before the DGR is approved, when will the known hydrocarbon resources that are trapped in oil shale in SW Ontario, in and adjacent to the DGR, be investigated? International dialogue is clear that hydrocarbons and DGRs are not compatible.

Finally, when and how will fracking and fracking-induced earthquakes be addressed?

Thank you,

Natalie Gallimore
Kanata, Ontario

From: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]
[mailto:CEAA.DGR.Project-Projet.DGR.ACEE@ceaa-acee.gc.ca]

Sent: Thursday, June 15, 2017 3:12 PM

To: Natalie Gallimore <email address removed>

Cc: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]
<CEAA.DGR.Project-Projet.DGR.ACEE@ceaa-acee.gc.ca>

Subject: RE: OPG's Deep Geologic Repository (DGP) - comments on the Deep Geologic Repository Project for Low and Intermediate Level Radioactive Waste

Dear Ms. Gallimore,

Thank you for your correspondence of May 26, 2017. Our apologies for the delay in responding, we wanted to take some time to consult with colleagues at Natural Resources Canada (NRCAN) and the Canadian Nuclear Safety Commission (CNSC) to best answer your questions beyond what was provided in our previous message.

The issue of hydrocarbon potential in the region, which considers fracking potential indirectly, was within the scope of the Joint Review Panel's (JRP) review and was the subject of NRCAN's Information Requests to OPG during the review. Please see [NRCAN's written submission](#) (CEAR #1256, page 15-16) for more details. Specific questions directly related to hydrocarbon extraction potential and fracking were also raised during the hearings in Kincardine in September 2013. Please see the transcripts from [September 18, 2013](#) (CEAR #1575, page 89, starts at line 22) and [September 19, 2013](#) (CEAR #1581, page 228, starts at line 4) for the questions that were raised and the responses from experts, which note the importance of institutional controls that would be in place following closure of the site.

Section 13.2.6 of the JRP Report addresses the risk related to hydrocarbon extraction, which were discussed during the hearings and based on NRCAN's analysis. The JRP Report mentions: "Another participant expressed concerns about changes to the seismic stability of the site, such as slippage on known or undetected faults, which could result from future induced hydraulic fracturing for hydrocarbon extraction or the presence of carbon dioxide injection wells in the extended vicinity of the site, up to 200 kilometres away. Natural Resources Canada explained that the examples provided related to extensive porous aquifers and intensely faulted regions. Since such conditions were not encountered during OPG's site characterization, Natural Resources Canada did not believe these concerns were applicable to the DGR site."

NRCAN's key recommendations informed the JRP recommendations to OPG and to the Government in that regard, as follows:

- Prior to construction, OPG shall re-assess mean shaking levels due to a maximum magnitude earthquake, to the satisfaction of the CNSC. The reassessment shall adopt methodologies employed by Natural Resources Canada and the United States Geological Survey, and consider mitigation strategies or plans for conditions of "beyond-design" ground motions.
- The CNSC, in consultation with other government agencies including Natural Resources Canada and the Ontario Ministry of Natural Resources, should evaluate institutional control options to restrict access to the surface and sub-surface of the DGR site. The evaluation should be completed in time to support the decommissioning licensing phase.

Under the *Canadian Environmental Assessment Act, 2012* process, any condition included in the Decision Statement by the Minister becomes a condition of the licence issued by the CNSC. In this case,

if the Minister includes NRCan's recommendations as an EA condition, CNSC would ensure that OPG implements the recommendations by including it as a licensing requirement.

Should you have additional comments or questions, please contact us at CEAA.DGRProject-Projet.DGR.ACEE@ceaa-acee.gc.ca.

Sincerely,

Deep Geologic Repository Project
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From: Natalie Gallimore <email address removed>

Sent: May 26, 2017 12:31 PM

To: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]

Subject: OPG's Deep Geologic Repository (DGP) - comments on the Deep Geologic Repository Project for Low and Intermediate Level Radioactive Waste

Hello,

Thank you for providing the link to the Joint Review Panel Environmental Assessment Report of 2015.

As you must know, Section 13.2.6 of the Joint Review Panel report only relates to the analysis of historic regional seismic activity with no mention of fracking and the known occurrence, as per the USGS, of manmade earthquakes created by fracking; activities that are conducted in Michigan and an activity that Ontario's provincial Liberal government left open for consideration when they rejected a proposed fracking ban back in 2015.

Additionally, doing a key word search through the provided Joint Review Panel Environmental Assessment Report, I can find no mention of fracking or oil shale (which is the cap rock), nor manmade earthquakes or increased seismic activity. Since these terms are not in this final assessment report nor is fracking mentioned in the section dealing with seismic risk, can you please provide me with documents to prove that this risk has been identified and addressed?

