JOINT REVIEW PANEL FOR THE ENBRIDGE NORTHERN GATEWAY PROJECT
COMMISSION D'EXAMEN CONJOINT DU PROJET ENBRIDGE NORTHERN GATEWAY

Hearing Order OH-4-2011
Ordonnance d'audience OH-4-2011

Northern Gateway Pipelines Inc.
Enbridge Northern Gateway Project
Application of 27 May 2010

Demande de Northern Gateway Pipelines Inc.
du 27 mai 2010 relative au projet
Enbridge Northern Gateway

VOLUME 160

Hearing held at
Audience tenue à

Chances Prince Rupert
240 West, 1st Avenue
Prince Rupert, British Columbia

April 4, 2013
Le 4 avril 2013

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HEARING /AUDIENCE
OH-4-2011

IN THE MATTER OF an application filed by the Northern Gateway Pipelines Limited Partnership for a Certificate of Public Convenience and Necessity pursuant to section 52 of the *National Energy Board Act*, for authorization to construct and operate the Enbridge Northern Gateway Project.

HEARING LOCATION/LIEU DE L'AUDIENCE

Hearing held in Prince Rupert (British Columbia), Thursday, April 4, 2013
Audience tenue à Prince Rupert (Colombie-Britannique), jeudi, le 4 avril 2013

JOINT REVIEW PANEL/LA COMMISSION D'EXAMEN CONJOINT

S. Leggett	Chairperson/Présidente
K. Bateman	Member/Membre
H. Matthews	Member/Membre

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- Ms. Kathleen Shannon
- Mr. Dennis Langen
- Mr. Douglas Crowther

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- Mr. Darryl Carter

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- Ms. Caroline O'Driscoll

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- Mr. Chris Tollefson
- Mr. Anthony Ho
- Ms. Natasha Gooch

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- Mr. Chris Peter

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- Mr. Keith Bergner
- Mr. Lewis L. Manning

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- Ms. Cheryl Brown
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- Mr. Dave Shannon

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Fort St. James Sustainability Group
- Mr. Lawrence Shute
- Ms. Brenda Gouglas
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- Ms. Dawn Remington
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- Ms. April MacLeod
- Mr. Ken Maitland

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- Mr. David De Wit
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- Ms. Dominique Nouvet

United Fishermen and Allied Workers' Union
- Ms. Joy Thorkelson
- Mr. Hugh Kerr

Terry Vulcano

Dr. Josette Wier

National Energy Board/Office national de l'énergie
- Mr. Andrew Hudson
- Ms. Carol Hales
- Ms. Rebecca Brown
- Mr. Asad Chaudhary
- Mr. Neil Patterson

ERRATA

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Paragraph No.:	Should read:
2738: "…average value or the 75 -- 5th percentile or the…"	"…average value or the 75th percentile or the…"
2805: "…they're talking about not really going to affect…"	"…they're talking about are not really going to affect…"
2806: "Our proposed or preliminary operating criteria…"	"For our proposed or preliminary operating criteria…"
2807: "...triple island…"	"...Triple Island…"
2823: "They have access to, by radio, to Coast Guard…"	"They have access too, by radio, to Coast Guard…"
2854: "**MR. CROWTHER:** …"	"**MR. MICHAEL COWDELL:** …"
2887: "…generally follow a great circle route or come with a great circle route which it takes in…"	"…generally follow a great circle route or composite great circle route which takes in…"
2974: "One it's at Victoria and one at Triple Island."	"One was at Victoria and one at Triple Island."
3023: "Mr. Robinson, a question of how…"	"Mr. Robinson, the question of how…"
3077: "...navigational aid, he would the ability…"	"…navigational aid, he would have the ability…"

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Paragraph No.:	Should read:
3190: "…unless they're tug escort is available."	"…unless the tug escort is available."
3210: "…of the pendering system…"	"…of the fendering system…"
3214: "…I think Mr. Cowdell indicated that a range of limits in the application…"	"… I think Mr. Cowdell indicated that a range of limits appears in the application…"
3236: "**MR. MICHAEL COWDELL:** …"	"**MR. DAVID FISSEL:** …"
3244: "…beat the resistance of the underwater."	"…beat the resistance of the underwater hull."
3245: "…-- end up with a very small vector in the actual…"	"…-- end up with a very small side-ways vector in the actual…"
3306: "…electronics, Ektus, GPS, they are…"	"…electronics, ECDIS, GPS, they are…"
3354: "…that is clearly was not a tanker …"	"…that it clearly was not a tanker…"
3357: "…running over the fish ground -- boat or going aground."	"…running over the fish boat or going aground."
3236: "**MR. MICHAEL COWDELL:** ..."	"**MR. DAVID FISSEL:** …"
3369: "…an area where they weren't compelled to make…"	"…an area where they were compelled to make…"

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Paragraph No.:	Should read:
3446: "…major losses of single-hulled tankers were involved, uncoated ballast tanks."	"…major losses of single-hulled tankers involved uncoated ballast tanks."
3457: "…from the Designated Classification Society."	"…from the designated classification society."
3468: "So the double bottomed -- the…"	"So the double bottom -- the…"
3471: "**MR. ROBINSON:** …"	"**MR. CROWTHER:** …"
3515: "And what you see there identified are… the inner shell is 4 metres -- millimetres."	"And what you see identified are…the inner shell is 4 millimetres."
3665 to 3670: "**MR. ROBINSON:** …"	"**MR. STEVEN SCALZO:** …"
3733: "…regulations and rules and voyage."	"…regulations and rules and buoyage."
3807: "...the navigator hands the ship…"	"...the navigator handles the ship…"
3865: "…from Dariana in China to…"	"…from Darian in China to…"
3873: "... I don't if he was pouring..."	"… I don't know if he was pouring..."
3896: "...I don't think if this is helpful."	"...I don't know if this is helpful."

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Paragraph No.:	Should read:
3909: "...and the pilot is coming down it's initiating a port turn."	"... and the pilot is coming down he initiates a port turn."
3910: "...because it has to go..."	"...because he has to go..."
3912: "We want him to see that he..."	"We want to see that he…"
3919: "...send a lead aft…"	"...centre lead aft..."
3958: "…over the last year so I think…it's rather random cycle exchanges that…"	"…over the last years so I think…it's rather random cyclic changes that…"
3964: "All with regard to collisions,…"	"Only with regard to collisions,…"
3968: "…don't remain 2constant, that…"	"…don't remain constant, that…"
3982: "…is exactly that way to report -- it has been included in the report."	"…is exactly that way -- it has been included in the report."
3992: "…recommend that Northern Gateway to do at a significantly later stage when the detailing hearing has come forward…"	"…recommend the Northern Gateway to do at a significantly later stage when the detailed engineering has come forward…"
3993: "…we discussed earlier, whether might be some uncertainty…"	"…we discussed earlier, where there might be some uncertainty…"

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Paragraph No.:	Should read:
4038: "But if we go verify that on the Friday, the 5th,…"	"But if we verify that on the Friday, the 5th,…"
4028: "This quantitative risk assessment was to look at hazards due to project traffic..."	"This quantitative risk assessment was to look at hazards to project traffic..."

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AQ77-B	Douglas Channel Watch - IMO Guidelines for Formal Safety Assessment 2002.pdf	4994
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AQ77-E	Douglas Channel Watch - Environment Canada - West Coast Marine Weather Hazards Manual, 2nd edition	4994
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AQ77-G	Douglas Channel Watch - World Meteorological Organization - Manual on the Global Observing System, Vol. 1	4994
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Description **Paragraph No./No. de paragraphe**

UNDERTAKINGS/ENGAGEMENTS

No.	Description	Paragraph No./No. de paragraphe

--- Upon commencing at 7:59 a.m./L'audience débute à 7h59

JOHN CARRUTHERS: Resumed
JERRY ASPLAND: Resumed
JENS BAY: Resumed
AUDUN BRANDSAETER: Resumed
DAVID FISSEL: Resumed
AL FLOTRE: Resumed
KEITH MICHEL: Resumed
STEVEN SCALZO: Resumed
THOMAS WOOD: Resumed
MICHAEL COWDELL: Resumed
HENRIK KOFOED-HANSEN: Resumed

4050. **THE CHAIRPERSON:** Good morning, everyone. We meet again. Thank you very much for being back in Prince Rupert so that we can continue to test the information and understand the file in front of us.

4051. Before we get under way this morning, the Panel would like to briefly address a motion that was filed by BC Nature and Nature Canada on the 2nd of April. Through that motion, BC Nature has asked the Panel to issue a further procedural direction in which the following two questions would be addressed.

4052. The first one is, what is the content of the right of cross-examination in the Enbridge Northern Gateway Joint Review Panel hearing. And the second question was, what are the obligations of witnesses in this hearing when under cross-examination.

4053. BC Nature further seeks to have the current Northern Gateway shipping and navigation panel extended and to have any ensuing panels stay pending a ruling on this motion. This would provide BC Nature and any other intervenors with the opportunity to reopen their cross-examination of the Northern Gateway shipping and navigation panel based on the clarifications and elaborations in any procedural direction the Panel issues.

4054. On the 3rd of April, letters in support of the BC motion were filed by Coastal First Nations, the Sustainability Coalition and the Council of the Haida Nation.

4055. The Panel will accept further comments in writings from parties in

support of the motion by noon Pacific Standard Time on Friday, the 5th of April, 2013. Parties opposed to the motion may comment in writing again by noon Pacific Time on Monday, the 8th of April, 2013. BC Nature may reply in writing by noon Pacific Time on the 10th of April, 2013.

4056. The Panel will not extend the hearing time for the current shipping and navigation witness panel or otherwise defer future witness panels at this time. If necessary, witnesses could be recalled to testify. Accordingly, until further notice, we will proceed as planned with the current witness panels.

4057. Are there any other parties who have preliminary matters that they wish to raise?

4058. Good morning, Mr. Crowther.

4059. **MR. CROWTHER:** Good morning, Madam Chair and Members. I have two preliminary matters, but I understand one of the witnesses may have a transcript correction to make on the record.

4060. **THE CHAIRPERSON:** Let's proceed with that first, then.

4061. **MR. CROWTHER:** And I think it may be Mr. Brandsaeter, who I assume is listening.

4062. **MR. AUDUN BRANDSAETER:** Yes, I am.

4063. **MR. CROWTHER:** Go ahead, Mr. Brandsaeter, please.

4064. **MR. AUDUN BRANDSAETER:** Good morning, everyone. I have a correction to make in my testimony of Friday, March 22nd in the transcript in paragraph 3965, Volume 159 in response to Mr. Robinson's question in paragraphs 3960 and 3961. It's related to increase of traffic and expected increase of collision frequency.

4065. If all traffic increased uniformly by two percent and everything else remained constant, then the expected increase in collision frequency could be approximately four percent at 1.02 times 1.0 to equal 1.04 or, even more exactly, 1.0404.

4066. On the other hand, if the increase in all traffic is four percent, it would

not be correct to square four and get 16 and assume a 16 percent increase in collision frequency. An increase of approximately eight percent would be expected at 1.04, squared is 1.08.

4067. An increase in collision frequency by the square of the increase in traffic would presuppose, among others, a uniform increase in all traffic, project-related traffic as well as non-project related traffic. It would apply to the total collision frequency, not to the number of incidents per nautical mile and, hence, this would not justify an increase in the scaling factor, for instance, for collisions by the square of the increase in traffic and neither would the collision frequency as estimated in the marine shipping QRA increase by the square of the increase in traffic to Prince Rupert or Kitimat alone.

4068. That was my correction. Thank you.

4069. **MR. CROWTHER:** Madam Chair, the two other procedural matters are, firstly, I'm delighted to say that I am -- for the record, that I am joined at the witness table by -- sorry; at the counsel table by Ms. Kathleen Shannon, who will be with me for the balance of the appearance of this witness panel.

4070. As to the second, Madam Chair, I'm appreciative of the process that you have established regarding the motions that were received recently. Nevertheless, I submit that the circumstances are such that immediate comment by Northern Gateway is both justified and necessary. Northern Gateway will likely have quite a bit more to say in its written submissions that it will file according to your schedule.

4071. The motions and letters and, in particular, the motion filed by BC Nature and Nature Canada, make allegations and insinuations regarding the conduct of the Northern Gateway witnesses, to say nothing about those aimed against the Joint Review Panel and me as counsel that, in my submission, have a real prospect of prejudicing Northern Gateway and impinging upon the orderly progress of this proceeding. They cannot be left unchallenged before the questioning of this witness panel continues.

4072. Simply stated, Madam Chair and Members, I urge you to reject any attempt, including these latest ones, to create an impression -- whether within this proceeding or perhaps for another audience outside of it -- that the Northern Gateway witnesses are being anything less than forthright in their testimony before this Joint Review Panel. Such attempts are grossly unfair to these

gentlemen and are as insulting as they are baseless.

4073. The Members of the Joint Review Panel will know that, for decades and as a matter of course, the National Energy Board has permitted, perhaps encouraged, the appearance of witnesses in panels. The Board's practice is also to permit the witnesses to confer, the best able witness to answer, and more than one witness to respond to a question when appropriate.

4074. You confirmed this earlier in the proceeding, Madam Chair, when you stated at paragraph 11179 of Transcript Volume 113:

"...in this setting this is a perfectly typical approach."

4075. The approach is not only typical but, importantly, promotes efficiency.

4076. As you also stated previously, Madam Chair, as reported at paragraph 11180 of the same Transcript Volume, it facilitates the Panel obtaining the best evidence possible on the record.

4077. Further, it must be noted that Procedural Direction Number 9, which was issued as long ago as August 17th of last year, expressly contemplated among other things, members of a witness panel consulting with each other before answering questions.

4078. In short, Madam Chair, these witnesses have done nothing new and nothing wrong. To the contrary, I submit that they are quite obviously doing all that they can to provide you with the best possible evidence.

4079. And one final related comment. No one knows better that you, Madam Chair and Members, that the evidentiary record in this case is massive. The back row support teams have been made available in the hearing room throughout the proceeding to assist the Northern Gateway witnesses in responding to the many intervenors who are fully exploiting the ample opportunities that they have been provided to test that evidence.

