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October 7, 2021

Residential Consumer Intervener Association
c/o Midgard Consulting Inc.
Suite 828 – 1130 W Pender Street
Vancouver, B.C.
V6E 4A4

Attention: Mr. Peter Helland, Director

Dear Mr. Helland:

Re: FortisBC Energy Inc. (FEI)

Application for a Certificate of Public Convenience and Necessity (CPCN) for Approval of the Coastal Transmission System Transmission Integrity Management Capabilities Project (Application)

Response to the Residential Consumer Intervener Association (RCIA) Information Request (IR) No. 2

On February 11, 2021, FEI filed the Application referenced above. FEI respectfully submits the attached response to RCIA IR No. 2 in advance of the deadline established in British Columbia Utilities Commission Order G-285-21.

If further information is required, please contact the undersigned.

Sincerely,

FORTISBC ENERGY INC.

Original signed:

Diane Roy

Attachments

cc (email only): Commission Secretary
Registered Parties

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A. Project Need and Justification

16. Reference: Exhibit B-1, Application, pp.38-39; Exhibit B-8, RCIA IR 1, IR 2.3

Application pp. 38-39:

"FEI is aware of the existence of these cracking threats through inspections of its pipelines during integrity dig activities."

Table 3-6: FEI CTS Pipelines: Occurrences of Cracking on FEI pipe identified through JANA's review of selected integrity digs

#	Pipeline Short Name	Pipeline Full Name	SCC Susceptibility	Seam Weld Cracking Susceptibility	Integrity Digs with Cracking Threats
1	HUN BAL 1066	Huntingdon – Balfour 42"	Yes	Low	0
	BAL NIC 1066	Balfour – Roebuck 42"	Low	Low	0
2	HUN NIC 762	Huntingdon – Nichol 30"	Yes	Yes	0
3	LIV COQ 323	Livingston – Coquitlam 12"	Yes	Yes	2
4	LIV PAT 457	Livingston – Pattullo 18"	Yes	Yes	9
5	NIC PMA 610	Nichol – Port Mann 24"	Yes	Yes	0
6	CPH BUR 508	Cape Horn – Burrard 20"	Yes	Yes	15
7	ROE TIL 914	Roebuck – Tilbury 36"	Yes	Low	0
8	TIL BEN 323	Tilbury – Benson 12"	Yes	Yes	4
9	TIL FRA 508	Tilbury – Fraser 20"	Yes	Yes	1
10	NIC FRA 610	Nichol – Fraser 24"	Yes	Yes	2
11	TIL LNG 323	Tilbury – LNG Plant 12"	Yes	Low	0
12	NOO EMT 610	Noons Ck – Eagle Mtn 24"	Low	Low	0
13	PMA CPH 914	Port Mann – Cape Horn 36"	Low	Low	0

RCIA IR 2.3:

"As explained in Section 3.2.4 of the Application, cracking is a time-dependent threat, meaning that its potential to impact the pipeline increases over time. This threat can lead to pipeline failure by rupture, which could have significant consequences, especially given the urban development surrounding the CTS pipelines. Given factors including industry knowledge about cracking threats, FEI's identification of cracking on its own pipelines, and the understanding that FEI's existing integrity management practices do not, and cannot, identify all cracking, it is necessary for FEI to initiate this project in a timely manner to enable the collection of cracking related ILI data for its system."

16.1 For each incidence of cracking found by FEI on its CTS pipelines through integrity dig activities shown in Table 3-6, provide the date when the cracking was discovered (line items with zero cracking threats may be eliminated from the table). As well, distinguish between whether the cracking was SCC or related to the seam weld.

Response:

For each incidence of cracking found by FEI on its CTS pipelines through the integrity dig activities shown in Table 3-6, the table below (prepared with the support of JANA), indicates whether the cracking was SCC or related to Other Cracking.[1] The table also identifies when the cracking was discovered.

