Q. Will any upgrading work be required on the section of transmission line from Western Avalon to St. John's if the Labrador Infeed does not proceed? If yes, describe the required upgrading.

A. No upgrading will be required in this scenario.

Q. Has a report been completed on the entire 230kV transmission system from Bay d'Espoir to St. John's to identify the required upgrading for the Isolated Island Option and for the Labrador Infeed scenario. If yes, provide a copy. If not, why not?

A. The analysis to support the required upgrades is provided in Exhibit 24, *"Island Transmission Outlook".* Confidential Exhibit CE-10, *"HVdc Sensitivity Studies",* and Exhibit 114 "Upgrade *Transmission Line Corridor Bay d'Espoir to Western Avalon*" provide additional detail for the required upgrades to the 230 kV transmission system east of Bay d'Espoir. These analyses are based on the assumption that previous works, including the installation of the shunt capacitor bank at Come By Chance, are completed.

The Island Transmission Outlook is updated on an annual basis to confirm the requirement and timing of transmission expansion plans previously identified and to identify longer term expansions that should be incorporated into the 20 year capital plan. For the Bay d'Espoir- East system, with the exception of those identified in the Exhibits referenced above, no further upgrades are required during the planning horizon. Any upgrades to the 230 kV system east of Soldiers Pond / Holyrood beyond the planning horizon would be common to both expansion plans, and would not affect the relative CPW difference between the Interconnected Island and Isolated Island expansion plans.

Q. Pg. 28 of the Report referred to in PUB-Nalcor-151 refers to a full import of 475 MW from the Maritimes under the Labrador Infeed scenario during the loss of the HVdc link between Labrador and the Island. What improvements, if any, would be required to the transmission system west of Bay d'Espoir to accommodate the full import of 475 MW from the Maritimes, what are the anticipated further capital expenditures associated with these improvements and will they be included in the cost of the Maritime Link?

A. While the Maritime Link is capable of importing 475 MW into Bottom Brook, Nalcor has used a 300 MW import from Nova Scotia in its analysis with the Maritime Link in service. Please refer to the 300 MW import referenced in Table 3 in Exhibit 106.

No upgrades to the system west of Bay d'Espoir beyond those contemplated to interconnect the Maritime Link are required to accommodate this level of import from Nova Scotia, and therefore no further capital expenditures are anticipated beyond those required to interconnect the Maritime Link. The costs required to interconnect the Maritime Link are included in the cost of the Maritime Link.

Q. Pg. 3 of Exhibit 105 states: *"While Hydro does not have a formal transmission planning criteria consistent with NERC transmission planning standards TPL-001 through TPL-006, most, if not all, of the procedures used in planning Hydro's transmission system are comparable to those used by other utilities. This Planning Manual documents the current transmission planning practices used and the tests applied to verify these practices. The Planning Manual also serves as a first step towards the development of a formal criteria."*

When does Nalcor anticipate completion of the development of its formal transmission planning criteria?

A. The establishment of a framework for reliability oversight is within the purview of the Government of Newfoundland and Labrador. As indicated in the *Energy Plan*[1], the Government of Newfoundland and Labrador will "monitor the development of standards of practices in the North American electricity industry, particularly market rules, transmission access rules and reliability oversight. This will ensure we are prepared to appropriately adopt these practices when we become more electrically integrated."

Once the Province establishes a process for introducing reliability oversight, Nalcor will prepare formal criteria as required by that process.

[1] *Energy Plan*, page 47.

Q. With reference to pg. 13 of Exhibit 106, should the phrase *"0.38 and 4.9 pole outages per year"* be *"0.16 and 4.9 pole outages per year"*?

A. Nalcor believes the phrase "0.38 and 4.9 pole outages per year" to be appropriate. Table 5 from the CIGRE report[1] discussed in Exhibit 106 is reproduced below (emphasis added):

(B) 2 Terminal Systems - 1 Converter per Pole

System	2007				2008				Average to 2008				
	Pole		Bipole		Pole		Bipole		Years	Pole		Bipole	
	f_p	d_p	f_b	d_b	f_p	d_p	f_b	d_b		f_p	d_p	f_b	d_b
Skagerrak 1 & 2	1.25	3.1	0.00	0.0	2.00	3.8	0.50	1.0	20	1.54	17.1	0.13	1.03
Skagerrak 3 (1)	1.00	1503.2	-	-	0.50	4360.4	-	-	15	1.53	484.2	-	-
Square Butte	1.00	4.1	1.50	0.3	5.25	0.8	0.00	0.0	18	2.85	6.2	0.42	2.27
CU	0.50	23.8	0.00	0.0	1.25	58.5	0.00	0.0	20	1.71	4.6	0.28	1.66
Gotland 2 & 3	0.25	0.8	0.00	0.0	0.50	46.6	0.00	0.0	20	0.38	35.8	0.20	1.49
Fennoskan (1)	2.00	14.2	-	-	1.50	46.4	-	-	19	2.26	10.1	-	-
SACOI (3)	3.33	1.7	-	-	1.67	2.5	-	-	16	4.90	2.6	-	-
New Zealand Pole 2 (3)	2.50	4.3	-	-	0.50	0.7	-	-	17	1.65	2.7	-	-
Kontek (1)	0.50	2.7	-	-	1.00	32.0	-	-	7	0.86	15.7	-	-
SwePol (1)	0.50	2.4	-	-	2.00	1.7	-	-	8	3.56	21.0	-	-
Kii Channel	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	8	0.16	99.6	0.00	0.00
Grita (1)	4.00	42.2	-	-	4.5	9.3	-	-	5	2.70	17.1	-	-