4080. I introduced each of the four gentlemen who are providing back row assistance to this witness panel and explained their role when these witnesses were empanelled on March 18th. The transcript reference is Volume 155, paragraph 31032. Northern Gateway makes no apologies for these efforts to

ensure that the Joint Review Panel receives the best evidence upon which to base its decision.

4081. Now, that is what I have to say on these matters for the moment, Madam Chair. Thank you.

4082. **THE CHAIRPERSON:** Mr. Crowther, as I mentioned earlier this morning, we will continue to handle this matter as a written matter.

4083. So we will proceed now with the resumption of the questioning of the Shipping and Navigation Panel.

4084. Just for the record, so I make sure that I'm in the right headspace, the order that I have of questioners at this point is we will start this morning with the Gitxaala Nation, followed by Douglas Channel Watch, then the Heiltsuk Tribal Counsel, United Fishermen and Allied Workers Union and then the Haisla Nation.

4085. So if there are any changes to that order that I'm not aware of, would you please have -- make our legal counsel aware of those changes?

4086. So seeking nobody else coming to the mic with preliminary matters, Ms. Mathers, you're on the phone; is that correct?

4087. **MS. MATHERS:** I am.

4088. **THE CHAIRPERSON:** Terrific, Ms. Mathers.

4089. Please go ahead with your questions of this Panel.

--- EXAMINATION BY/INTERROGATOIRE PAR MS. MATHERS:

4090. **MS. MATHERS:** Thank you.

4091. Good morning. My name is Virginia Mathers. I'm here this morning on behalf of the Gitxaala Nation.

4092. Am I coming through clearly? Can you hear me okay?

4093. **THE CHAIRPERSON:** Ms. Mathers, it's Sheila Legget. You're

very clear actually, so please proceed with your questions.

4094. **MS. MATHERS:** Thank you.

4095. So in light of the considerable ground covered by the parties who questioned a few weeks ago, Gitxaala just has a few questions for this Panel and I'd like to start with, Madam Gilbert, if you could please bring up the first AQ filed by Gitxaala for this Panel, which is the Oil Tanker Spills Statistics document?

4096. Thank you.

4097. Have the members of the Panel had the opportunity to review the highlighted portions of this document?

4098. **MR. KEITH MICHEL:** Yes, we have.

4099. **MS. MATHERS:** This document is a publication of -- by the International Tankers Owners Pollution Federation Limited.

4100. Is that correct?

4101. **MR. KEITH MICHEL:** Yes, that is correct.

4102. **MS. MATHERS:** And this is an international organization that tracks oil spill data; correct?

4103. **MR. KEITH MICHEL:** Correct.

4104. **MS. MATHERS:** And the data collected by this organization had been referenced in Northern Gateway's Application; is that right?

4105. **MR. KEITH MICHEL:** Yes, it has.

4106. **MS. MATHERS:** Thank you.

4107. Would the members of the Panel agree that this organization, which I'll call the "ITOPF", that it's a reliable source of data on oil spills?

4108. **MR. KEITH MICHEL:** Yes, this is one of the best sources and one

of the most comprehensive sets of data on oil spills.

4109. **MS. MATHERS:** Thank you.

4110. Ms. Gilbert, if we could please go to page 6 of this document?

4111. Thank you.

4112. At the highlighted portion of page 6, the authors of the report note that most of the oil spilled, which they're tracking, comes from a relatively small number of large spills.

4113. Does the Panel agree with that finding?

4114. **MR. KEITH MICHEL:** Yes, we do.

4115. **MS. MATHERS:** In fact, the authors' note that, in the 2000s, 44 percent of the oil spilled came from just two incidents; is that right?

4116. **MR. KEITH MICHEL:** That's correct.

4117. In fact, I think it would be helpful if we looked briefly -- I think it's Figure 4, which shows the spill history of -- actually, if we could go down to a little further. Keep going. Well, that's -- I think I have the 2011 report which is different than this one.

4118. But there have been a number of major spills since 1970 that have contributed to the large majority of the oil spilled in the water.

4119. There is a graph presented by ITOPF which shows nine of these major spills and it should be noted that every one of the major spills was from a single-hulled tanker. In fact, since 1990, when double-hulled tankers began to be built in significant quantities, there've only been a few spills from double-hulled tankers, and the largest spill is 2500 tonnes. So this is very small compared to the large spills that you're showing and the amount of spillage.

4120. And although it's recognized that, someday, we will have a spill from a double-hulled tanker larger than 2500 tonnes, in fact, the large spill scenario that is presented in TERMPOL is 36,000 cubic metres versus the 2500 tonnes or roughly 3,000 cubic metres that has been experienced by double-hulled tankers

since 1990.

4121. So the assumed large spill in TERMPOL is nearly, or more than, 10 times the size of what's been experienced to date from double-hulled tankers.

4122. So again, yes, a few large spills contribute to the majority of total spillage. These have all been from single-hulled tankers and -- but we do agree with the statement as presented.

4123. **MS. MATHERS:** And in terms of the data collected by the ITOPF, the data they have access to is predominantly those spills from single-hulled tankers; is that right?

4124. Because the double-hulled tankers are a much newer fleet?

4125. **MR. KEITH MICHEL:** They are a newer fleet -- since 1990 -- between 1990 and 2012, which is -- during that time period on a weighted average, approximately 45 percent of the tankers were double-hulled tankers. It was only a few percent in 1990, today it's well over 95 percent are double-hulled tankers. So on the average, a little less than half on a weighted average were double-hulled tankers.

4126. **MS. MATHERS:** So we don't have quite the same track record in terms of tracking the safety of double-hulled tankers as we do for single-hulled tankers at the moment?

4127. **MR. KEITH MICHEL:** It's now been 22 years since OPA '90 was adopted and we have quite a significant track record and it's a very good track record. If you look at the number of incidents of double-hulled tankers compared to the total number of incidents, it's a very small percentage.

4128. I could only find in the database five incidents of double-hulled tankers involved in collisions or groundings that had a spill greater than 700 tonnes. This is a very small percentage of the total number of spills over 700 tonnes in spite of the fact, as I noted earlier, roughly 45 percent of the ships during this period were -- the tankers during this period were double-hulled tankers.

4129. So there is a significant amount of data available now, and the data strongly indicates that the number of incidents are declining for tankers in

general, and that double-hulled tankers are working quite well, meeting or exceeding the projected expectations that were developed analytically in 1990.

4130. **MS. MATHERS:** Ms. Gilbert, if we could turn to page 7 of this document, please?

4131. So what we see at Table 3 is a list of major oil spills since 1967; is that right?

4132. **MR. KEITH MICHEL:** That's correct.

4133. **MS. MATHERS:** And at the bottom of this table, the Exxon Valdez spill is listed not because it's one of the largest, but for comparison; is that right?

4134. **MR. KEITH MICHEL:** Yes, it's listed. I'm not sure why ITOPF chose to list it, but it may well be as you say.

4135. **MS. MATHERS:** And that 37,000 tonnes, the Exxon Valdez spill is by far the smallest spill listed on this table; is that right?

4136. **MR. KEITH MICHEL:** That's correct. Again, we should note that this data extends from the early seventies through 1990-91, I see the Prestige 2002. Again, every single tanker that appears on this list is a single-hulled tanker.

4137. **MS. MATHERS:** According to this table, the ITOPF has identified seven major oil spills larger than the Exxon Valdez since 1989; is that correct?

4138. **MR. KEITH MICHEL:** We could accept that subject to check.

4139. **MS. MATHERS:** Thank you.

4140. And in fact, some of these spills have been significantly larger than the Exxon Valdez; correct?

4141. **MR. KEITH MICHEL:** That is correct.

4142. **MS. MATHERS:** And being an international organization, these -- this data has been collected from spills that have been distributed around the world; correct?

4143. **MR. KEITH MICHEL:** Yes, this is an international database.

4144. **MS. MATHERS:** And some of these spills have happened out in the high seas and the open water; correct?

4145. **MR. KEITH MICHEL:** Yes. The -- again, we'll -- we should go back to the type of casualties that single-hulled tankers have been subject to. And single-hulled tankers in the past were not always properly coated, particularly the ballast tanks and some of these vessels experienced extensive corrosion. And particularly in the 1970s, there were a number of single-hulled tankers that in the open ocean broke in half and lost their entire contents.

4146. Again, as we've discussed earlier in the hearings, the double-hulled tankers have higher structural reliability than single-hulled tankers. There are new regimes for coating of tankers, for inspection of tankers to help ensure that these incidents don't occur again. And there hasn't been a single occasion of a foundering of a double-hulled tanker.

4147. **MS. MATHERS:** Some of these spills have also happened near ports, for example, the Prestige spill near Spain; is that right?

4148. **MR. KEITH MICHEL:** That is correct. The Prestige spill initiated close to port and it eventually was moved offshore, but it was a spill that occurred close to port.

4149. **MS. MATHERS:** Given the evidence that's been provided by this panel, would the witnesses be surprised if an oil spill the size of the Exxon Valdez resulted from this project?

4150. **MR. KEITH MICHEL:** Yes, it would be very unlikely that spills the size of the Exxon Valdez resulted from this project. The quantitative risk assessment which was carried out as part of TERMPOL shows that there's a very low probability -- very small probability of a spill and particularly a large spill.

4151. **MS. MATHERS:** Thank you, Madam Chair, those are all my questions. Thank you, Panel Members.

4152. **THE CHAIRPERSON:** Thank you, Ms. Mathers.

4153. **MS. MATHERS:** Thank you.

4154. **THE CHAIRPERSON:** So we'll call Douglas Channel Watch now, please.

4155. Ms. Gilbert, while Douglas Channel Watch are getting seated, could we get an AQ number please for the Gitxaala Nation?

4156. **THE REGULATORY OFFICER:** AQ76.

---AID TO CROSS-EXAMINATION NO./AIDE AU CONTRE-INTERROGATOIRE No. AQ76-A:

Gitxaala Nation - ITOPF-Oil Tanker Spill Statistics 2011.pdf

--- (A short pause/Courte pause)

4157. **THE CHAIRPERSON:** Good morning, Ms. Brown, Mr. Shannon. Who's going to begin with the questions?

4158. I see the microphone pointed in your direction, Ms. Brown, it looks like you're going to begin with the questions; is that correct?

4159. **MS. BROWN:** Yes, I am.

4160. **THE CHAIRPERSON:** Thank you. Please begin when you're ready.

--- EXAMINATION BY/INTERROGATOIRE PAR MS. BROWN:

4161. **MS. BROWN:** Just to let Mr. Brandsaeter -- I have difficulty hearing him. I was listening to his conversation in the earlier part and I had difficulty hearing parts of his sentences, so I'm not sure how to rectify that.

4162. **THE CHAIRPERSON:** Why don't you ask your questions of Mr. Brandsaeter and if we're still having trouble hearing, then we'll make sure that we make the whatever corrections ---

4163. **MS. BROWN:** Okay.

4164. **THE CHAIRPERSON:** --- can occur.

4165. **MS. BROWN:** Okay. All right.

4166. **THE CHAIRPERSON:** Mr. Brandsaeter, it may be a matter of you speaking a little more slowly and clearly just to make sure that people can hear your answers to any questions that you're posed.

4167. **MR. AUDUN BRANDSAETER:** Yes, I'll be sure to try to speak very slow.

4168. **MS. BROWN:** Yeah, I -- the -- just I'm going to ask some questions around the tugs.

4169. So the introduction and proper operation of tethered and close escort tugs more than triples the return periods within the DNV document.

4170. I wanted to ask, are you -- about your determination of the effectiveness of the tubs -- tugs. And there's some -- there's numerous references to this, but I'd like to go to in B23-31, Table 8.1.

4171. **THE CHAIRPERSON:** Ms. Brown, do you have an Adobe page number for that?

4172. **MS. BROWN:** One thirty-two (132).

4173. **THE CHAIRPERSON:** And it's B23-31?

4174. **MS. BROWN:** Thirty-four (34).

4175. **THE CHAIRPERSON:** Thirty-four (34).

4176. **MS. BROWN:** There it is.

4177. So in this table, you indicate the tug escort effect on reducing the frequency of incidents. I would like to ask how you get to the percentages listed on this table and the variety of incident types.

4178. **MR. AUDUN BRANDSAETER:** Yes. As were indicated, the report that this is based on is, unfortunately, a confidential report made for another

client, but based on the work from both for ---

4179. **MS. BROWN:** I can't hear.

4180. **MR. AUDUN BRANDSAETER:** --- wholly in the report that is referenced, and also in other work that we have done.

4181. **THE CHAIRPERSON:** Good morning, Mr. Brandsaeter, it's Sheila Leggett here.

4182. Ms. Brown, were you saying you're still having trouble hearing?

4183. **MS. BROWN:** Yeah, I don't know if it's the quality of the signal or if I need -- if there's a way that I can listen to a direct line. I -- when I was listening to Mr. Brandsaeter over the line, over the phone or, you know, through the webcam, I could hear him and understand him, but I don't hear him.

4184. **MR. AUDUN BRANDSAETER:** I also hear some echoes when I talk, so I -- some feedback from the hearing room.

4185. **MS. BROWN:** That's a bit better, yeah. It must be our age.

4186. **THE CHAIRPERSON:** So Mr. ---

4187. **MR. AUDUN BRANDSAETER:** Okay.

4188. **THE CHAIRPERSON:** --- Brandsaeter, if you could begin again. And again, I'd encourage you to speak slowly and enunciate clearly so that everyone in the room can follow, and on the webcast.

4189. **MR. AUDUN BRANDSAETER:** Yes, I will.

4190. Well, I don't think the webcast has audio as well. I was told by the technician that I should use the phone, but if there is an issue with that, of course I could try.

4191. **THE CHAIRPERSON:** Mr. Brandsaeter, are you on speakerphone at the moment?

4192. **MR. AUDUN BRANDSAETER:** Well, I'm on my phone just with a

headset just to hear you better, but I can try to go directly to the phone.

4193. **THE CHAIRPERSON:** Why don't we try that to see if we get better clarity?