For example, on LIV COQ 323, JANA reviewed a total of 31 integrity dig reports from 2002 to 2017. Of these, 12 dig sites had SCC and/or Other Cracking (4 SCC findings in 2002, and 11 findings related to Other Cracking in 2002, 2014, and 2017). Of the 12 dig sites, 3 had both SCC and other cracking.

FEI's integrity management activities, including data collection and analysis, continually improve over time. As such, updates to Table 3-6 have been incorporated into the table below with explanatory notes.

#	Pipeline Short Name	Integrity Digs with SCC (Year Discovered)	Integrity Digs Related to Other Cracking (Year Discovered)	Integrity Digs with Cracking Threats[Note 1]	Total Number of Integrity Digs Analyzed
2	HUN NIC 762	0	3 (2004)	3*	18
3	LIV COQ 323	4 (2002)	11 (2002, 2014, 2017)	12*	31
4	LIV PAT 457	11 (2002, 2003, 2009, 2011)	18 (2002, 2003, 2009, 2010, 2014, 2016)	22*	38
5	NIC PMA 610	1 (2005)	1 (2017)	2*	11
6	CPH BUR 508	11 (2001, 2007, 2013, 2014)	10 (2001, 2013, 2015, 2016)	18*	41
8	TIL BEN 323	0	4 (2002)	4	5
9	TIL FRA 508	0	0	0[Note 2]	5
11	TIL LNG 323	0	1 (2003)	1*	4

Notes:

1. *Data has been updated since the filing of the Application, and the pipelines with updated information are denoted with an asterisk (*) in the "Integrity Digs with Cracking Threats" column. In some instances, both SCC and other cracking were found in a single dig.*
2. *TIL FRA 508 was erroneously reported to have a previous instance of cracking in Table 3-6.*

[1] In their work, JANA grouped seam weld issues into a category called Other Cracking.

16.2 Explain how FEI managed (and continues to manage) the existence of these cracking threats, in addition to monitoring through opportunity digs, prior to the ability to perform EMAT ILIs. For example, has FEI implemented any SCCDA methodologies to address the SCC threats?

Response:

FEI has managed, and will continue to manage, the existence of cracking threats through opportunity digs prior to the ability to perform EMAT ILIs. Due the ineffectiveness of successfully finding critical or sub-critical cracking using indirect data (e.g., coatings, cathodic protection, etc.), FEI has not implemented SCCDA methodologies to address the SCC threats. As described in Section 4.4.1 of the Application, SCCDA cannot reliably identify cracking threats, and as such, is not feasible.

17. Reference: Exhibit B-1, Application, p.26; Exhibit B-5, BCUC IR 1, IRs 1.1, 1.5

Application p. 26:

"FEI's current integrity management practices for managing cracking threats involve the inspection of its transmission pipelines for cracking during "opportunity digs", when the pipeline is exposed because of other pipe condition assessments."

BCUC IR 1.1:

"There are 106 FEI transmission pipelines (including laterals) that are not included in the two reports prepared by JANA. Lines within the scope of the TIMC project are pipelines of NPS 10 and greater, due to the availability of commercialized EMAT tools for pipelines of these sizes."

BCUC IR 1.5:

"As discussed in Section 3.2.5 of the Application, FEI manages the risk of cracking threats on its remaining transmission pipelines which were not studied by JANA by inspecting for cracking during "opportunity digs" when the pipeline is exposed because of other condition assessments. If significant cracking is discovered, a line specific mitigation plan will be developed."

17.1 Confirm whether FEI has completed integrity digs on each of the 106 transmission pipelines, including laterals. If not confirmed, how many of these transmission pipelines have had at least one integrity dig?

Response:

FEI has not completed integrity digs on all of the 106 transmission pipelines, including laterals. Of the 106 transmission pipelines, the table below lists the 35 pipelines that have had at least one integrity dig between 2000 and 2020. FEI has not completed ILI digs on the remainder of the 106 transmission pipelines, including laterals, because none of these pipelines are currently capable of inline inspection and FEI has no other indication (e.g., results from cathodic protection surveys) that integrity digs are warranted.

