

REF: Exhibit I.SEC.1 and OEB Staff Interrogatory 1

Preamble: To be of assistance to the TSSA, we are providing the specific reference to which we believe, Staff IR 1 refers

<http://www.rds.oeb.ca/HPECMWebDrawer/Record/680231/File/document>

The table on pdf page 124 of that document states:

“NPS 12 pipe and fittings are not approved for general use by EGD and will require a variance from TSSA to install. Potential operational concerns because of limited experience with NPS 12 PE IP.

In addition to Staff’s IR 1, we would like to understand better the technical aspects of the approach that TSSA would undertake to provide a variance.

- 1) Has the TSSA, CSA or other recognized safety agency undertaken a testing of NPS 12 IP PE pipe exposed to hydrogen for the long term?
 - a) If not, please provide a brief description of the process that the TSSA would undertake to test the pipe while simulating long term exposure to hydrogen.
- 2) Has the TSSA, CSA or other recognized safety agency undertaken a testing of steel High Pressure exposed to hydrogen for the long term?
 - a) If not, please provide a brief description of the process that the TSSA would undertake to test the steel pipe under high pressure conditions while simulating long term exposure to hydrogen.

REF: TSSA EGI LCEP Review Report 20200708, page 2

Preamble: The TSSA review report states: *“DNV GL is an international accredited registrar and classification society headquartered in Hovik, Norway. DNV GL has initiated a global joint industry project (JIP) to help prepare the natural gas distribution infrastructure for the injection of hydrogen produced from renewable sources. HYREADY involves stakeholders from the natural gas value chain, including natural gas transmission and distribution system operators and technology providers. The result of this report discussed in a meeting with EGI dated June 26, 2020.”*

We would like to understand more about the TSSA reliance on DNV GL’s work in this area to inform its support for the EGI project.

- 3) Please provide the TSSA’s understanding of the JIP project as it pertains to the EGI project.
 - a) To the TSSA’s knowledge, has DNV GL done long term simulation testing of components in a natural gas system?
 - b) How might that work be applicable to the EGI project?
 - c) What other aspects of the JIP project provide TSSA comfort for its support of the EGI project?

- 4) Please provide the presentation materials from the June 26, 2020 meeting.
 - a) Please provide any minutes taken in the meeting.
 - b) Please provide all correspondence in regard to any follow-up items generated in the meeting.
 - c) Has TSSA initiated any communication directly with DNV GL to work toward standards and codes that may advance the blending of hydrogen with natural gas in a risk sensitive fashion?
 - i) If so, please provide a summary of the progress in this area.

REF: Exhibit B, Tab 1, Schedule 1, Page 18

Preamble: The TSSA review report states: *“Material interchangeability including existing piping system in the selected network: According to the above-mentioned reports and engineering assessment done by EGI, no adverse affect is anticipated on this hydrogen blending rate.”*

We would like to understand better the scope of the material interchangeability that the TSSA is relying upon.

- 5) Please describe material interchangeability as used in the above reference.
 - a) What conclusions does the TSSA draw from EGI’s information on material interchangeability?
 - b) Do these conclusions apply to each of the following systems in this project:
 - i) The natural gas delivery system
 - ii) The customer piping and its components
 - iii) The hydrogen creating and holding station that delivers hydrogen to the natural gas system.
- 6) Did these reports include documented assessments of the long-term effects of hydrogen embrittlement?
 - a) If so, please provide those aspects of the reports with included references as appropriate.

REF: TSSA EGI LCEP Review Report 20200708, page 2

Preamble: The TSSA review report states: *“The differences between properties of hydrogen (H₂) and methane (CH₄). More specifically the differences on Lower Explosive Limit (LEL), auto-ignition and flame speed. Hydrogen has lower LEL and higher flame speed and almost similar auto-ignition temperature. However, at this blending rate no adverse affect was suggested by any of the reports and pilot tests that are done around the world. “*

We would like to understand better the TSSA's views on the impact of a lower LEL from blending hydrogen into the natural gas stream as it pertains to risk.