4194. This is a new experience for us, so we're having ---

4195. **MR. AUDUN BRANDSAETER:** Can you hear me better now?

4196. **THE CHAIRPERSON:** Well, if you could just continue talking for a moment. Is it snowing in Norway?

4197. **MR. AUDUN BRANDSAETER:** No, it's actually have a bright blue sky, have very nice weather. We had a great Easter, so -- in that respect.

4198. **THE CHAIRPERSON:** Are people here in the hearing room able to understand what Mr. Brandsaeter is saying?

4199. **MS. BROWN:** Yeah.

4200. **THE CHAIRPERSON:** Okay. So then let's get away from the weather and go back to what we're here to talk about, which is -- now, Mr. Brandsaeter, did you understand Ms. Brown's question? Did you hear it? Did you need it repeated, or are you ready to provide the answer?

4201. **MR. AUDUN BRANDSAETER:** I think I'm ready to provide the answer.

4202. **THE CHAIRPERSON:** Please proceed.

4203. **MR. AUDUN BRANDSAETER:** The basis for the numbers that we have used, if unfortunately, a report or work that was done for another client and they have asked him, and unfortunately he wants to keep that confidential.

4204. However, if it's in line with the analysis that we have done and the reports that we have prepared also for other clients, the effectiveness for a close and tethered escort with regard to this grounding, as in all these others, shown to be extremely high. That's why we use a number as high as 90 percent as to effectiveness of the tethered and close escort tug with regard to this grounding.

4205. A slightly lower effectiveness has been shown for other groundings --

other solutions with regard to grounding. So for all the other types of grounding scenarios, we have used 80 percent, and we consider that to be quite conservative.

4206. When it comes to collision, it's a discussion whether 5 percent, in fact, is far too low efficiently -- for effectiveness. Indications show that it could just as well be of the order of 20 percent. But because collision doesn't contribute that much, we would rather use a conservative number, and we have used 5 percent.

4207. Of course, collision also involves other vessels, so there's no reason to believe that the effectiveness should be 50 percent or higher than that. So we know that it should be of the order of less than 50 percent. But the number 5 percent that we have used, we are very confident that this is extremely conservative.

4208. **MR. STEVEN SCALZO:** Also, I think we mentioned on the record, prior testimony, that other studies that we have seen -- and there's been a series of them, probably more than a half dozen -- have shown in similar situations for the application of escort tugs in mitigation to the risk of grounding and also collision similar percentages in that range as shown on this exhibit.

4209. Also, with respect to our experience operating escort tugs in similar services as will be indicated by this project, to date we have not experienced any incidences at all with respect to tankers with escort tugs that have resulted in either powered or drift groundings.

4210. **MS. BROWN:** You have not included those studies in your document. Is there a reason for that?

4211. **MR. STEVEN SCALZO:** No, the studies are not included, but all available publicly on websites and other access to general public.

4212. **MS. BROWN:** So then why was the 2002 study chosen specifically in reference to?

4213. **THE CHAIRPERSON:** Mr. Brandsaeter, are you still with us?

4214. **MR. AUDUN BRANDSAETER:** Yes, I am.

4215. **THE CHAIRPERSON:** Terrific. Thank you.

4216. **MS. BROWN:** So was there -- just to clarify that, was there a particular study why the 2002 DNV study was referenced to? And it was specifically referenced.

4217. **MR. AUDUN BRANDSAETER:** Sorry; I think I will ask Ms. Brown to repeat the question.

4218. **MS. BROWN:** The -- in the document, the DNV document, other studies were not included, but yet the 2002 DNV confidential study was specifically referenced.

4219. Was there a particular reason why that was the case when there were other studies available?

4220. **MR. AUDUN BRANDSAETER:** No, there was no particular reason, except that this report, even though it was confidential, gave numbers in terms of percentages in risk reducing effects for all the types that they wanted to assess.

4221. Whereas -- really, there were exceptions for collision, which we picked from another source; whereas the other ones did not consider tethered tugs to the same degree as found here. That was at least more difficult to identify whether they were just close escort tugs or tethered tugs in the assessment as we had available.

4222. So it was mentioned in order to show that it was not a number picked out of the air, so to speak. But the important -- as I said, they have asked for permission to make it public but -- our client didn't want and he had also his own clients to take care of, who neither wanted this presented in the public.

4223. **MS. BROWN:** So if I understood you correctly then, you're saying that this was a better study. The other ones weren't as inclusive and representative of what was being done in this particular -- how it was being compared to what it was being used for the Northern Gateway. Is that what you're saying?

4224. **MR. AUDUN BRANDSAETER:** Not necessarily that it was a better study but that it was one that had the numbers that we needed for completing this study. So it was a -- a choice that we made to select this one.

4225. **MS. BROWN:** Okay, I think I understood that.

4226. So what methodology did you use, looking at all these studies, to determine these percentages?

4227. **THE CHAIRPERSON:** Mr. Brandsaeter, did you hear the question from Ms. Brown?

4228. **MR. AUDUN BRANDSAETER:** Yes, I'm just needing to pick up some notes I've made here.

--- (A short pause/Courte pause)

4229. **MR. AUDUN BRANDSAETER:** I'm sorry I'm taking a little bit of time here to open my notes.

--- (A short pause/Courte pause)

4230. **MR. AUDUN BRANDSAETER:** What I can say from the methodology applied in the Fawley study without compromising the confidentiality of my client is that the risk of grounding for a tanker failing to Fawley terminal was assessed for the following scenarios, both without any escort operations, with the escort operations, the way they had used -- 2002, and a future escort operation with what they considered to be an optimized escort tug quite similar to the procedure we would like to apply for the Northern Gateway Project plans, specifically designed for the particular use of the tug.

4231. The effect of the tugs on the probability of collision was also subject to a course -- qualitative assessment, such as just mentioned a couple of minutes ago, to less deep a degree with regard to grounding.

4232. The capability of the tugs to prevent a tanker grounding in case of a blackout, steering machinery or steering system failure or a human failure was assessed. And the expected frequency of grounding, even the different tug schemes was then calculated.

4233. For the traffic to the Fawley terminal, the optimized escort tug was then considered to be a tug capable of providing a steering pull of 90 tonnes. And the reduction of the grounding frequency for an escort operation with this optimized escort tug was estimated to be 89.6 percent.

4234. The tug may assist in the turning and braking of the tanker to avoid the

collisions. However, due to very limited space available in the channel approaching Fawley, it was considered unlikely that it would be possible to steer the tanker back on course for that Fawley study and then avoid grounding in the more narrow part.

4235. But it should then be mentioned that with -- compared to the channel in the approach to Kitimat, that channel towards Fawley is extremely narrow. There's much, much less space to navigate with sufficient depth in that area.

4236. **MR. STEVEN SCALZO:** I'd just, again, add that our experience certainly backs up what Mr. Brandsaeter just said. And I think if you look at escort tug utilization recently, certainly since the early 2000s, there's been more experience recently with escort tug application similar to this in terminals around the world. Again, this is more recent experience.

4237. Our experience in Puget Sound goes back certainly to the 1980s and again our actual experience with escort tugs and the experience of recent facilities utilizing the escort tugs both sort of corroborate the statistics shown here that from our experience, there certainly haven't been any incidence related to drift grounding or power groundings.

4238. **MR. KEITH MICHEL:** In 1999, my company, Herbert Engineering Corp., conducted a tug escort study on behalf of the U.S. Coast Guard for the Strait of Juan de Fuca Puget Sound area. And ours was -- our analysis was completely independent of DNV. We utilized both our best efforts at first principles analytical study of this, which is very difficult, and also utilized a panel of experts to come up with estimates. And our numbers ranged from 64 percent to 91 percent effective, and we only evaluated close escort in that study. Tethered escort would be significantly more effective than a close escort.

4239. So once again, it's another piece of documentation that supports the numbers that were used in the QRA. That study is publicly available.

4240. **MS. BROWN:** So my understanding is, as I was putting this all together, that the information or the -- about the effectiveness of tugs is quite new. I think your study of 1999 and there's some history in the eighties but generally it's in the 2000s that the use of the escort tugs and the -- looking at their effectiveness is actually been in actual case, during this timeframe. So I understand that.

4241. Do you have a databank of how this -- how the tugs are being effective in regard to incidents that they've corrected or managed or -- and how that transpired? Is there...

4242. **MR. STEVEN SCALZO:** With respect to our specific experience, no, we've not kept a databank of specific incidents. Again, our history with escort goes back to the early 1980s and, in all cases, the application of escort tugs to any incidents were successful.

4243. So there is, in our specific case, certainly to the Pacific Northwest, the application Alaska and up and down the U.S. west coast a fairly large base of experience. Internationally, the application of escort tugs has really developed in the early 2000s.

4244. **MS. BROWN:** So what you're saying is you don't -- you haven't got a databank of the incidences that have been potentially corrected, as for lack of a different word, and near misses?

4245. **MR. STEVEN SCALZO:** No, we've not kept a specific list of incidents.

4246. **MS. BROWN:** Okay.

4247. **MR. STEVEN SCALZO:** Though there have been some, but none have resulted in any groundings and/or any spills.

4248. **MS. BROWN:** So the study that was done in 1999 in Puget Sound you said it was an analytical study. And I don't know if it's been referred to within this DNV study, but just a question regarding it. What variables did you consider within the quantitative study?

4249. **MR. KEITH MICHEL:** As I mentioned, it was a study of close escorts and not tethered escorts. So the tugs were escorting tankers. But in that case we looked at the ability of those tugs to rescue not only the tankers they were escorting but other vessels in the Strait of Juan de Fuca and Puget Sound.

4250. And so in that case we did an analytical study where we looked at the traffic flow through the Strait and into Puget Sound, assessed the probability that a ship would lose power, probabilistically how long it would take the escort tug to get to that vessel. We looked at a range of weather conditions over time.

4251. So we assessed the probability that the tug could make up with the stricken vessel and then stabilize that vessel. And so that type of statistical analysis was done. And then again we augmented that type of an analysis with expert opinion. The -- and they did largely collaborate each other in this case.

4252. **MS. BROWN:** Thank you.

4253. So the variables of distance, and weather, and traffic volume were considered within that study. But we do not know in the DNV 2001 study what variables were considered; is that right?

4254. **MR. KEITH MICHEL:** Ms. Brown, is that a question for Mr. Brandsaeter?

4255. **MS. BROWN:** Yes, sorry. Where is he?

4256. **THE CHAIRPERSON:** In Norway.

4257. **MS. BROWN:** Exactly.

4258. **MR. AUDUN BRANDSAETER:** The study was made on a general basis for all types of weathers, where -- approach to the terminal is allowed. I don't have the details of that but that would be similar to the process that would be made in order to establish the limits for when approach and berthing at Kitimat would be allowed. So that would be typically be part of the vehicle engineering of such an approach.

4259. **MR. KEITH MICHEL:** Again ---

4260. **MR. AUDUN BRANDSAETER:** I should, though, mention that for even a couple of years or maybe it's four years before the Fawley study was done, a similar study was made for a terminal on the west coast of Norway named Sture where the effectiveness with regard to grounding frequency was assessed to be as high as 92 to 96 percent for VLCCs escorted by one tug only in fact, and that is up to 32 knots and significant wave heights of up to 5.5 metres. So it's also an indication that the order of magnitude of these numbers are in the right ballpark.

4261. **MS. BROWN:** So in your data -- so it was experiential data that you were looking at. So you were using -- you hadn't done studies -- or had you done

studies to determine the effectiveness of tugs? Like your data currently is experiential data; is that correct? For lack of a better word. So you haven't -- you didn't -- my question is what type of data is this based on is it…

4262. **MR. AUDUN BRANDSAETER:** This is based on experience and the calculation of necessary steering force, the technical aspects of the situations that could occur and could cause a grounding to occur.

4263. **MR. KEITH MICHEL:** And again, in the QRA when the risk of a collision or grounding was initially evaluated in the unmitigated situation, the international database was utilized, which -- where you could assess the number of casualties that did occur over a period of time and, as was noted, a 17-year period of time was utilized for that part of the study.

4264. As was just explained by Mr. Scalzo, you couldn't use such data to assess escort tugs because there's never been a case, that we know of, where an escort -- where a tanker utilizing a tethered escort has run aground or been involved in a collision. And therefore it's necessary to rely on some level of analysis, and that does have its limitations, so then you rely on the opinion of experts.

4265. **MR. STEVEN SCALZO:** And in the case of the information that Mr. Michel just added, our experience over those years, going back to the early 1980s, has been with both tethered and untethered escort tugs.

4266. And I'd just like to make the distinction that we are talking about purpose built tractor designed escort tugs for services that have either voluntarily or by regulation required or requested escort service. So these are tractor tugs, purpose built designed and utilized in tanker escort services.

4267. **MS. BROWN:** So you must have had studies prior to the use of these tugs to determine their effectiveness within what you wanted to accomplish?

4268. **MR. STEVEN SCALZO:** Yes, that's correct. We conducted extensive studies prior to the application of tractor tugs for escort service. I think we put quite a bit of information on the record in previous testimony but included detailed investigation into the best type of tugs -- tug propulsion systems, strategies, that led to design and specific construction and operation of vessels to meet escort of large ships.

4269. And our discussion today, tankers, specific to routes, whether it was in Alaska or in Washington or California, the application of those tugs for those particular services.

4270. **MS. BROWN:** Was there any specific model used within the testing of those tugs?

4271. **MR. STEVEN SCALZO:** I'm sorry; could you repeat the question?

4272. **MS. BROWN:** Was there any specific type of modelling used within -- was the -- sorry.

4273. **MR. STEVEN SCALZO:** Yes, there was. Initially we developed a means by which we could model tug forces, and that modelling was done through calculation and a computer modelling. Then that was all verified by live tug tests to ensure that the types of tug forces and as we've described them in the past and don't want go necessarily through that long detail unless Madam Chair, you want me to both in terms of direct forces and indirect tug forces.

4274. Then the development of those tug forces were applied to the interaction with very large ships and specifically tankers. And from that modelling was done for the application of those tug forces to the ships and how to retard, steer, and arrest their movements in those definitions as previously defined before.