Pipeline Name
Afton Mine Lateral 114
BC Forest Products Lateral 168
Campbell River Lateral 219
Cariboo Pulp Lateral 168
Castlegar Nelson 168
Chase Lateral 88
Coldstream Lateral 114

Pipeline Name
Coldstream Loop 168
Finlay Forest Lateral 60
Finlay Forest Loop 114
Fording Lateral 219
Kamloops #1 Lateral 168
Kamloops #1 Loop 168
Kamloops #2 Lateral 114
Kelowna #1 Lateral 114
Kimberly Lateral 168
Lafarge Lateral 114
Mackenzie Lateral 168
Mackenzie Loop 168
Northwood Pulp Lateral 219
Northwood Pulp Loop 219
PG pulp Lateral 168
Prince George #1 Lateral 168
Prince George #2 Lateral 219
Prince George #3 Lateral 219
Pt Alberni Lateral 168
Quesnel #2 Lateral 114
Salmon Arm Lateral 114
Salmon Arm Loop 168
Savona Lateral 60
Sorrento Lateral 114
Summerland Lateral 114
Vernon Lateral 114
Williams Lake Lateral 114
Williams Lake Loop 168

17.2 Confirm whether FEI has identified SCC on any of the 106 transmission pipelines, including laterals, from integrity or opportunity digs.

17.2.1. If confirmed, identify the year when the first instance of SCC was identified.

Response:

FEI confirms that it identified one SCC instance on the Mackenzie Lateral 168 during an integrity dig in 2019, which was the first instance of SCC identified on this pipeline or any of the 106 transmission pipelines, including laterals. FEI will modify the Mackenzie Lateral 168 to accommodate geometry and MFL ILI tools through the Inland Gas Upgrades project. Currently, there are no proven and commercialized EMAT tools available for 168 mm pipelines, and as a result, FEI will continue to inspect for SCC during opportunity digs.

17.3 Confirm whether FEI has identified seam weld cracks on any of the 106 transmission pipelines, including laterals, from integrity or opportunity digs.

17.3.1. If confirmed, identify the year when the first instance of seam weld cracking was identified.

Response:

FEI confirms it has found evidence of seam weld cracking on some of the 106 transmission pipelines. However, FEI cannot with reasonable effort identify the year when the first instance of seam weld cracking was identified. FEI inspects for seam weld cracks during all integrity digs, including opportunity digs, using magnetic particle inspection. FEI does not maintain a database of findings for seam weld cracking, beyond the data that was prepared for the CTS TIMC Application and provided in the response to RCIA IR2 16.1.

To respond to this question, FEI would need to manually review approximately 1300 dig reports to determine the first instance of seam weld cracking. FEI estimates that this would take approximately 14 working days to complete. Furthermore, as FEI's current in-line inspection techniques do not allow FEI to detect seam weld cracks, and FEI has conducted digs on less than 1 percent of its pipelines, the date that the first seam weld cracking was found through opportunity digs is not reasonably indicative of the timing or extent of seam weld cracking on FEI's system. Given that the information would not materially add to the evidentiary record or assist the BCUC in its decision in this proceeding, FEI respectfully declines to provide the requested information.

B. Project Description

18. Reference: Exhibit B-1, Application, pp.100-101; Exhibit B-8, RCIA IR 1, IR 12.1

Application pp. 100-101:

"Re-purposing Existing Pressure Reduction Capabilities at Huntingdon Control Station to enable 20 percent Reduction in Operating Pressure

…

The outlets of each pressure regulating station at Huntingdon Control Station merge into a single line before feeding the two pipelines leaving the facility and therefore operate at the same pressure. Rather than adding a new PRS to the NPS30 pipeline, FEI decided to split the outlet line so that one of the two pressure regulating stations can be dedicated to one pipeline at a time (as required) while the bypass acts as a redundant path. This setup requires the bypass line to be upgraded with bigger control valves and the addition of a fourth regulating run to Station 1."