The Kii Channel system has demonstrated excellent performance during the eight years of operation reported in Table 5, and while the table indicates a pole outage rate ranging between 0.16 and 4.9 outages per year, Nalcor is of the opinion that operating experience from systems with longer operating history may be a better indicator of long-term performance. For systems with 15 or more years of operating history, the range is between 0.38 and 4.90 outages per year.

[1] CIGRE B4_2009_2010 "A Survey of the Reliability of HVdc Systems Throughout the World During 2007 – 2008", by M.G. Bennett, N.S. Dhaliwal, A. Leirbukt, CIGRE 2010

Please note Nalcor compared the upper end of the pole outage range (9.8 pole outages on a bipole system) to the rule of thumb of one pole outage per 100 km per year, but has not relied on the lower end of the range in its analysis.

Q. On pg. 21 of Exhibit 106, in reference to the corridor for 230 kV lines, TL202 and TL206, it is stated: *"It is difficult to determine the exact return period due to the lack of meteorological data along the corridor, loading data on the transmission lines, and actual line failures of TL202 and TL206. Based upon the analysis completed for the Avalon Upgrades and the lack of a structural failure on either TL202 or TL206, it is assumed that the design of each line is in the order of 1:25 years."*

The table on pg. 155 of Exhibit 85 clearly shows a structural failure of both TL202 and TL206 in February, 1970, due to wind and ice.

Please explain this discrepancy.

A. The structural failure that occurred on TL202/206 in February 1970 occurred at the eastern end of the transmission line in the vicinity of the Sunnyside Terminal station. This area, which is exposed to meteorological conditions similar to those experienced elsewhere in the Avalon area, is not indicative of the conditions experienced on the remainder of the transmission line route for TL202/206.

Table 2.1 of Exhibit 85 provides the design wind and ice loads for the Bay d'Espoir project. TL202/206 are in the Normal Zone[1], so the applicable design criteria are:[2]

Radial Ice in inches (mm)	Gust Wind Speed in mph (km/hr)
1.0 (25)	0 (0)
0.5 (13)	73 (117)
0 (0)	110 (176)

[1] Exhibit 85, Figure 2.1, page 35
[2] Exhibit 85, Table 2.1, page 33

Exhibit 87 describes an assessment of probabilistic climatic loadings on TL202/206, and Table 6 of Exhibit 87 indicates that the modeled ice loadings corresponding to a 10, 25, and 50 year return period are 31, 39, and 45 mm respectively along much of the TL202/206 route.[3]

The design ice loading for TL202/206 corresponds to a modeled 1 in 10 year return period, but the operating performance of the line (notwithstanding the failure in the Avalon area) has been good for over 40 years of operation. There is, however, a lack of meteorological data, a lack of loading data, and also a lack of actual failures along the majority of the route. Consequently, a 1:25 year return period has been assumed.

[3] Referring to Figure 6 of Exhibit 87, much of the route is in the 200 to 250 m elevation range, so the 183 m elevation is selected from Table 6.

Q. Further to PUB-Nalcor 166, with the failure data in Exhibit 85, more recent meteorological data and the analysis completed for the Avalon Upgrades, could an analysis such as that performed for the Avalon Upgrades be completed for TL202/206?

A. Such an analysis for TL202/206 is presented in Exhibit 87. As indicated in Nalcor's response to PUB-Nalcor-166, the failure data from Exhibit 85 is not useful in this analysis, as the loading in the area where the 1970 failure occurred is comparable to that of the Avalon Region.

Q. Table 5, Exhibit 106, indicates that the level of unsupplied energy for the Isolated Island Option varies from 0 MWh to 19,838 MWh for the years 2017 to 2037. Corresponding figures for the Island Interconnected Option without the Maritime Link range from 14,384 MWh to 93,744 MWh over the same period. This demonstrates that over the period 2017 to 2037 the Isolated Island Option has less unsupplied energy than the Island Interconnected Option without the Maritime Link.

Assuming for the moment that the loss of TL202/206 under the Isolated Island Option and a bipole outage under the Island Interconnected Option without the Maritime Link for the "*worst 2 week window*" is a reasonable comparison, please confirm that Table 5 demonstrates that the Isolated Island Option is more reliable than the Island Interconnected Option without the Maritime Link for the period 2017-2037?