4275. And then once that was done we designed and built tugs to meet the requirements. And subject to then the completion of those tugs when we put them in service we did full-scale live tests to corroborate the performance of the tugs against the models. Certainly adjusted the models to reflect actual performance, and then grew that base of information and made it available.

4276. We were the first people to bring this type of technology to North America and the first to use it for large tanker escort. We provided that information, both nationally and internationally, to help further the capability of the requirements.

4277. We went as far as to model it face and test the hull forms of the tugs and the tug's interaction with the tankers and to do it the -- testing in a model basin sea-state testing. And the live tests were done in various sea conditions also.

4278. So I think there's a good base of information both in terms of design information, simulation information, modelling information and live testing information that went to the development of the reports and then the development of the tugs. And I think it goes to then the reason why certainly in the application of escort tugs to tanker movements in specific waters that it's been very, very successful.

4279. The reports that we have done have been through significant peer review. Both within Canada quite frankly at some of your international or your national Canadian tug conference as well as international oil institute and able architects in the U.K., within the International Tug and Salvage conferences held world-wide.

4280. And again, we have shared that information and we have also benefited from many other tests that have come from that and -- and some information developed on performance of tugs and continue to advance the state of modelling and corroboration of tug performance to performance models.

4281. **MS. BROWN:** Thank you.

4282. Just -- it's a comment, it's hard to build new science on something that you're just introducing in terms of its credibility, is it not?

4283. **MR. STEVEN SCALZO:** Well I -- I wouldn't call it new science, this has been going on since the early 1980s. We actually started the investigation in the late 1970s as a result of mandated requirements. When I say mandated, mandated, both from state initiatives, as well as voluntary initiatives.

4284. So it's been a wealth of information well corroborated over an extended period of time since the late 1970s and -- and in our case most aggressively in the early 1980s.

4285. **MS. BROWN:** So you've had lots of positive pieces of these tugs. Has there been -- have there been recorded incidences of -- of difficulties of using escort and tethered tugs in that not only do you have one just vessel out there but now you have one, two, three vessels interacting?

4286. **MR. STEVEN SCALZO:** You know when you -- when you look at the application and operation of the vessels and actual uses it's been pretty

consistent. When I say consistent many, many locations were operating two escort tugs in combination with a single large ship tanker and so I -- I think the experience is based on both tethered and untethered single and certainly two tugs in combination working tankers.

4287. **MS. BROWN:** I'm just aware of a couple of incidents that have occurred because of just trying coordinate between escort and tethered and -- and tankers.

4288. Do you -- do you have any familiarity with any of those incidences?

4289. **MR. STEVEN SCALZO:** No. I guess if you could be more specific to the knowledge that you have then I can maybe address that.

4290. But I guess I would add that as part of this process a lot of time and effort and training has gone into the coordination between the vessel, the vessel's captain, the pilot and the captain and crews on the tugs, as well as the vessels being escorted and assisted.

4291. So it is a combination of -- of, you know, the system that is in place. The tugs just being one tool in prevention.

4292. **MS. BROWN:** True. I guess the -- the one that I'm familiar is -- was the Sea Voyager, happened in 1998. I guess one of the tugs was moving another boat and there was three -- actually three vessels that were involved as a result of some error that occurred.

4293. I -- I guess it brings me back to the -- the database though and the lack of the database in regarding near misses and -- and the understanding of -- of what maybe the problems of -- of what the tugs are, what they actually -- how effective they are in certain incidents and how effective they are. So just regarding the database again, I'm surprised there's -- there is not one.

4294. **MR. CROWTHER:** Is there a question there, Ms. Brown?

4295. **MS. BROWN:** Just wondering why there is no database?

4296. **MR. STEVEN SCALZO:** I think as -- as Mr. Michel mentioned, the database of information has resulted from and is gathered based on incidents.

4297. In the case of escort tugs and utilization with tankers for escort there haven't been any incidences.

4298. **MS. BROWN:** Yet I've -- I just -- I haven't got it as an aid to cross-examination listed but there are several incidents, one of them being this -- the Sea Voyager is the name of the tug. So there are incidents that do occur.

4299. And I'm just curious why as part of best practices that the tug industry and the navigational -- or the shipping industry is not monitoring and tracking those near misses and the actual incidents?

4300. **MR. STEVEN SCALZO:** Yeah, I guess to the incident that you're actually -- if you could take us to a reference it would be very helpful.

4301. **MS. BROWN:** Alyeska report, I'm not sure where it comes from. Valdez, yeah.

4302. January the 12th, 1998, is what we have here.

4303. **THE CHAIRPERSON:** Is there an exhibit number for this?

4304. **MS. BROWN:** No. No, sorry, I -- we didn't put it in as an aid to -- to evidence but it's an incident that -- that has occurred.

4305. So I'm just wondering if there's no database there must be other incidents that have occurred that have not been put on record. So I…

4306. **MR. STEVEN SCALZO:** The -- I'm not directly familiar with the incident of the Sea Voyager.

4307. I know offhand pretty well the names of all the tractor tugs operating on the west coast in Alaska. I know that -- I don't -- I don't think that vessel is a tractor tug involved in escort.

4308. **MS. BROWN:** Okay.

4309. **MR. JERRY ASPLAND:** I need to say just a couple words here I think.

4310. Escorting on the west coast started with the beginning of the Valdez

trade. There were escorts up in Prince William Sound and we had escorts in the Northern Puget Sound.

4311. After 1989, some of us in this industry who are passionate about it and want to see it run very, very safely came to the conclusion that tug boat escorting had changed. And the tug boat escorting had changed because of the equipment.

4312. With the development of the tractor tug, it was then possible to change -- it appeared to be possible to change the way escorting was conducted. Prior to that, we used great big tug boats with lots and lots of horsepower that were what we call "conventional boats" that we had hoped would just stop the vessel. In fact, that probably wasn't true.

4313. Mr. Scalzo has talked about the effort that was done in the North Puget Sound and I'm very, very proud to say that it was the Atlantic Richfield's Marine Division, ARCO Marine which I was President, who initiated that study. We initiated that study because we knew that the present escort system was not viable and we needed to be sure that, in fact, that we could do something about an escort or we ought to fess up and say "This is not what it is."

4314. We chose Faust Maritime because, technically, they were one of the most advanced that I personally knew. We both went into this study with our eyes wide open and shared the cost, which was in the millions of dollars. We did not know what was going to come out but, at the end, before we built the tug -- tow boats, we had convinced ourselves that there was a new way to do it. And with the use and a purposely, specifically built escort tow boat, we could safely add another level of safety to the transit of the tankers.

4315. I didn't like the contract they gave me to go ahead and build the boats, but we did it anyway. But once the boats were built, we went in to -- Mr. Scalzo would have to tell you, but maybe a four-month testing period in which we actually committed the tankers, the boats. We went so far as to set up triangulization so we knew exactly what the speeds were and how fast things stopped and so on and so forth.

4316. At the end of all of this, we were convinced that, in fact, today's escort towing and escort of tankers is very, very effective. We've not seen a grounding, we've not seen a collision when escorts are involved in tanker escorting.

4317. This also though depends on a very close relationship between the tug

boat crew and the pilot because if they're not both in sync and not both trained so that they know the capabilities of the escort tug, sometimes things don't work.

4318. I don't know of any incidences, I don't -- I know the Sea Voyager. The Sea Voyager was one of those boats, shall we say, that was before we got the tractor tugs. As I sit here and listen -- and I've been involved in this Project -- tractor tugs, the design of this system deserves the credit it gets for increasing the safety of this program.

4319. **MS. BROWN:** Thank you, Mr. Aspland.

4320. In -- on B23 -- sorry, B23-15, I would like to just go there for a minute, Adobe 49.

4321. It's a comment that's made throughout many documents but I just happen to have this one to pull up. I can't see the document number, what have you got? B23-15?

4322. **THE CHAIRPERSON:** It's B23-15 that's on the screen.

4323. **MS. BROWN:** Adobe 49?

4324. **THE CHAIRPERSON:** Adobe page 49, yes.

4325. **MS. BROWN:** Oh, okay. It's a table, sorry.

4326. Can you go down a bit further? Where is it? Yeah, there we are. Okay. Yeah, just below that table, yeah, the paragraph there.

4327. So it's -- to read -- I don't need to read it. But in the last statement there, it says:

> *"Typical causes of grounding and collision incidents were studied by DNV to ascertain how an escort tug might help a tanker avoid an incident, or [to] minimize the damage if the incident was to occur."*

4328. You describe the situation as "might". My question is: What -- considering this is to be a quantitative evaluation of the effectiveness of tugs, how confident are you in your studies when you considered using the word "might"?

4329. The language leaves some level of doubt.

--- (A short pause/Courte pause)

4330. **MR. KEITH MICHEL:** Yeah, I'll speak to that one.

4331. The wording “might” is intended to convey the fact that it's a probabilistic based assessment. There is no way to 100 percent eliminate the risk of a spill. And as shown, there's some probability you'll have a spill and some probability that we'll be able to mitigate that risk.

4332. In the case of drift groundings, with escort -- tethered escort tugs, you see that 90 percent of the incidents that would otherwise have led to a spill are eliminated.

4333. But there's still the 10 percent that would be a spill and that’s the reason the word “might” was applied in this case.

4334. **MS. BROWN:** Okay.

4335. Just before I leave the table of what we were previously at, 8.1 in the previous document, I don’t know if you can go back there? Yeah.

4336. So I'm not completely certain how we got to the 80 percent. So is it -- was it done by -- I know you talked about studies and looked at variables but, when you have a non-incident, how do you get to the 80 percent?

4337. I guess an example of that is ---

4338. **THE CHAIRPERSON:** Ms. Brown, let's let ---

4339. **MS. BROWN:** Okay.

4340. **THE CHAIRPERSON:** --- let's let the witness answer the question.

4341. **MR. KEITH MICHEL:** Mr. Brandsaeter, could you answer that question?

4342. **MR. AUDUN BRANDSAETER:** I'm afraid I will need to have a

repetition of that question, I didn't really get it.

4343. **MS. BROWN:** Just going back to Table 8.1 in the document of ---

4344. **MR. AUDUN BRANDSAETER:** Yes.

4345. **MS. BROWN:** --- 23-34, I think it is, how do you -- I heard a lot of talk about various studies and variables from Juan de Fuca and others but how do you get to the 80 percent?

4346. **MR. AUDUN BRANDSAETER:** That was based on the results from the report in 2002.

4347. **MS. BROWN:** So that's the one we can't view or don't know the variables of; is that correct?

4348. **MR. AUDUN BRANDSAETER:** That is correct, yes.

4349. **MS. BROWN:** Okay. So we don't know how we got to 80 percent? At least I don't.

4350. **MR. AUDUN BRANDSAETER:** No, not except for -- not except for the way I tried to explain it some minutes ago.

4351. **MS. BROWN:** I didn't hear that last part, sorry.

4352. **MR. AUDUN BRANDSAETER:** I tried to explain the methodology that we had used where we calculated the steering forces, et cetera, and looked at the different types of events that could cause a grounding to occur, and as such this were the results of those assessments and analysis.

4353. **MS. BROWN:** So you can't share those -- the calculations that you used in terms of even how they -- how you got to the 80 percent; is that correct?

4354. **MR. AUDUN BRANDSAETER:** No, not to the extent because that is based on the information we received from the client and as such it's part of the confidential information.

4355. **MS. BROWN:** So there's -- and just going back to the Juan de Fuca and other studies that were talked about, there doesn't seem to be any -- or at least

I haven't picked up any methodology of determining this 80 percent from any of the studies. Am I correct on that?

4356. **MR. KEITH MICHEL:** No, I don't think you're correct.

4357. **MS. BROWN:** Okay.

4358. **MR. KEITH MICHEL:** I think we've explained that -- Mr. Brandsaeter explained the methodology applied in the Fawley study, and I explained the methodology that was applied in the Strait of Juan de Fuca study, both the analytical analysis and the reliance on expert opinion, and then Mr. Scalzo applied the methodology that was utilized when they directly assessed the ability of a tethered escort tug to prevent a collision or a grounding in the event of loss of power or steering.

4359. So there's -- I think all the methodologies have been explained and they're combined to come up with these values. And the alternative studies that we've mentioned, as we've said, are consistent with the numbers applied in the QRA.

4360. **MS. BROWN:** I guess -- but they're not available for me to look at or for me to evaluate or for anyone to do that?

4361. **MR. KEITH MICHEL:** I explained earlier that the Strait of Juan de Fuca study is available publicly. The Coast Guard posts its studies and it can be obtained from the Coast Guard.

4362. And Mr. Scalzo explained that a number of the studies that he referred to are in the public domain.

4363. **MS. BROWN:** Okay. So just going on further here, in these studies -- and just referring to the DNV 2002 study and I've heard from others in their studies, a variation of whether or not the studies were evidenced for only escort or for tethered.

4364. So did the -- I guess for lack of -- or to provide clarity, did the 2002 DNV study just do escort tugs? It wasn't clear.

4365. **MR. CROWTHER:** Ms. Brown, just for my benefit, are you contrasting escort tugs with tethered tugs?

4366. **MS. BROWN:** Yes.

4367. **MR. CROWTHER:** Thank you.

4368. **THE CHAIRPERSON:** Mr. Brandsaeter, did you hear the question and are you able to provide a response?

4369. **MR. AUDUN BRANDSAETER:** Yes, I heard the question. I'm just looking in my notes to get to that possible answer. Just a few seconds.

--- (A short pause/Courte pause)

4370. **MR. AUDUN BRANDSAETER:** Unfortunately I can't find it in my notes now. But I'm quite certain that that was looking at tethered tugs, otherwise the steering and breaking analysis that was done wouldn't be done that way.

4371. So I'm confident that these tugs were tethered and optimized tug that was used as basis for the estimation of the 90 percent effectiveness with regard to the grounding for close and tethered escort tugs. They also are with regard to power groundings. That is both with close and tethered escort tugs it was on the order of 80 percent effectiveness.

4372. So we didn't see a significant difference with that, but that might be that it was a conservative modelling of the tethered tugs in that aspect.