RCIA IR 12.2:

"FEI is aware through its discussions with peer pipeline operators that initial EMAT ILI tool runs can result in a significant number of indications that require timely inspection and validation. These indications do not always require repair; however, until they are excavated and inspected, they may need to be treated as an integrity risk. On this basis, there is the possibility that FEI may have more features requiring an in-ditch assessment in a timely manner than can be dealt with prior to the winter peak season."

18.1 Assuming FEI prepared in advance to complete the Huntingdon station modifications to the pressure regulation (i.e. designs, execution planning), when would FEI need to commence "repurposing" of the existing regulation equipment in order to have the work completed prior to the winter peak following the EMAT ILI?

18.2 To put the above question another way: does FEI have sufficient time to defer a decision on the Huntingdon modifications until it has reviewed the preliminary results of the HUN ROE 1067 EMAT ILI?

18.2.1. If FEI does not have sufficient time, explain why not.

18.3 For the following year when FEI intends to perform an EMAT ILI on HUN NIC 762, and assuming FEI did not proceed with the Huntingdon station modifications the year prior, does FEI have sufficient time to defer a decision on the Huntingdon modifications until it has reviewed the preliminary results of the HUN NIC 762 EMAT ILI?

18.3.1. If FEI does not have sufficient time, explain why not.

18.4 Assuming FEI prepared in advance to complete the Nichol station modifications to the pressure regulation, does FEI have sufficient time to defer a decision on the Nichol station modifications until it has reviewed the preliminary results of the NIC FRA 610 and NIC PMA 610 EMAT ILIs?

18.4.1. If FEI does not have sufficient time, explain why not.

18.5 Assuming FEI prepared in advance to complete the station modifications to the pressure regulation, does FEI have sufficient time to defer decisions on the Coquitlam, Roebuck, and Livingstone station modifications until it has reviewed the preliminary results of the remaining EMAT ILIs?

18.5.1. If FEI does not have sufficient time, explain why not.

Response:

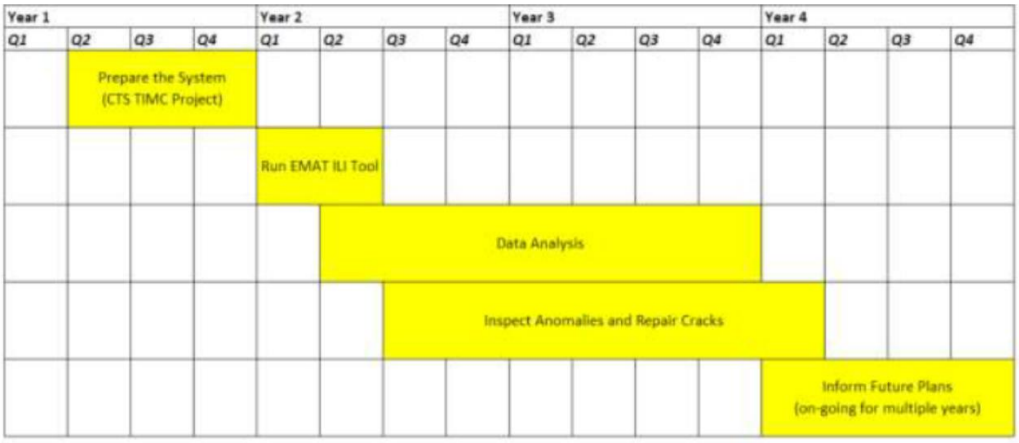
FEI does not consider it prudent to delay the Huntingdon, Nichol, Coquitlam, Roebuck and Livingstone Station facility modifications.

FEI has determined that the facility modifications identified in Table 5-8 of the CTS TIMC Application are required to maintain safe and reliable service to customers while FEI conducts ongoing mitigation efforts to identify and address SCC and crack-like features on its transmission pipelines. This applies to both the initial EMAT ILI run and response, as well as to future EMAT ILI runs and responses. All of the modifications identified in Table 5-8 of the Application are required to meet the Project objective, whether to support the initial EMAT ILI run response, or to support future EMAT ILI run responses.