Scientists and government in the US and the UK have discussed fracking and the risk that hydrocarbon extraction poses to nuclear operations including DGR's. Please consider the links that I provide below that proves these countries have identified fracking and oil shale as a risk to DGRs. To date I can find no evidence within the OPG documentation, now also within the Joint Review Panel's final report, that OPG or the Government of Canada have discussed and evaluated the risk posed by hydrocarbon extraction.

As many American US states, particularly Oklahoma, and British Columbia have clearly shown (also now formally recognized by the U.S. Geologic Survey), fracking induces earthquakes that effect the underlying rock to a sizable depth in the crust. One cannot only look at a historic seismic profile when doing a risk assessment for the DGR which must maintain its integrity for 1,000++ years: one must attempt to assess and calculate all risks by examining technological trends and also looking outside Canada at global research and dialogue.

Unless your organization, or OPG, have differing global research, what I have encountered during my research is shale cap rock should not be an 'oil shale' since there is a risk that in the future someone will try to extract said hydrocarbons placing the integrity of a DGR at risk. The UK admits it does not know how close, or what effect, fracking and extraction activities have on nuclear operations: did OPG provide such research to the Environmental Assessment panel?

Please reply to me with respect to the Joint Review Panel's finding on the risks posed by hydrocarbon extraction, specifically hydraulic fracking, which as per the USGS will increase seismic activity/earthquakes – lessening the integrity of the DGR's shale cap rock. If you could provide the corresponding documents as to the identification and assessment of fracking risk during the Environmental Assessment, this would be appreciated.

If fracking and hydrocarbon extraction has not been identified as a risk to the DGR by either OPG, CNSC, Environment Canada, or the Joint Review Panel, please also let me know.

Regards,

Natalie Gallimore

From: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]
[<mailto:CEAA.DGR.Project-Projet.DGR.ACEE@ceaa-acee.gc.ca>]
Sent: Friday, May 26, 2017 10:59 AM
To: Natalie Gallimore <email address removed>
Cc: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]
<CEAA.DGRProject-Projet.DGR.ACEE@ceaa-acee.gc.ca>
Subject: RE: OPG's Deep Geologic Repository (DGP)

Dear Ms. Gallimore,

Thanks you for your correspondence of May 25, 2017 concerning the Deep Geologic Repository for Low and Intermediate Level Radioactive Waste Project (the Project) proposed by Ontario Power Generation (the proponent). Your message raises concerns about potential earthquakes and hydrocarbon fracking.

First, we would like to draw your attention to the project file on the Canadian Environmental Assessment Agency's (the Agency) registry, reference number [17520](#). The registry is the primary source of information pertaining to the project to date, and it is updated on an ongoing basis.

To provide context, we would like to note that the Project's environmental assessment was referred to a review panel in June 2007 and the Environmental Impact Statement (EIS) submitted by the proponent in April 2011 (Registry record [298](#)). The Joint Review Panel (JRP) was established in January 2012 (Registry record [318](#)) and its Report released in May 2015 (Registry record [2205](#)); following a six-month public review period, over 30 days of public hearings, and a thorough review of the proponent's EIS. The overall conclusion from the Joint Review Panel is that the Project is not likely to cause significant adverse environmental effects, taking into account the implementation of the mitigation measures committed to by the proponent, with the mitigation measures recommended by the Panel. Of most relevance to your concerns, Chapter 13 of the JRP Report provides a discussion and recommendations for the Project's Postclosure Safety Case and associated risks of earthquakes and intrusion. We invite you to consult the

[Joint Review Panel report](#) for further information and ancillary documents on the registry, such as the [EIS](#) itself and other relevant records.

At this time, the Agency conducting the review of Additional Information requested in February 2016 by the Minister of Environmental and Climate Change (Registry record [2872](#)) to inform her decision under the *Canadian Environmental Assessment Act, 2012*. The request focused on an assessment of alternate locations, an updated cumulative effects analysis, and updated mitigation measures commitments. It is supplemental to the JRP Report, meaning that the analyses and recommendations discussed in the JRP report will not be revisited. The proponent submitted its response to the Minister's request on December 28, 2016 (Registry record [2883](#)), further materials on these three topics were requested on April 5, 2017 by the Agency and a response is expected on May 26, 2017. If the response satisfactorily answers the Agency's requests, the Agency will commence the draft report writing phase for the Additional Information. The Agency will complete its draft report and make it available for a 30-day public comment period and consultation with Indigenous groups.

We welcome your input and encourage you to participate in the upcoming public comment period, which is currently scheduled to occur later in the summer.