4373. **MR. KEITH MICHEL:** And just if I could add something in that regard relative to the conservative nature of these assumptions.

4374. We do believe that these percentages are conservative but, furthermore, many of the other mitigating effects of the escort tugs have not been taken into account in the QRA, only the impact on drift and power groundings and collisions while in the waterway. In fact, the effectiveness of the escort tugs, should there ever be an incident that in fact results in a grounding and damage to the hull, it's likely that the tug will reduce the energy involved and reduce the likelihood of a spill, and given a spill, reduce the size of the spill.

4375. Another example of the conservative nature of this QRA is that the effectiveness in the escort -- of the escort tugs in rescuing a vessel once it's beyond escort, once it's in the open water, that has not been included in the QRA

assessment. And so many conservative assumptions are made throughout the QRA.

4376. **MS. BROWN:** So just going back to the question -- the original question -- so I got lost in all the detail, but -- so did the evidence do only the escort tug or did you say it did both the escort and the tethered?

4377. So, in other words, you were -- the studies you were looking at, what tugs did they include, the escort only?

4378. **MR. AUDUN BRANDSAETER:** No, it included both. But for the powered grounding they're more confident in the results with regard to -- sorry, let me phrase it another way.

4379. Even though it looked both at the tethered tugs and close escort tugs, we didn't give any additional benefit to the tethered escort tug with regard to power grounding, even though that may be extremely conservative because it's very likely that the tethered tugs would have a better effect than just a close escort tug.

4380. **MS. BROWN:** So did you make the assumption that the tethered tug then is -- like are you saying that you only looked at the escort and then you made the assumption of the tethered tug?

4381. **MR. AUDUN BRANDSAETER:** No, I don't really understood what you have ---

4382. **MS. BROWN:** So I'm still confused. I'm sorry. The studies indicate only the escort tug. And so my question I guess is, is the tethered tug then just assumed based on the studies?

4383. **MR. AUDUN BRANDSAETER:** No, I tried to explain, rounded off of it, that it was done for tethered tugs and for close escort tugs but we were not as confident in the difference so that we didn't give any additional benefit for the tethered escort tug with regard to power grounding. For this grounding we saw that there was a significant difference.

4384. That's why we have used the 90 percent for the -- that's with closed and tethered escort tugs with regard to drift grounding but only 80 percent with regard to power grounding.

4385. **MS. BROWN:** Okay. So I just -- sorry.

--- (A short pause/Courte pause)

4386. **MS. BROWN:** So in your simulations, you indicated that tugs were not a necessary piece for the transport of vessels in this Project; that they were a mitigating piece but they weren't a necessary piece to actually do the transit.

4387. Is that correct?

4388. **MR. MICHAEL COWDELL:** Do you have a reference for that statement that we could go to?

4389. **MS. BROWN:** It's throughout the document.

4390. I didn't put it in here but it is indicated through the documentation, both in the simulations of the vessels and with the -- that the transit of these large vessels can take place without the aid of tugs and that it was quite possible to do.

4391. **MR. JERRY ASPLAND:** The answer to that is 'yes'.

4392. **MS. BROWN:** Yeah.

4393. **MR. JERRY ASPLAND:** The VLCCs and all other ships can, in fact, without tug boat escort, without the assistance of tug boats, go from the open ocean to Kitimat and from Kitimat to the open ocean, loaded or unloaded.

4394. **MS. BROWN:** That was my understanding. Right. Okay.

4395. So you're -- what you're saying as well in some of these studies -- because it seems -- and I'm just trying to hear Mr. Brandsaeter's comments -- it's sometimes difficult -- the escort tug would be a mitigating factor and a tethered tug would actually make it even more the likelihood of it being 90 percent because it says "laden with closed and tethered escort tug being 90 percent"?

4396. **MR. KEITH MICHEL:** That's correct.

4397. The assumption is that a close escort will reduce the risk of drift grounding within the confined waterways by 80 percent and then there'll be an

additional 10 percent reduction with the use of a tethered tug.

4398. **MS. BROWN:** Right. Okay.

4399. **MR. AL FLOTRE:** I think it's important for the Panel to note that we have a history of oil tanker boom from Vancouver Harbour to Victoria Pilot Station over the past 22 years and we have the information -- the information about incidents is spread amongst all the pilots for the benefit of safety.

4400. And up to four years ago when I retired, they had 18 years of tankers travelling from Vancouver to Victoria without using the escort tugs. So the 90 percent is not 90 percent of all vessels making the route, it's 90 percent of any incidents that may or may not occur.

4401. **MS. BROWN:** Just some clarification of the use of tethered and escort tugs.

4402. In your response to the Province -- and I don't have the evidence number here -- but you did an IR No. 2 to the Province, and it's on page 69 -- sorry, I don't have the data -- but you state in that that:

> *"...the safety measures proposed by Northern Gateway will supplement the Canadian legislation included but not limited to use of closed and/or tethered tugs."*

4403. And based on the fact that you say that tugs are actually not necessary within this transit, is there a possibility that the tethered tugs would not be implemented within this Project?

4404. **MR. JOHN CARRUTHERS:** No, we're committing to the tug escort as we've outlined, that's tethered and escort for laden and escort for unladen.

4405. **MS. BROWN:** Okay. Thank you.

--- (A short pause/Courte pause)

4406. **MR. JOHN CARRUTHERS:** What we would have referenced that for is, again, to show the extent we're going to to ensure -- to drive the chance of an incident as low as practicable. So you put in a number of redundancies.

4407. So, notwithstanding, they could do it safely on their own without escort, we're putting in these additional measures.

4408. **MS. BROWN:** I just want to go to my aid to cross-examination -- the CB -- AQ3 I guess it is. Just a quick comment here.

4409. This was the -- I went and did some investigation of the Fawley Marine Terminal as to what the study was based on and this was quite interesting for me to look at. This is a huge terminal. I understand this is one of the largest area, Southampton, for shipping in the U.K., so quite impressive. I guess the big thing -- and also I was reading through the various use of pilots and escort tugs, and they've got a variety of different scenarios that they follow and what have you.

4410. But, anyways, I was trying to determine what the commonality would be between this and the Northern Gateway piece and maybe somebody could enlighten me on what the commonality between why this study would even be considered as being relevant to the Northern Gateway?

--- (A short pause/Courte pause)

4411. **MR. KEITH MICHEL:** Mr. Brandsaeter, could you initiate the -- or answer that question?

4412. **MR. AUDUN BRANDSAETER:** Yes, I could give a brief explanation for why we considered the relevance of the Fawley Study to be applicable for Northern Gateway project.

4413. That is based on the fact that they used tug boats to escort the tankers into the terminal via an area with canals that were relatively narrow and much narrower than would be the case in any of the parts or segments of the approach to Kitimat.

4414. It gave us information about what effect the tugs could have. With regard to the size of the terminal, that is not necessarily very relevant but the operation of the vessels is similar to a sufficient extent that the results were considered to be applicable.

4415. **MS. BROWN:** So just looking at the potential variables here, you

know, from the Juan de Fuca Strait and the analytical piece that was done there and the reference to other studies, what variables here are similar to what would be happening for the Northern Gateway?

4416. **MR. KEITH MICHEL:** Could you repeat the question, please?

4417. **MS. BROWN:** Just wondering, in relation to this study or this particular area and study that is referenced to, what variables would be similar to the Northern Gateway scenario, based on just your past experience of other studies that you've done at the Juan de Fuca and other ---

4418. **MR. KEITH MICHEL:** Yeah, each scenario has some differences and some similarities.

4419. **MS. BROWN:** I appreciate that.

4420. **MR. KEITH MICHEL:** You know, if we compare the Strait of Juan de Fuca situation to, say, the confined waterways from Triple Island up to Kitimat, some of the differences -- you know, overall the pathway between Triple Island and Kitimat is narrower than the Strait of Juan de Fuca and, therefore, there is a greater risk of a drift or powered grounding. However, the effectiveness of an escort tug is quite similar, a tethered escort tug, in both situations.

4421. An example on the other side is that the traffic in the Strait of Juan de Fuca is many times more dense and there's far more crossing traffic in the Strait of Juan de Fuca than there is in -- from Triple Island to Kitimat, and also even in the open water outside Prince Rupert, and therefore the risk of a collision is significantly higher in the Strait of Juan de Fuca area than it would be in Triple Island to Kitimat. And those type of influences affect the risk mitigation measures that you ultimately seek.

4422. In the case of the Strait of Juan de Fuca, a decision was made not to utilize escort tugs because the cost benefit was not there because the higher risk was collision over drift groundings, and as we've seen, the principal advantage of escort tugs, and especially tethered escort tugs, is in mitigating the influence of a grounding.

4423. In the case of Triple Island to Kitimat, that risk was identified as the principal risk of concern, was grounding and, therefore, the escort tugs were adapted for this particular project.

4424. **MS. BROWN:** Thanks for that.

4425. Just in addition, or just as part of that for Fawley, just if you look down a little further -- and I didn't include the charts and stuff for this particular terminal, but the traffic is really heavy here, as you can well imagine. So I imagine, as you say with the Juan de Fuca piece, the risk -- the higher risk is regarding collision. I'm not sure -- I can't remember exactly, but there is some issues, I believe, in terms of the narrowness of this, that it's -- but I would -- from what you're saying about the Juan de Fuca, the highest risk is collision.

4426. So I'm trying to understand why Fawley would be used as a study that would be representative of the Northern Gateway?

4427. **MR. THOMAS WOOD:** I would like to jump in here. I'm quite familiar with the Port of Fawley in the South of England. As a tanker master, I've been there on several occasions. Both the risk of collision and the risk of grounding are relevant to this port. The channels, tidal channels, give risk of grounding in mud and in certain areas on rocks.

4428. **MS. BROWN:** So there's the two risks as well as collision, right?

4429. The other piece, when you go down a little further -- keep going further down.

4430. So just to clarify, did you know what the deadweight tonnes that were going into Fawley -- were they -- from this chart there was no ---

4431. **THE CHAIRPERSON:** Ms. Brown, let's just let the witnesses answer the question, please.

4432. **MS. BROWN:** Okay. Sorry.

4433. **MR. JOHN CARRUTHERS:** Yes, could you please repeat that question?

4434. **MS. BROWN:** Well, I'm just wondering if this -- if you were -- like, this is the information I had, but I wonder what the accuracy or what the deadweight tonne going into Fawley is? Does anybody know?

4435. **MR. THOMAS WOOD:** The Berth Number 5, crude oil berth, can take VLCCs to 44,000 tonnes. The product information is there on your AQ.

4436. **MS. BROWN:** Yeah, okay. I was just clarifying that.

4437. Just further down then to the map, I think there's a little attachment there. There we go. This is just a Google map. The distances here are about -- I forget -- 20, 30 -- does that say kilometres? Yeah, 25 to 30 kilometres here. So the variable of distance is such for the Northern Gateway.

4438. So how, just to clarify, how this particular variable would be comparable to the Northern Gateway?

4439. **MR. KEITH MICHEL:** I can answer that and perhaps Mr. Brandsaeter will have something to add. The QRA did its analysis based on the probability of an incident per nautical mile and, therefore, it was extended out and accounted for the longer voyage from Triple Island to Kitimat.

4440. **MR. AUDUN BRANDSAETER:** Yes. Well, I can just confirm what Keith Michel just said. As we are looking at the probability of an incident in this particular case, a grounding primarily, per nautical mile, it will be taking into account by multiplying by the distance in the area. So as long as the distance into Fawley, also if sufficient -- and also includes need for tugs to make some relatively sharp turns, which are not very different from those that could be experienced or would be experienced on the approach to Kitimat, because it would be quite relevant as a comparison.

4441. **MS. BROWN:** So when you look at this study, what's your level of confidence in determining your 80 percent then? Like, I'm looking at it from a scientific view. From a quantitative -- you're using this as a quantitative analysis. What is your level of confidence?

4442. **MR. AUDUN BRANDSAETER:** They haven't estimated a quantitative confidence interval for this as of yet. However, we have used numbers that we are confident that are conservative. So they didn't take into account additional effects on tethered tugs compared to close escort tugs for powered groundings. We used the numbers approximately 90 percent for the -- or used the number 90 percent for the effect of tethered tugs on drift groundings, whereas we had the other reports that indicated a 92 and 96 percent. So we chose the lower number, if they are on the conservative side. But we didn't estimate a

confidence interval for that. We didn't calculate any number for the confidence, if that's what you are seeking for.

4443. **MS. BROWN:** Thanks for that.

4444. Have any of your studies been peer reviewed?

4445. **MR. AUDUN BRANDSAETER:** Not to my knowledge, no.

4446. **MS. BROWN:** Okay.

4447. **MR. AUDUN BRANDSAETER:** However, the -- some have been used in several later studies as well, both the Northern Gateway Project, but also for several other clients and, as such, it has been reviewed by several clients, among them oil companies.

4448. **MS. BROWN:** So a question, for the purpose of understanding the logic of your probability, would not a greater transparency of the data have been appropriate?

4449. **MR. AUDUN BRANDSAETER:** If it were available, that would be beneficial and that would make life easier, so to speak, in certain circumstances. If you're considering the numbers used for the effectiveness of the tugs for other data, I think we have sufficient transparency so that those -- we would like to look into it, have the possibility.

4450. **MR. STEVEN SCALZO:** The -- going to your question on peer review, the tug escort study included the review as a peer participant of Robert Allan, the principal, now retiring principal of Robert Allan Limited here, out of Vancouver, Canada, who is one of the world and certainly your nation's leading architect, marine architect, and also someone who has been involved in the development of studies of escort tugs, the application of escort tugs at locations and facilities similar to what this project has identified.

4451. Rob Allan's designs are well known worldwide, and the application of his tugs are used worldwide, and I would say that between our designs and his designs, probably the majority of escort tugs so used. So Rob Allan was involved as a peer participant in the escort study.

4452. And then going to the issue of studies and their relationship, there are

many factors that apply to the application of escort tugs for safe transit in waterways. You know, we've talked about all of them here, waterway width and depth, tanker size, speed, tethered and untethered, the environmental conditions, et cetera, and those are all taken in in these studies following the best practices of the studies to determine the performance capability of the tugs as a tool in prevention or in response.