As shown in the Typical Timelines Gantt chart provided in the response to CEC IR1 33.1 (reproduced below), the initial EMAT ILI run must occur in Q1 or Q2 of a given year in order for the tool to travel at a velocity appropriate for collection of quality data while also leaving sufficient time in Q2 and Q3 to respond to any urgent features that are identified. Based on this timeline, FEI estimates that it would receive the initial tool run report in Q2 or early Q3. Were FEI to adopt the approach suggested by the RCIA, FEI would have a maximum of two quarters to undertake the facility modifications. This is not enough time to procure and install the required equipment, so FEI would have to purchase them before the ILI run and have them on hand.

If the results identified a sufficient number of features, such that the modifications were required, FEI would then have to implement the facility modifications concurrently with the “Inspect Anomalies and Repair Cracks” activities. Both activities require the same resources, which are also involved in FEI’s typical Operations activities. If FEI is unable to complete the required activities in the time remaining, this would increase the risk of a cracking feature growing to failure.

As such, the minor potential deferral benefit of the installation of some facility modifications is outweighed by the risks associated with running the tools without an appropriate plan to respond to the findings, especially given the uncertainties associated with an initial EMAT ILI run.


Year 1
Year 2
Year 3
Year 4
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
Prepare the System (CTS TIMC Project)
Run EMAT ILI Tool
Data Analysis
Inspect Anomalies and Repair Cracks
Inform Future Plans (on-going for multiple years)

1

2

19. Reference: Exhibit B-8, RCIA IR 1, IR 12.1

"FEI cannot know how many features will be found on any of the 11 CTS TIMC pipelines until after each of their baseline EMAT ILI runs and initial data analysis, including on the HUN ROE 1067 line. However, all CTS pipelines – with the exception of the HUN ROE 1067 pipeline – can have their operating pressure reduced by 20 percent for extended periods until all repairs are complete."

19.1 Considering the HUN ROE 1067 cannot have its pressure reduced by 20% for extended periods (which RCIA interprets to mean through the winter peak) how does FEI propose to address an eventuality where there are too many features to repair on this line prior to the need to return this line to full operating pressure?

Response:

Please refer to the response to BCUC IR2 37.2.

19.1.1. Could a pressure reduction of less than 20% address FEI's concerns with continuing to operate this pipeline in advance of remediating the defects found from the EMAT ILI?

Response:

As explained in the response to BCUC IR2 34.3, a 20 percent pressure reduction is reasonable and accepted industry standard practice. While it is possible that an engineering assessment could define a pressure reduction of less than 20 percent, FEI cannot predict this value. It is prudent to plan for the industry accepted value of 20 percent to ensure FEI is able to respond to EMAT ILI findings.

As described in the responses to BCUC IR2 36.1 and 37.2, the CTS has insufficient capacity when the HUN ROE 1067 pipeline is operated with a 20 percent pressure reduction. FEI does not intend to have unrepaired features remaining on the HUN ROE 1067 pipeline prior to the winter peak period, and thus does not anticipate needing to apply a pressure reduction to this pipeline over the winter period.

20. Reference: Exhibit B-8, RCIA IR 1, IR 12.5; Exhibit B-1, Application, p. 99

RCIA IR 12.5:

"FEI will typically reduce the operating pressure in a pipeline for following situations:

…

2. Prior to inspections or repairs. FEI may reduce the operating pressure of individual pipelines for short periods to establish a factor of safety when working around the gasified line (for example while conducting integrity digs)."

Application p. 99:

"Currently, Huntingdon Control Station is the sole location where operating pressure can be reduced in the 11 pipelines identified in this Project's scope."

20.1 Explain how FEI reduces the operating pressure in individual pipelines if Huntingdon Control Station is the only location where operating pressures can be reduced.

20.2 If FEI is able to reduce the operating pressure of individual pipelines, explain why new pressure regulating stations are required for the CTS TIMC project.

Response:

FEI is currently unable to reduce the operating pressure in individual pipelines with the exception of the LIV PAT 457 and CPH BUR 508 pipelines. These two pipelines were inspected under the EMAT Pilot Project in 2019 and 2020, respectively. As described in Sections 5.3.3.1 and 5.3.3.2 of the Application, FEI installed a pressure regulating station at the upstream end of each pipeline to allow for localized pressure reductions following EMAT ILI tool runs.