A. While Nalcor agrees that Table 5 of Exhibit 106 indicates the Isolated Island alternative has less unsupplied energy than the Island Interconnected alternative without the Maritime Link, Nalcor does not agree with the conclusion that the Isolated Island alternative is more reliable than the Interconnected Island alternative without the Maritime Link for the period 2017 to 2037. Further information and context than is provided in Table 5 would be required to draw such a conclusion.

The results presented in Table 5 represent a worst case comparison of the level of risk of unsupplied energy during extraordinary events in the Isolated Island alternative and Interconnected Island alternative without the Maritime Link. As

indicated in Exhibit 106, the likelihood of an icing event occurring during the worst 2 week period is remote and the level of unsupplied load would be expected to be less than half of that indicated in Table 5 should an outage due to icing occur.[1]

While the Isolated Island expansion plan has considerable investment in thermal generation on the Avalon Peninsula, thermal units are deployed on the Avalon for economic rather than reliability reasons.

The expansion plans presented for both the Isolated Island and Interconnected Island alternatives meet all prescribed and accepted criteria for generation planning and from this perspective both can be considered of comparable reliability with the Interconnected Island alternative showing a considerable economic preference.

Without established criteria setting the level of acceptable risk to unsupplied energy during extraordinary operating conditions, Exhibit 106 demonstrates both the Interconnected Island and Isolated Island options perform comparably to or better than the current system during such conditions. Notwithstanding the level of performance provided by the current system, Table 6 in Exhibit 106[2] indicates that the level of unsupplied energy in the Interconnected Island alternative without the Maritime Link can be decreased through the addition of combustion turbines on the system, and the "level of exposure can be managed to a preset level by incremental additions of combustion turbines"[3].

[1] This issue is discussed in Exhibit 106 on pages 26 through 29
[2] Exhibit 106, Page 25
[3] Exhibit 106, Page 24

Nalcor has signed a term sheet with Emera for the construction of the Maritime Link, and therefore believes a comparison between the Isolated Island alternative and the Interconnected Island alternative with the Maritime Link is reasonable. If, however, the Maritime Link were not to proceed, and new reliability criteria were developed that required a lower level of unsupplied energy, then the exposure in the Interconnected Island expansion plan without the Maritime Link can be reduced by installing combustion turbines.

Nalcor therefore disagrees with the conclusion that the Isolated Island alternative is more reliable than the Interconnected Island alternative.

Q. Has Nalcor established a standard for the maximum acceptable limit of unsupplied energy? If so, please advise this standard. If not, why not?

A. NL Hydro has not established a definitive standard or limit for unsupplied energy. Instead of a single standard for unsupplied energy, NL Hydro has a Business Continuity Planning process that assesses both the impact on customers and likelihood of occurrence of events that could result in unsupplied energy. Based on this analysis NL Hydro completes an overall risk ranking.

The impact on customers is measured on the level of unsupplied energy on a scale of one to five with one being " business as usual" and five being an unsupplied energy of greater than 830 MWh. The likelihood of occurrence is also measured on a scale of one to five with one being " not very likely" (likelihood of occurrence less than once in 100 years) and five being " near certain" (likelihood of occurrence more than once per year). Based on the impact and likelihood an overall risk ranking of Low, Medium or High is determined.

Risks with an overall ranking of High have both high customer impact and high probably of occurrence and mitigation of these risks takes priority. Medium and Low risks on the other hand are less severe and these are assessed individually. The cost of risk mitigation may often out weigh the benefit and when this is the case the prudent utility view is to develop an emergency response plan to implement in the rare event of occurrence. Nalcor believes that an assessment of risk, including both assessment of customer impact and probability, along with the development of a mitigation plan to address these risks, is an appropriate and prudent alternative to implementing a single limit for unsupplied energy.

The loss of TL 202 and TL 206 in the current operating scenario and the loss of the Bipole in the Island Interconnected scenario are both High impact Low likelihood events. The cost of mitigation for either of these events is high and NL Hydro has opted to accept these risks consistent with its Business Continuity Planning process.

Q. Pg. 14, footnote 7 of Exhibit 106, refers to continuous monopolar rating of 552.6 MW. Is this correct? If not, the figure of 702.6 MW is also incorrect.

A. Footnote 7 is incorrect. The correct value for the continuous monopole rating is 530.6 MW, as stated in the last paragraph on page 14 of Exhibit 106. Together with three combustion turbines, the available capacity is 680.6 MW, which exceeds the 645.7 MW peak deliveries to the Island Interconnected System.

Footnote 7 should read:

The continuous monopolar rating of 530.6 MW plus start up of three 50 MW combustion turbines (Stephenville, Hardwoods and the new unit scheduled for 2014) results in a capacity of 680.6 MW, which exceeds the 645.7 MW Island Interconnected System block thereby eliminating any shortfall.