4453. And so I guess the point I'm trying to make is that the standard by which the reports are done are done by best practices. They're done in a pretty consistent manner in that the results of those studies, through the actual performance of escort at facilities like proposed here, like in Valdez or in Northern Puget Sound or in Fawley here, have shown a very, very high level of success.

--- (A short pause/Courte pause)

4454. **THE CHAIRPERSON:** Ms. Brown, were you waiting for a further answer to your question?

4455. **MS. BROWN:** No, I'm just thinking.

4456. **THE CHAIRPERSON:** Okay.

4457. **MS. BROWN:** I'd like to bring up AQ1. Yes, CBQ A1, that would be it.

4458. So this was then -- this is a document that -- or FSA or Formal Safety Assessment that was referred to in the DNV. So I'd like to use pieces of this document. And on Adobe ---

4459. **MR. CROWTHER:** Ms. Brown?

4460. **MS. BROWN:** --- page 51. Yes?

4461. **MR. CROWTHER:** I'm sorry to interrupt, but just to clarify, I at least don't seem to have a copy of the document that is being displayed.

4462. **MS. BROWN:** It was distributed through email to Ken MacDonald. Is that his name? Through the Enbridge ---

4463. **MR. CROWTHER:** Right. But be that as it may, are you suggesting that this particular document was referenced in the Quantitative Risk Assessment?

4464. **MS. BROWN:** Yes.

4465. **MR. CROWTHER:** Okay.

4466. **MS. BROWN:** Yes.

4467. So at Adobe ---

4468. **THE CHAIRPERSON:** Ms. Brown, have you highlighted the portions that you plan to refer to?

4469. **MS. BROWN:** I'm not sure about this one. I have done some and I had submitted that, but where they are, I don't know. But on page 51 ---

4470. **THE CHAIRPERSON:** So have the witnesses had an opportunity to review this AQ -- this proposed AQ?

4471. **MR. JOHN CARRUTHERS:** No, we have not seen this through -- as an AQ, no.

4472. **MS. BROWN:** It's come through on the email. It was ---

4473. **THE CHAIRPERSON:** However it tried to get there, it didn't get there, and so the witnesses have not had an opportunity to be familiar with this document, nor do I understand that you've highlighted the portions that you wish to refer to. So even if they had received it, they wouldn't have had the opportunity to focus on the areas that you plan to question on.

4474. **MS. BROWN:** There was two that I sent in, one was without highlight and one was with highlight. I realize that there was that difficulty, so I did send it in. And I did talk to the secretary from Ken -- is it MacDonald -- because I got an email back to say that he was not in the office and I was wanting to make sure that that email, in terms of the submission of that aid to cross-examination, would get to him. And she reassured me that he was reading his emails and that he would have gotten it for the Northern Gateway.

4475. **THE CHAIRPERSON:** Ms. Brown, why don't we proceed on the

basis of -- why don't you ask your question without the AQ and see how we get there?

4476. **MS. BROWN:** Okay.

4477. **THE CHAIRPERSON:** Thank you.

4478. **MS. BROWN:** This document -- and I don't need -- we don't need to -- because it is referred to as part of the best practices for the QRA. In it, it indicates that the interested parties carrying out the QRA should provide the most significant results in a clear and concise manner, and that it should be understood by all parties, including non-experts, in terms of their risk assessment techniques.

4479. Do you feel that the QRA has done this in a way that is understandable by others besides those just at this table?

4480. **MR. MICHAEL COWDELL:** I think the QRA does a good job of communicating the results in a way that can be well understood.

4481. **MS. BROWN:** It also indicates that the application should provide the other interested parties with timely and open access to relevant supporting documentation and sources of information or data, which is referred to in the above-mentioned reports.

4482. So do you agree with that statement of part of the formal safety assessment group and best practices?

4483. **MR. JOHN CARRUTHERS:** I'll let others firm up after I've spoken, but certainly that was one of the things we looked at initially and that's why we invited people to participate in the QRA, so that they themselves would be at the table in terms of the selection of the company to do the QRA and the components necessary, and to review it. So we started with that thought of being very inclusive for everyone who might have an interest in the information of the QRA and invited them to participate.

4484. **MR. KEITH MICHEL:** And the data that's utilized throughout this QRA is summarized as far as can practicably be done without -- recognizing the confidentiality of certain datasets. Again, the principal data on incidents and spills is the Lloyd’s Register data and it's publicly available at a cost, but it is publicly available.

4485. **MS. BROWN:** I guess the FSA recommendations are the best practices that indicate that it is timely and open access to the relevant supporting documentation that supports the conclusions that a document comes to.

4486. Would you agree with that part?

4487. **MR. KEITH MICHEL:** I believe the QRA was both timely -- it's been on public record for an extensive period of time -- and that the key assumptions and the key sets of data that are utilized and the calculation procedure that's utilized within the QRA is clearly explained.

4488. **MS. BROWN:** So does not best practice -- sorry -- does not best practices indicate that an open, transparent system enables others to understand and scrutinize the process?

4489. **MR. MICHAEL COWDELL:** Again, following up on what Mr. Carruthers said, I think that was the intent of the QRA Working Group, was for parties that were interested in reviewing those results and asking questions of the consultant, in this case DNV that completed the work, those -- the QRA Working Group participants being able to ask questions and ask for clarification, that was part of that process.

4490. So I think it was a very clear and transparent process that we established in developing the QRA, definitely more so than you would perhaps typically see.

4491. **MS. BROWN:** Are those results something that is available to look at and scrutinize?

4492. **MR. MICHAEL COWDELL:** Can you clarify what you mean by "results"?

4493. **MS. BROWN:** Well, your conversations and the review by the QRA panel that you ---

4494. **MR. MICHAEL COWDELL:** Those discussions are summarized in Volume 4 and the appendices to that volume.

4495. **MS. BROWN:** I've read those volumes and I have not seen

information that allows me to understand what is happening at the QRA, particularly in regard to understanding the significance of tugs, for example. So I don't -- can you explain where that material is and how I would see it?

--- (A short pause/Courte pause)

4496. **MR. JOHN CARRUTHERS:** I'm not sure exactly what you're getting at.

4497. Again, we talked about -- and just to -- the first was we addressed the process issues in Volume 4 and that at this -- in your other information and what we're doing today is responding to questions on things like the use of tugs and the effectiveness.

4498. So I think all the information is there and today we're responding to specific questions on that.

4499. **MS. BROWN:** It's just that in the -- one of the -- and I haven't got it here, sorry, available, but in one of your information responses to -- I believe it was Living Oceans -- they asked the question of information from the interviews that occurred from the QRA process, and it was indicated to them that those documents were confidential.

4500. I fail to see the transparency here. Can you please clarify a bit more on ---

4501. **MR. JOHN CARRUTHERS:** Yes, if you'd like to bring up the reference, we can do our best to ---

4502. **MS. BROWN:** Yeah, I've got it in my pile of papers here and I'm not going to find it easily.

4503. **THE CHAIRPERSON:** Ms. Brown, that sounds like the perfect cue for the time to take the morning break.

4504. **MS. BROWN:** Thanks.

4505. **THE CHAIRPERSON:** And then if you want to pursue this, you can find that reference and we can do that.

4506. Can you give us an update as to where you're at? I know the original estimate was three and a half hours, just for planning purposes. It's been about an hour and a half now. How is Douglas Channel Watch doing in their questions?

4507. **MS. BROWN:** It's difficult to determine at this time because of the answers and what have you we're receiving.

4508. **THE CHAIRPERSON:** So roughly, you'd be about 40 percent of the way through your questions according to your time estimate with both you and Mr. Shannon? Does that resonate with you? I just want to know where we're going to be in terms of the scheduling for the day.

4509. **MS. BROWN:** Perhaps we could look at that and then get back to you on that?

4510. **THE CHAIRPERSON:** If you could give us what your estimate is after the coffee break that would be great.

4511. So let's break now and come back for 10:15, please.

4512. Thank you.

--- Upon recessing at 9:59 a.m./L'audience est suspendue à 9h59
--- Upon resuming at 10:16 a.m./L'audience est reprise à 10h16

JOHN CARRUTHERS: Resumed
JERRY ASPLAND: Resumed
JENS BAY: Resumed
AUDUN BRANDSAETER: Resumed
DAVID FISSEL: Resumed
AL FLOTRE: Resumed
KEITH MICHEL: Resumed
STEVEN SCALZO: Resumed
THOMAS WOOD: Resumed
MICHAEL COWDELL: Resumed
HENRIK KOFOED-HANSEN: Resumed

4513. **THE CHAIRPERSON:** Thank you, everyone, for being back promptly.

4514. Ms. Brown, how are we doing on your time estimate, first of all?

4515. **MS. BROWN:** Probably be into the afternoon a bit. Just -- I'm just going by what -- how the questions are going.

4516. **THE CHAIRPERSON:** M'hm.

4517. **MS. BROWN:** I'm only guessing.

4518. **THE CHAIRPERSON:** And so you've been about an hour and a half and so you expect to be another couple of hours between you and Mr. Shannon. Is that a fair summary?

4519. **MS. BROWN:** Yes, I would think so.

4520. **THE CHAIRPERSON:** So you're right on schedule is what you're telling me?

4521. **MS. BROWN:** Is that right? I'm surprised.

4522. **THE CHAIRPERSON:** Thank you very much. It's just so that we know which witness -- which questioners are coming up next ---

4523. **MS. BROWN:** Okay.

4524. **THE CHAIRPERSON:** --- and we can be organized.

4525. Mr. Crowther?

4526. **MR. CROWTHER:** Madam Chair, with apologies to Ms. Brown and Mr. Shannon, we've been able to confirm that the aid to questioning that was displayed just before the break, the International Maritime Organization document, was in fact received at our end but then not provided to the witnesses.

4527. Over the break we did try to rectify that situation and I believe they now have copies and have had at least some limited opportunity to review the highlighted portions.

4528. Mr. Shannon -- or either Mr. Shannon or Ms. Brown, or a combination of the two apparently forwarded additional AQs. We haven't been able to

confirm that they were received at our end. My understanding is that the Joint Review Panel did receive them. We've made arrangements for them now to be forwarded to Northern Gateway.

4529. And since Ms. Brown and Mr. Shannon are likely to continue their questioning this afternoon, hopefully that'll give us sufficient opportunity that the witnesses can then review the relevant portions of those additional AQs.

4530. But I just wanted to correct on the record the fact that at least in respect of the International Maritime Organization document, the problem seems to be at our end and we're doing what we can to get the balance of the AQs to the witnesses.

4531. I would suggest we just proceed and see how things go, but I wanted to offer my apologies to Ms. Brown.

4532. **THE CHAIRPERSON:** Thank you, Mr. Crowther.

4533. And we appreciate everybody's continued cooperation to work together to make sure that we can get the best answers to the questions that are posed.

4534. So, Ms. Brown, please continue with your questions.

--- EXAMINATION BY/INTERROGATOIRE PAR MS. BROWN: (Continued/Suite)

4535. **MS. BROWN:** I just -- I found -- I haven't got the electronic reference to this, but Information Request No. 2 from -- sorry -- how it's worded is "Northern Gateway response to Living Oceans, IR Number 2" and in it it's indicated that -- the response from Northern Gateway states that:

> *"In the interest of receiving candid feedback [from] [...] the BC shipping industry in general, hazards to navigation and current rules and regulations, these interviews were conducted on a confidential basis."*

4536. And just to clarify that last bit that we we're talking about ---

4537. **THE CHAIRPERSON:** Let's try to get the electronic reference ---

4538. **MS. BROWN:** Okay.

4539. **THE CHAIRPERSON:** --- so that we can do that. Has anybody got that reference at hand yet? There's always someone in the room who's pretty quick on the ---

4540. **MR. CROWTHER:** I'm advised that it may be B47-4.

4541. **THE CHAIRPERSON:** B47-4. Ms. Gilbert, could we pull that on the screen and see if that's what Ms. Brown is referring to?

4542. **MS. BROWN:** Yes, that's the one, yes.

4543. **THE CHAIRPERSON:** Thank you very much for providing that reference.

4544. And so what page are you on, Ms. Brown?

4545. **MS. BROWN:** In terms of ---

4546. **THE CHAIRPERSON:** The Adobe page?

4547. **MS. BROWN:** For this document?

4548. **THE CHAIRPERSON:** Yes.

4549. **MS. BROWN:** I don't -- sorry, I don't have it because I've only got a hard copy.

4550. **MR. CROWTHER:** Can you ---

4551. **MS. BROWN:** It's right at the bottom of this.

4552. **THE CHAIRPERSON:** Can you -- right at the bottom of page 1?

4553. **MS. BROWN:** Yes, it's right at the bottom of this.

4554. **THE CHAIRPERSON:** Okay.

4555. **MS. BROWN:** It's the response there.

4556. **THE CHAIRPERSON:** So this is what you -- this is what you're posing your question around?

4557. **MS. BROWN:** Right.

4558. **THE CHAIRPERSON:** Okay.

4559. **MS. BROWN:** It was just the question -- and I can't remember the question now, but it's around the issue of transparency of information and where it would be available to have this information considering that this is conducted on a confidential basis.

4560. So how is it that transparency can be ensured within this process?

--- (A short pause/Courte pause)

4561. **MR. JOHN CARRUTHERS:** I'm not sure what we can add further. Again, we did, as I had mentioned, cast the net widely in terms of participation in the QRA process. So there was certainly potential for people to participate.

4562. The reports, we've summarized. All the reports have been put into an information both within the TERMPOL review process and within this process, in the application. We have filed information, made people aware of the assumptions. So there's been quite a bit of information filed. So I would say it's been very transparent.

4563. We've also answered a number of questions through various processes, through the IR process and, of course, on this panel and other panels. So I think there is a lot of information out there. People can look at the information, make their own conclusions.

4564. But again, it was set to be a very inclusive process and there is a lot of information filed so people can come to their own conclusions, their own assessment.

4565. **MS. BROWN:** So just a couple of quick questions here. So you would agree then that the best practices indicate that an open transparent system enables others to understand and scrutinize the process?