For all other CTS pipelines, FEI must apply a pressure reduction at Huntingdon Control Station which results in a system-wide pressure reduction and impacts to system capacity. To mitigate impacts to the capacity of the CTS when a pressure reduction is required, FEI needs the ability to reduce the operating pressure of individual pipelines. As such, FEI is proposing to construct new pressure regulating stations as described in Section 5.5.4 of the Application.

21. Reference: Exhibit B-8, RCIA IR 1, IR 11.5

Table 1 of the response to RCIA IR 11.5 identifies the percentage coverage obtained by the most recent ILIs.

FEI states:

"Where data has not been obtained during past ILI or where degraded specification data has been obtained, FEI manages integrity through:

- Reliance on data from a complementary technology previously run successfully in the line, with additional conservatism applied, where available;
- Reliance on data from a prior successful run(s) of the same technology, with additional conservatism applied, where available; and
- Analysis that accounts for uncertainty associated with degraded specification data, where available.

The above strategies, while appropriate over the timeframe that they have been adopted, are not appropriate on a permanent basis for managing time dependent threats on an aging pipeline system, as time-dependent threats can grow with time."

21.1 Table 1 identifies magnetic flux leakage ILIs which are typically used to evaluate corrosion, a time-dependent threat. If the strategies listed in the response to RCIA IR 1 11.5 are not suitable for these ILIs on a permanent basis, explain how FEI manages corrosion threats on a permanent basis.

Response:

FEI confirms that MFL ILIs are suitable for managing *corrosion* time-dependent threats on a permanent basis.

For clarity, running magnetic flux leakage (MFL) ILIs and using the strategies suggested in RCIA IR1 11.5 are not suitable for managing *all* time-dependent threats and, in particular, are not suitable for managing cracking threats (which can be managed using EMAT ILIs).

21.2 Explain whether FEI has 100% coverage from a combination of ILIs (from previous runs of either the same technology or a suitable alternative technology) of the CTS transmission pipelines.

21.2.1. If 100% coverage does not exist and there are permanent "blind spots", explain how FEI manages the integrity of these sections.

Response:

FEI has 100 percent coverage from a combination of magnetic flux leakage (MFL) and geometry ILIs (from previous runs of either the same technology or a suitable alternative technology) for all of the CTS transmission pipelines.

22. Reference: Exhibit B-1, Application, p.98; Exhibit B-8, RCIA IR 1, IR 11.5

Application p. 98:

"However, there are EMAT ILI tools provided by certain vendors that do not come with built-in speed control which will require a FCS. Since the EMAT ILI tools that do not have built-in speed control are limited to NPS24, NPS30 and NPS36, the FCS will be used for these pipeline sizes only."

Table 1 of the response to RCIA IR 11.5 identifies the percentage coverage obtained by the most recent ILIs:

Table 1: FEI CTS Pipelines: Summary of most recent MFL and geometry ILI tool runs