Should you have additional comments or questions, please contact us at CEAA.DGRProject-Projet.DGR.ACEE@ceaa-acee.gc.ca.

Sincerely,

Deep Geologic Repository Project
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From: Natalie Gallimore <email address removed>
Sent: May 25, 2017 11:30 PM
To: Deep Geologic Repository Project/ Projet de stockage de déchets radioactifs[CEAA\ACEE]
Subject: OPG's Deep Geologic Repository (DGP)

To whom it may concern,

I have previously written to the Environment Minister, Catherine McKenna, and also to the Canadian Nuclear Safety Commission but thus far have not been provided an adequate response so I am asking your group to provide me with some information, and reassurance, regarding the DGR, specifically its shale cap rock.

There are untapped hydrocarbon resources in SW Ontario, specifically, hydrocarbons trapped in shale http://www.ogsrlibrary.com/downloads/Ontario_Shale_Gas_OPI_2009_Nov11.pdf. This is the same shale layer that would seal the DGR. This cap rock is recognized as hydrocarbon rich in the OPG-commissioned report http://www.opg.com/generating-power/nuclear/nuclear-waste-management/Deep-Geologic-Repository/Documents/GSR/4.1.13_Analogue-Study-of-Shale-Cap-Rock-Barrier-Integrity.pdf. However, this report limits itself to the boreholes on the DGR property in the discussion of hydrocarbon potential, reporting the DGR boreholes do not show currently commercial hydrocarbons nor does a nearby borehole (3 km away) owned by Texaco. The report does mention that

equivalents to the Blue Mountain & Collingwood shales are known to be regionally variable in hydrocarbon potential. Additionally, this report does not identify the risks posed by fracking for hydrocarbons in other locations in SW Ontario within these oil shales.

The risk to the DGR include fracking itself - which increases the permeability in the shale as to release the hydrocarbons - but even more concerning are the manmade earthquakes that fracking activities generate.

https://profile.usgs.gov/myscience/upload_folder/ci2015Jun1012005755600Induced_EQs_Review.pdf

As per the U.S. Geological Survey, fracking generated earthquakes can occur at depths beyond the borehole depth and effect territory beyond the immediate borehole and horizontal fracking extension. Very active in fracking, Oklahoma has recorded an increase in such earthquakes.

<https://www.bloomber.com/news/articles/2016-09-03/oklahoma-quake-triggers-closing-of-fracking-waste-disposal-wells>

Two years ago, Ontario's liberal government defeated a NDP motion which would have banned fracking in Ontario <http://globalnews.ca/news/1903199/government-rejects-ban-on-hydraulic-fracking-in-ontario/>. This is troublesome since by voting the proposed fracking ban down the provincial government demonstrated a disconnect in insight of how fracking is an egregious activity to conduct around nuclear operations, especially waste containment or long-term disposal.

The following 'industry' article discussing shale as a containment rock for nuclear waste states that shale containing hydrocarbons should not be considered for long-term nuclear waste disposal – i.e. places such shales out of consideration. <http://thebulletin.org/shale-overlooked-option-us-nuclear-waste-disposal7831>. In addition, in the UK they have admitted that they do not have the research to know how fracking may effect such nuclear activities.

<http://www.telegraph.co.uk/news/earth/energy/11808616/Geology-across-30pc-of-UK-suitable-for-nuclear-burial-site.html>

Ontario can ban hydraulic fracking, thereby limiting manmade earthquakes, but what about nearby Michigan which is already active in fracking albeit currently in another gas play.

Additionally, future technological development and reevaluated economic feasibility may make the shale that would cap the DGR more appealing. If Canada goes against the industry notion that containment shales must not contain hydrocarbons, Ontario must ban fracking forever since it is a risk to the DGR. Additionally, Ontario will need Michigan's commitment to ban fracking near their border with Ontario close to the DGR since the Oklahoma situation shows how far-reaching such fracking earthquakes can be.

Please respond and let me know that fracking has been has been researched, discussed, risk assessed and addressed with respect to Ontario Power Generation's deep geologic nuclear waste repository.

Regards,

Natalie Gallimore
Kanata, Ontario

Other documentation:

Michigan government web page on fracking: http://www.michigan.gov/deq/0,4561,7-135-3311_4231-262172--,00.html

December 2016 submission from the Ontario Petroleum Institute to Ontario's provincial government summarizing the oil and gas reserves in SW Ontario. Unconventional oil - oil shale - is brought up as a potential future hydrocarbon resource on page

25. <http://www.ontariopetroleuminstitute.com/test/wp-content/uploads/2016/12/OPI-SUBMISSION-ONTARIO-LTEP-2.pdf>