4566. **MR. JOHN CARRUTHERS:** Yes, we agree.

4567. **MS. BROWN:** Okay.

4568. **MR. JOHN CARRUTHERS:** And again, we went to what I've outlined in terms of ultimate transparency in terms of trying to get people involved in the process.

4569. **MS. BROWN:** And you would agree that information to lay out a factual basis -- that it is important to lay out a factual basis for a given conclusion?

4570. **MR. JOHN CARRUTHERS:** Yes.

4571. **MS. BROWN:** Okay. And you probably would agree then as well, because you're working with quantitative data, that decision should be made from a scientific information base?

4572. **MR. KEITH MICHEL:** You do that as far as practicable. If data is too sparse to use the quantitative assessment alone, then you rely on support from expert opinion.

4573. **MS. BROWN:** Okay. And you would probably agree as well that the scientific information for a decision should be able to be tested and validated?

4574. **MR. KEITH MICHEL:** Yes, again, the QRA is laid out in a way that it can be evaluated piece-wise. The analytical approach is clearly explained in the documents.

4575. **MS. BROWN:** Good. Thank you.

4576. I would like to go to -- regarding, first of all, yes, we'll just go to 23-34, Adobe 20. So the beginning paragraph, it talks about the FSA.

> *"The methodology used to complete this QRA is based on the International Maritime Organization (IMO) definition of a [...] (FSA) (2002)."*

4577. And in another document, you -- in 23-15, Adobe 41 -- you don't need

to go there -- but it also says that:

> *"The QRA follows the international best practice from the IMO definition of a Formal Safety Assessment."*

4578. So I presume I don't have to ask this question, but you would agree then that the QRA follows international best practices based on these statements?

4579. **MR. AUDUN BRANDSAETER:** I could elaborate a little on that.

4580. It is following a best practice that is common for marine risk assessments. It should be noted, of course, that the FSA guideline from the IMO is a guideline primarily developed for the development of rules that should be applied worldwide by the International Maritime Organization.

4581. So as such, all elements of it is not necessarily directly applicable. And at least I would say that it's absolutely justified that the transparency, when developing international rules that should be mandatory to all shipping worldwide, is much -- even much more important than the transparency with regard to one specific projects. Even though I completely agree that to the extent data is available and knowledge is available, it should be as transparent as possible.

4582. But sometimes there are -- we have to compromise between privacy of people that give information and the need for transparency.

4583. So I'll just support Mr. Carruthers on the fact that we want the information from the local people, but if we would lose part of that information if names were disclosed, for instance, that would be a much bigger loss than the loss of -- or the lack of transparency.

4584. **MR. KEITH MICHEL:** And just relative to the Figure 2-1 that you've had placed on the screen, it identifies six steps in a risk assessment. These are typical steps taken in most marine risk assessments, in fact, most risk assessments, and these steps were followed in the QRA.

4585. **MS. BROWN:** So just Adobe 1 of the FSA document, so that would be the Aid to Cross-Examination -- AQ1, I guess it is.

4586. So in Adobe 1, so in line 2, just to put the parameters in this, it's a

rationale in systematic process for assessing risk relating to marine safety, protection of marine environment, and evaluation of costs and benefits and the benefits of IMO's option to reducing risks. So that's the kind of parameters of this.

4587. Is that the understanding of Northern Gateway in the use of the -- in the statement of the FSA in the application of the methodology?

4588. **MR. KEITH MICHEL:** Again, as Mr. Brandsaeter explained, the basic steps in the FSA were applied in this study, but the FSA itself was developed by IMO and specifically to apply with the development of regulations by IMO.

4589. So some of the -- for instance, some of the cost benefit assessment that might be done by IMO was not done in this case. We use as an example the decision to apply escort tugs, both tethered and close escort. That's a very expensive solution. A decision was made by Northern Gateway to apply that without having done, I think, a complete cost benefit assessment. It was just decided that in their effort to mitigate risk as low as reasonably practicable, that was an appropriate application.

4590. So there are some differences between how Northern Gateway went at the assessment of risk mitigation and how an international maritime organization would do it, but the fundamental steps -- as I said, the fundamental steps explained in the FSA document were followed in this assessment.

4591. **MS. BROWN:** Okay. In Adobe 5 of the FSA document, they do the guidelines for assessment. And further on in this document, it talks about the QRA. So my understanding from this document is it's not just for rule making and also that it is referenced in the QRA for the -- for the Northern Gateway as a -- as a practice -- as a document for best practices; am I correct on that?

4592. **MR. KEITH MICHEL:** Yeah if you could break that question down. You -- you asked multiple questions.

4593. **MS. BROWN:** Right.

4594. **MR. KEITH MICHEL:** And then I think Mr. Brandsaeter can answer it.

4595. **MS. BROWN:** Yeah. Well, you indicated, and it says here as well, that it is for rule making but it's also being used for -- for QRA development and it -- it specifies that in the document further along.

4596. But you also -- but you also acknowledge that this -- this FSA document and -- and the guidelines for it have been adopted by the QRA for the Northern Gateway to determine best practices. I'm just ---

4597. **MR. JOHN CARRUTHERS:** Ms. Brown, so I could -- sorry, just to follow along could you just -- you said it's referred to somewhere, could we just go to that so we can all be speaking to the same information?.

4598. **MS. BROWN:** Yeah. And I'm going to refer to it later on but I'm not -- I haven't got it right in front of me here.

4599. But -- but Northern Gateway does use it as the formation of their best practices or their piece of best practices as stated in their methodology.

4600. So I -- I don't need you to confirm that because I think you already have. Okay.

4601. **THE CHAIRPERSON:** So we move onto your next question.

4602. **MS. BROWN:** So in 1.1.2, so it looks at -- it's for making new regulations and for marine safety and protection, blah, blah, blah. Okay, with a review of achieving a balance between various technical operational issues including the human element and marine -- and between marine safety or protection of the marine environment and costs.

4603. Okay, so I just want to look at -- at those pieces. So -- so achieving a balance between the various technical and operational issues including the human element and between marine safety and protection of the marine environment, were all those components achieved within the Northern Gateway QRA?

4604. **MR. KEITH MICHEL:** Yes.

4605. **MS. BROWN:** Okay. Within the DNV document I did not see a portion -- the portion of the FSA best practices that referred to the -- that refer to the human element. Particularly they do a human reliability assessment piece. Is that -- is that -- be fair?

4606. **THE CHAIRPERSON:** Ms. Brown, I -- I'm having trouble following you.

4607. **MS. BROWN:** Sorry.

4608. **THE CHAIRPERSON:** Who's they?

4609. **MS. BROWN:** Oh, the DNV, the document of the QRA.

4610. So there isn't -- I don't -- I ---

4611. **THE CHAIRPERSON:** So could you -- could you ask your question again, just a straight question without anything else in it so that we can all follow?

4612. **MS. BROWN:** I do not see the human element within the QRA DNV document.

4613. **THE CHAIRPERSON:** And what's the question?

4614. **MS. BROWN:** Is that correct?

4615. You said -- you indicated -- sorry.

4616. **MR. AUDUN BRANDSAETER**: It is correct that you will not see an attestment of human reliability of the human element specifically. It's a separate part because we went with analysis on the actual statistics.

4617. And of course the human element has been an important part in all the accident that has already happened and in which -- on which we based the -- the survey.

4618. So -- so this is one of the parts of the -- of the FSA guidelines that is particularly important when the IMO shall develop new rules and regulations.

4619. Where they both put in regulations and rules for the technically development of vessels and -- and the construction of vessels, but also with regard to -- to the human element in terms of regulations for watch keeping, knowledge, competence building, et cetera, et cetera, including the safety management system of the operators and so on and so forth.

4620. So with regard to assessing the risk of a specific operation I think the parts of the FSA that we have used as a guideline for the QRA it's the appropriate ones. Whereas there are definitely several parts of the FSA guideline that we have not used in detail and we are confident not applicable to such an assessment.

4621. **MS. BROWN:** So this -- these human reliability analyses that they talk about within the FSA guideline or the human element period, has not been incorporated in the DNV QRA as I understand you to say?

4622. **MR. AUDUN BRANDSAETER:** No, that was not part of the scope for that assessment.

4623. **MS. BROWN:** Okay.

4624. In ---

4625. **MR. MICHAEL COWDELL:** But -- but it's important to remember and we -- we talked about this in an IR response, it was in response to Coastal First Nations IR 117h, and we talk about the -- the fact that the – the human element is implicit in -- in all the incidence statistics that form the base frequencies of the QRA.

4626. So the -- it is -- it is implicitly included in the QRA calculations.

4627. **MS. BROWN:** And that was going to be my question to you. In a response to myself, it was A -- I think I've got it right, A2G9F6, you indicated that -- if you want to pull that up.

4628. So you got that as a piece -- is that evidence? Is that a number of evidence, A2G9F6. No it's not.

4629. **THE CHAIRPERSON:** No. Unless it's a letter of comment.

4630. **MS. BROWN:** No. So it's Northern Gateway's response to C. Brown, IR Number 2.

4631. **THE CHAIRPERSON:** Mr. Crowther?

4632. **MR. CROWTHER:** We're just trying to find the exhibit number,

Madam Chair.

4633. **MS. BROWN:** Sorry, I didn't do that right. Marked it on here thinking I had it.

4634. **THE CHAIRPERSON:** And so it's -- it's Northern Gateway's response to your second information request? Is that what you said?

4635. **MS. BROWN:** Yes. Yes.

4636. **THE CHAIRPERSON:** Thank you.

4637. I think we've got Ms. Gilbert and Ms. Shannon working on this judging by the ---

4638. **MR. CROWTHER:** It's B43-4, according to Ms. Shannon.

4639. **MS. BROWN:** Oh, that's what it is. Yeah. I wrote it down somewhere else. Sorry.

4640. **THE CHAIRPERSON:** B43-4?

4641. **MR. CROWTHER:** That's my understanding.

4642. **MS. BROWN:** Yeah, that would be it.

4643. **THE CHAIRPERSON:** Thank you, Ms. Shannon.

4644. **MS. BROWN:** So in your response you state:

> *"Accident statistics and [...] applied base frequencies for powered…"*

4645. **THE CHAIRPERSON:** Sorry, Ms. Brown, if I could just stop you again.

4646. **MS. BROWN:** Okay. Sorry.

4647. **THE CHAIRPERSON:** Can we get to the page number?

4648. So if you've got a hard copy there just tell us what hard copy page you're working on. Or -- or give us a reference like 2.1 or just so that we can zone in on ---

4649. **MS. BROWN:** It's page 3.

4650. **THE CHAIRPERSON:** Page 3 of the hard copy?

4651. **MS. BROWN:** Yeah.

4652. **THE CHAIRPERSON:** And so this is 2.2; is this what you're wanting to question about?

4653. **MS. BROWN:** No. It's was -- it's 2.3.

4654. **THE CHAIRPERSON:** Two point three (2.3), great. Okay, so we'll just scroll down. There we go, 2.3 yeah.

4655. **MS. BROWN:** So the response to me was -- the question was about the human element from my perspective because the -- it had been indicated that the -- in the preamble that the report of power groundings are due to navigator's inability et cetera, et cetera.

4656. So the -- the -- it was asked how these factors were tabulated in a risk assessment in the -- and the response being the statistics are accident statistics and applied base frequencies are inclusive in the incident, as you indicated caused by misjudgement, lack of attention et cetera. Okay.

4657. So where do these statistics come from?

4658. **MR. MICHAEL COWDELL:** That would -- that would be the IHS Fairplay data that we talked about in previous testimony.

4659. **MS. BROWN:** Are they -- are they auditable? Like -- or can you read them in terms of -- of cause and effect?

4660. **MR. MICHAEL COWDELL:** Mr. Brandsaeter, do you want to respond to that question?

4661. **MR. AUDUN BRANDSAETER:** So some extent information is

available in there, IHS Fairplay database on these issues.

4662. But still, as you just mentioned, as we used the total accident statistics, it's -- it's already a part of -- of the actual statistics. So we haven't included any specific assessment but it would in fact have kind of double-up the effect of the human element, if we should add that in addition.

4663. **MS. BROWN:** Okay. So when you look at these statistics, you're virtually getting a cause and effect piece. You're not getting -- so you get a cause of grounding and the effect of -- or how does that work? Like, how does the human element -- if somebody makes a navigational error and it causes a grounding, how do you -- how does that figure factor into the probability? Sorry, I'm having trouble with this.

4664. **MR. AUDUN BRANDSAETER:** I'm afraid I didn't really understand that question. Could you please repeat it or rephrase it?

4665. **MS. BROWN:** The accident statistics give a coarse, for lack of a better word, cause and effect understanding; it doesn't really define what were the factors creating the cause. Is that a good way of framing that, or am I correct on understanding that?

4666. **MR. AUDUN BRANDSAETER:** When we assess this related to, take grounding as an example, we analyze the data, accident statistics that is available, look at the exposure in terms of how many nautical miles have been sailed, which is related to this type of accident, and then we get the frequency of groundings per nautical miles sailed. But we do not, in a study like this, go into details of what caused it. That would, of course, in relation point to the rulemaking process in the IMO be very important because you'd look at what kind of measures should be implemented, worldwide requirements for seafarers in order to reduce the probability of such events happening in general.

4667. But with regard to a specific project, that should give some information if we wanted to mitigate the risk purely by introducing procedures and what I will call soft way of reducing the risk. But for that type of assessment and in order to estimate the risk level, it would probably not give any additional information.

4668. **MS. BROWN:** So it is a bit limiting, I would think; that's my personal opinion.

4669. But in the FSA document on page 12, Adobe 12, at the very bottom -- I obviously got my highlighted one here.

4670. So they talk about methods of areas of needing control, and they talk about identification of these potential risk control measures and what they need, but one of the pieces of the control measures, or understanding the complex chain of events and diversity of causes, and they have at the bottom, they talk about causal factors leading to failure, leading to circumstance, leading to the accident, and then the consequences.

4671. So would you not agree that the course statistics from Fairplay that are used are somewhat limiting in understanding the causal pieces and the need for certain mitigation factors?