#	Pipeline Short Name	Pipeline Full Name	Distance Inspected (km)	MFL-A/Caliper			MFL-C		
				Year of ILI Run	Distance Valid ILI data were not Obtained (m)	Percent of Pipeline Successfully Inspected	Year of ILI Run	Distance Valid ILI data were not Obtained (m)	Percent of Pipeline Successfully Inspected
1	HUN BAL 1066 BAL NIC 1066	Huntingdon to Balfour 42" Balfour to Roebuck 42"	55.7	2018	0	100	2018	143	99.7
2	HUN NIC 762	Huntingdon to Nichol 30"	56.4	2016	45.2	99.9	2017	1312	97.7
3	LIV COQ 323	Livingston to Coquitlam 12"	34.9	2019	278.9	99.2	2019	1410	96.0
4	LIV PAT 457	Livingston to Pattullo 18"	29.8	2020	0	100	2019	2801	90.6
5	NIC PMA 610	Nichol to Port Mann 24"	4.9	2016	294	99.3	2016	130	97.3
6	CPH BUR 508	Cape Horn to Burrard Thermal 20"	9.0/8.0 (MFL-A/Caliper) 17.0 (MFL-C)	2019/2016	1641/242	81.8/96.9	2013	3490	79.5[2]
7	ROE TIL 914	Roebuck to Tilbury 36"	12.8	2020	39.7	99.7	2016	527	95.9
8	TIL BEN 323	Tilbury to Benson 12"	5.9	2021	0	100	2017	368	93.7
9	TIL FRA 508	Tilbury to Fraser 20"	9.6	2020	0	100	2016	2033	78.8[3]
10	NIC FRA 610	Nichol to Fraser 24"	24.3	2020	271	88.8	2016	1012	95.8
11	TIL LNG 323	Tilbury to LNG Plant 12"	1.7	2020	0	100	2020	10	99.4
12	NOO EMT 610	Noons Ck to Eagle Mtn 24"	1.8	2015	0	100	Baseline inspection scheduled for 2022	N/A	N/A
13	PMA CPH 914	Port Mann to Cape Horn 36"	1.3	2016	0	100	2016	0	100

22.1 Confirm which of the ILIs listed in Table 1 in the response to RCIA IR 1 11.5 had internal speed control capabilities, similar to the speed control capabilities in the proposed EMAT ILI tools.

Response:

FEI confirms that the ILIs listed in Table 1 of the response to RCIA IR1 11.5 had internal speed control capabilities similar to the speed control capabilities in the proposed EMAT ILI tools, except for the following pipelines:

- #8 – TIL BEN 323
- #9 – TIL FRA 508
- #11 – TIL LNG 323

Currently, the EMAT ILI tools provided by Rosen have the speed control capabilities for all of the pipeline diameters listed in Table 1, whereas the EMAT ILI tools provided by Baker Hughes have the speed control capabilities for 610, 762, and 914 mm pipeline diameters only.

23. Reference: Exhibit B-8, RCIA IR 1, IR 4.1; Exhibit B-1, Application, p. 29

Application p. 29:

"As part of FEI's project development work, FEI is completing a pilot of EMAT ILI evaluations on two CTS pipelines. This pilot is in progress, and as such, FEI is in the process of validating potential cracking detected by the EMAT tool."

RCIA IR 4.1:

"FEI has not received the vendor's final report of the pilot EMAT ILI. FEI is still in the process of validating EMAT ILI performance, the results of which will be used to generate the final report."

23.1 Confirm whether FEI has now received the vendor's final report of the pilot EMAT inline inspections. If confirmed, provide the vendor's final report.

Response:

FEI has not yet received the vendor's final report of the pilot EMAT inline inspections. FEI is still in the process of analyzing the cut-outs from the validation digs. As there are no reports of urgent crack related integrity threats on the pipeline sections included in the pilot project, FEI expects to share the results of testing with the ILI vendor in 2022, which will be used to generate the final report.

23.2 Confirm how many of the five remaining validation digs on each of the LIV PAT 457 and CPH BUR 508 lines have now been completed.

Response:

The five remaining validation digs on CPH BUR 508 have now been completed. The remaining five validation digs on LIV PAT 457 are scheduled for 2022.

23.3 Provide details of the validation dig findings including descriptions of features investigated, comparison of the in-ditch measurements with ILI measurements, and an assessment of the EMAT tool's performance.

Response:

During the validation digs, FEI investigated the following types of features identified by the EMAT ILI:

- Crack-groups in long seam or pipe body;
- Cracks in long seam;
- Cracks in pipe body;
- Linear indications, not deemed cracks, but which are narrow and straight in geometry; and
- Features of interest on pipe body or long seam, which may be cracks or crack-like features.

Comparison of the in-ditch measurements with ILI measurements is still on-going because many features have been cut out for further laboratory evaluation, which will determine the actual dimensions of the features. An assessment of the EMAT tool's performance will follow after sharing the information with the ILI vendor and after their re-evaluation of the ILI logs.