- 7) Please define Lower Explosion Limit and Upper Explosion Limit (UEL)?
- a) What is the LEL and UEL of hydrogen?
 - b) What is the LEL and UEL of natural gas?
 - c) What is the resulting LEL and UEL of 2% hydrogen blended with 98% natural gas?
 - d) What would the effect of the broader range between LEL and UEL for the blended stream on unanticipated leakage inside a customer's premises which prevented atmospheric release of the gas?
 - i) What are TSSA views on the additional risk associated with the blended stream vs. the non-blended natural gas stream?

REF: TSSA EGI LCEP Review Report 20200708, page 2

Preamble: The TSSA review report states: *“TSSA requested more documents for review of this project by an email dated April 14, 2020. In this email several items requested for review including risk assessment done on this project. CFD modelling on indoor leaks, Dispersion modelling on outdoor leaks, fault tree analysis on end-user equipment (with the addition of hydrogen), all items that are incorporated in the EGI risk assessment to quantify the “global” risk. This document is not received yet for review.”*

We would like to understand better the nature of the requested items and the potential impact on contingent approvals.

- 8) Please provide the email request.
- a) Please provide all follow-up correspondence to or from EGI relative to these requests.

REF: TSSA EGI LCEP Review Report 20200708, page 3

Preamble: The TSSA review report states: *“This project so far has been reviewed on the technical aspects of the project including design, material specification, wall thickness calculation, end-user equipment assessment. In general, TSSA is in support of this project for the following reasons:....*

c) The pilot projects mentioned on Exhibit B, Tab 1, Schedule 1, attachment 1, table 1 clearly shows successful blending of hydrogen even on higher percentages.”

We would like to understand better the TSSA basis for its support of this project as it pertains to the issue of Hydrogen Embrittlement.

- 9) Please provide an explanation of the concept of hydrogen embrittlement of steel pipe.
 - a) How did the TSSA evaluate the impact of the addition of hydrogen on the steel components in the existing system that will be exposed to the hydrogen.
 - b) In the view of the TSSA, what is the maximum % content of hydrogen in a natural gas stream below which steel components can carry the gas safely at high pressures over an extended period of time?
 - i) Please add any clarifications in terms of Specified Minimum Yield Strength, Maximum Operating Pressure, etc.
- 10) For the projects referenced in the referenced Table 1,
 - a) did the TSSA review these projects for applicability to the proposed EGI project?
 - i) If so, did the TSSA review these projects to determine if the components of these systems were comparable to the those proposed by EGI?
 - (1) If yes, please provide a summary of conclusions drawn from the review.
 - ii) If not, what aspects of Table 1 provide the TSSA the necessary evidence to provide support for the project?

REF: Exhibit B, Tab 1, Schedule 1, Attachment 1, Page 15-16

Preamble: EGI evidence states: “Enbridge Gas consulted with the Technical Standards and Safety Authority (TSSA) to introduce and provide information on the Project. The TSSA indicated that they will act as a technical reviewer on behalf of the Ontario Energy Board for the LTC application if requested.”

We would like to understand better how the TSSA intends to perform the role of technical reviewer.

- 11) Please provide a reference to the standards that the TSSA has applied to technical reviews of other hydrogen-natural gas blend projects?
 - a) Would these standards be applied to the review of this project?
 - b) If not, what standards will be applied?

REF: TSSA EGI LCEP Review Interrogatory Responses

Preamble: Throughout the letter of 20200708, we noticed a strong reliance on external agencies including EGI for statements made by TSSA in support of the project. We believe the Board ought to be informed of the source of TSSA's understanding as a basis for response to Interrogatory Responses provided to the Board

- 12) For each of the responses provided to our interrogatories above and the Board staff's interrogatories, please specify which of the responses relies on:
- a) Codes published in Ontario or Canada – please provide the Code and reference
 - b) Safety regulators from other jurisdictions – please specify the regulator
 - c) Enbridge Gas Inc.
 - d) Enbridge Inc.
 - e) External Associations – please specify the association
 - f) Other utilities – please specify the utility
 - g) Literature Review – please provide a specific literature reference