4672. **MR. AUDUN BRANDSAETER:** I would agree that if much more details on these topics were available, that would be -- make, like, that process much easier, and probably also improve the quality of it. But even in the rulemaking process, in the IMO, this is one of the large struggles which makes it difficult. And I'm talking about there is no better data available than the IHS Fairplay, so that's why we -- in almost all of the analysis we do in DNV and base it on the IHS Fairplay.

4673. **MR. KEITH MICHEL:** We discussed extensively last week that it's acknowledged throughout the marine industry that human factors are responsible for a majority of marine incidents. And IMO has adopted many regulations, as has Transport Canada and others, that address the human factor side, and we've discussed a few; ISM, International Ship Management Code, STCW was discussed last week.

4674. When you perform a quantitative risk assessment under TERMPOL, the intent of that type of study is to identify what the significant hazards are in the particular project and what the appropriate risk mitigation measures are. And there are certain items that you're not capable of addressing directly, and fortunately, IMO, Transport Canada, and others are addressing those items. As an example, the ability to mitigate risk of a main engine failure; you have to rely on the international and national codes and best practice of industry to mitigate that.

4675. What we can do is mitigate the impact should a -- such a failure occur, and that's what the QRA addresses, and it addresses it through a range of risk

mitigation measures, for instance, speed reduction, the use of escort tugs. So in this way, the data tells us the risk, and human factors are understood to be part of that risk, contributing to that risk, and the risk mitigation measures that are adapted help to mitigate that particular risk, and that's the way these type of marine risk assessments are carried out.

4676. **MS. BROWN:** So what was the date of the development of the DNV QRA tool?

4677. **MR. AUDUN BRANDSAETER:** Could you please repeat that question?

4678. **MS. BROWN:** When was the -- the current tool that's being used by DNV for the QRA, when was it developed and when was it updated?

4679. **MR. AUDUN BRANDSAETER:** If you, by tool, mean a specific software, we have given that reply to an information request, but I could very briefly just say that it is primarily based on spreadsheets and the methodology is explained in the report, how it has been developed, and I think it's possible to reproduce most of the numbers as well. So there is no specific software to relate, if that's what you're looking for.

4680. **MS. BROWN:** What I'm asking is the tool is being developed by DNV to do the QRA, so there was a standard tool. Sorry. And I'm just wondering when it was last updated. When was ---

4681. **MR. AUDUN BRANDSAETER:** I believe no specific software, there is no date for any update either. It was used at -- informed in the reply to the information request, the calculations were made based on the methodology and described in the QRA, except for some of the common simulations for the speed calculations or the speed distribution calculations.

4682. **MS. BROWN:** And just going back to the -- and I didn't write down the number of what the IR number 2 to myself, or to me, was.

4683. **THE CHAIRPERSON:** I think it was B43-4?

4684. **MS. BROWN:** Yeah.

4685. **THE CHAIRPERSON:** And so do you have a page number that you

want to go to?

4686. **MS. BROWN:** It would be on page 3, I understand. Wait a minute -- sorry. Hold on. It would be page 1, I think it was.

4687. **THE CHAIRPERSON:** It's Section 2.1; is that correct, Ms. Brown, that you wanted to refer to?

4688. **MS. BROWN:** Page 1, yeah. Is this it? There I asked for the DNV tool. So the calculation is based on the methodology, simulations, but there was no date on it. My question is if best practices were being reviewed as an assessment standard, would not the recommendations of the FSA, which is dated 2002, be incorporated into this tool?

4689. **MR. AUDUN BRANDSAETER:** Except as indicated in that reply or response, these calculations were made based on the methodology and interest described in the report, and those calculations were performed in an Excel spreadsheet, and those were specifically made for this project. So it was updated just before we issued the report in April/May 2010.

4690. **MS. BROWN:** So the QRA, there was -- so the FSA -- sorry -- indicated that the human health piece was -- it was -- should be considered in ongoing risk assessments. And in the back of this document there are a number of tools that are being suggested.

4691. **THE CHAIRPERSON:** Ms. Brown, which document?

4692. **MS. BROWN:** Oh, sorry, the FSA.

4693. **THE CHAIRPERSON:** Okay. Thank you.

4694. **MS. BROWN:** So, for example, on Table 3 -- I don't have the Adobe page, sorry. Maybe Mr. Shannon will help me.

4695. **THE CHAIRPERSON:** And so you're in the FSA document ---

4696. **MS. BROWN:** Yes.

4697. **THE CHAIRPERSON:** --- which is your AQ ---

4698. **MS. BROWN:** Yes.

4699. **THE CHAIRPERSON:** --- and you're looking for Table 3?

4700. **MS. BROWN:** It's in the back in the appendices.

4701. **THE CHAIRPERSON:** Why don't we start at page 50 or something like that, Ms. Gilbert, and see where we are.

--- (A short pause/Courte pause)

4702. **MS. BROWN:** Sorry for not doing that. I didn't have it.

4703. **THE CHAIRPERSON:** I believe Ms. Gilbert's found it for you. Is that it?

4704. **MS. BROWN:** Oh, good. Okay.

4705. **THE CHAIRPERSON:** Thank you, Ms. Gilbert.

4706. **MS. BROWN:** So here they talk about the human error on board and things that are considered. And I must admit there is some difficulty in doing this kind of assessment piece even, and though it's recommended by the FSA, they have different tools.

4707. But just to look at the pieces of human related hazards that are certainly part of a risk assessment and that should be looked at, and they go through personal factors that are there. I think they go down and they talk about -- so they have task features, and I'm sure a lot of these can be mitigated.

4708. I guess the point of it is that each situation or each route, i.e. the Northern Gateway, has in it inherent different human risk factors that perhaps need to be looked at. And the methodology used, has it addressed these?

4709. **MR. AL FLOTRE:** If I could answer this, and I did give this answer earlier on in the previous weeks. But the human factors have been mitigated with a plan where the Canadian pilot, who is very familiar with the area, familiar with all kinds of ships, will board the ship, and the compulsory pilot to each boundary, or at the terminal, when it's outbound, at that point in time on all ships, the ship's crew, the bridge team switches their duties from navigating the ship to monitoring

the pilot. In difficult areas along the route, the captain may be asked to come to the bridge and also monitor the pilot.

4710. With a loaded tanker we have two tugboats with completely independent navigation systems and they will also be monitoring the progress of the tanker as it goes through the channels. And the plan of the team approach will be that the masters of the tugs or the navigators of the tug will be able to question the actions of the pilot at any time.

4711. And also, as an additional factor, or mitigation factor, the MCTS traffic will have the tools available to them either with shore-based radar or AIS capabilities on their computer to also monitor the actions of the pilot as he navigates the ship down the channel.

4712. So if you were asking about the procedures or plan in place to mitigate the human factors, that's what Northern Gateway is proposing.

4713. **MS. BROWN:** I have great respect for what the pilots do from watching what happens in the Douglas Channel, that there's limited ---

4714. **MR. AL FLOTRE:** No, the pilots are navigating the ship.

4715. **MS. BROWN:** Right.

4716. **MR. AL FLOTRE:** That's by Canadian law.

4717. **MS. BROWN:** Right.

4718. **MR. AL FLOTRE:** They have a conduct ---

4719. **MS. BROWN:** But I have great respect for what they do and the professionalism that is there, yes.

4720. **MR. AL FLOTRE:** But human error can -- you know, can attack a pilot too ---

4721. **MS. BROWN:** Yes.

4722. **MR. AL FLOTRE:** --- on rare occasions.

4723. **MS. BROWN:** Yes. And that ---

4724. **MR. AL FLOTRE:** But he will be backed up by the bridge team, the tugs, the escort tugs, and MCTS.

4725. **MS. BROWN:** Some features of -- this is just one of many pieces of the human risk piece that they talk about within the FSA, but one of the pieces that's interesting is the piece around the organizational and the leadership piece. It's number three of this document. So just -- and, you know, but my -- and looking at that, it's -- what I'm trying to say is that the mitigation is beyond -- and the understanding of risk is beyond what the core statistics have indicated, and that mitigation is greater than the escort tugs and, say, the navigational aids. There's a broad scope of mitigating factors that need to be looked at. Would you agree with that?

4726. **MR. MICHAEL COWDELL:** I think we're -- I'm just getting a little bit confused myself. But the QRA -- the base incident frequencies in the QRA implicitly include the human element and human error. The QRA -- the purpose of the QRA was to identify the hazards to navigation for Northern Gateway, including incidents like powered grounding that could be as a result of human error, and to look at possible mitigations, which we did. We've looked at putting in place radar. That doesn't exist. We've looked at putting in place escort tugs, which don't exist. We've committed to training. We talked about the pilot and tug escort crew training that we've committed to assisting with.

4727. The incidents themselves, though, are always investigated by -- you know, in Canada by the Transportation Safety Board. And if those investigations determine that additional rules and regulations are required, then government agencies will put in place additional rules or they'll change pilotage regulations or *Canada Shipping Act* statutes to reflect the necessary changes that have to be made.

4728. But again, you know, from the project specific perspective, looking at the human interface will be a part of -- will always be a part of the project through design and planning and into operations. It will always be something that will be reviewed. And if it can be -- if improvements can be made or additional risk mitigation measures can be put in place, then we will -- we will do so.

4729. And you know, even since the QRA was completed there's been additional discussion on what can be done in that regard. And we -- in the IR

response we talked about last week we were here, we talked about that commitment to the training between the pilots and the tug crews just as one example of how that human error can be mitigated.

4730. And we would definitely be looking at other opportunities as well through HAZOPs and HAZIDs. It would be done through detailed planning and into operations and commissioning of the project if it was approved.

4731. **MS. BROWN:** So you're saying monitoring and evaluation and feedback are part of your model for the QRA.

4732. **MR. MICHAEL COWDELL:** It's not so much part of the QRA, but it will be part of the ongoing operations monitoring and continuous improvement.

4733. **MS. BROWN:** Okay. Because I was looking at your model -- your schematic on 23-34, I guess it is, in your, you know, an ecosystem definition, et cetera, rate to risk mitigation and that monitoring and feedback should be part of that model schematic.

4734. **MR. MICHAEL COWDELL:** Which page are you referring to?

4735. **MS. BROWN:** I believe it was 23-34, Adobe 20 when we went there.

4736. So in this model piece, you're saying that mitigation evaluation should be -- not mitigation, but evaluation and monitoring should be part of that schematic.

4737. **MR. JOHN CARRUTHERS:** Certainly -- I'm not sure what you're getting at exactly, but as we go through and we're into operations, you'll continually have processes to monitor how you're doing, feedback and continuous improvements.

4738. So that'd be very -- ensuring that you're -- continue to drive the chance of incident to as low as practicable, you'll have a number of systems in place, management systems, reporting systems, information systems, learning systems. So those would all be part of what we would do going forward.

4739. **MS. BROWN:** Okay, thank you.

4740. **MR. THOMAS WOOD:** I would like to put that into context as it

actually has happened over the years.

4741. The QRA is born of statistics which have happened over a number of years and the human element has been included, as my colleagues have said.

4742. Now, during those same years, a number of implementations by the IMO and other professional bodies on all ships in the ocean, including tankers, and some specific before tankers have improved the human element factor on ships at sea. And the -- we could name some of these as STCW training, we could name the ISM Code and others. But these are all in place to ensure that the highest standard of seamanship is available on the ships at sea today.

4743. And I would also like to add that, in my experience, the introduction of ISM alone is something which has brought about checks and balances within this -- the management system on board tankers that allows the senior management of the tanker and the company and the junior management and the seamen all to participate and all to ensure each other's human element factors are under control.

4744. It is a safe business. The tanker business is one of the most highly-regulated businesses in the world today. Tankers are safe and the statistics prove that.

4745. Thank you.

4746. **MS. BROWN:** Thank you for that.

4747. In B23-34 on Adobe 64, so here -- you talk about here a peer review was conducted to validate the findings. And the workshop took place on May the 19th, 2009, included a number of experts, and Dr. Soma was there as the human factors and risk expert.

4748. I guess my question is, was this peer review only about the scaling factors or was it more inclusive?

4749. **MR. MICHAEL COWDELL:** Mr. Brandsaeter, are you available to answer that?

4750. **MR. AUDUN BRANDSAETER:** Sorry; I'm moving my phone.

4751. That workshop was primarily arranged in order to assess the scaling

factors. We went systematically through all the scaling factors and Mr. Hoffmann and Mr. Friberg participated in that workshop as facilitators and scribe -- facilitator and scribe. They have also participated in the previous work so they could inform the rest of the group on the basis for their assessment.

4752. Some minor changes were made after that peer review but, in general, the methodology they had applied and the scaling factors that had been set were considered to be acceptable and, as such, no major changes were made.

4753. There were some minor changes because there was some inconsistencies that were discovered, but that is a part of the normal process in developing an early draft of such an analysis to a later stage.

4754. **MS. BROWN:** So how -- my question is, how independent from the QRA was this peer review?

4755. **MR. AUDUN BRANDSAETER:** Prior to that meeting, it was only Viktor Friberg and Peter Hoffmann that had been involved in the work with the QRA, while Dr. Soma, Mr. Nilsen and myself had not yet been involved. So this was my first participation in the project.

4756. **MS. BROWN:** Because I see as author of the QRA -- I see your name listed there, so I was trying to figure out what role you would play within this committee as an independent peer review.

4757. **MR. AUDUN BRANDSAETER:** Yes. As I just mentioned, this was my first involvement in the project. So as such, I was a person independent from those who had made the first assessment and established the base scaling factors. And then together with Dr. Soma and Mr. Nilsen, we could review the work that Viktor Friberg, Peter Hoffmann and a couple of other our employees had done and give some guidance on how to improve it further.

4758. **MS. BROWN:** Thank you.

4759. Was there any other third party review after this?

4760. **MR. AUDUN BRANDSAETER:** No. No other third party review, if you by that mean other than DNV or the project that was our client.

4761. **MS. BROWN:** Okay. Just going on to another area, I'm just going to

ask a few questions about the HAZID process. I know a number have already been asked before; I was reading the transcripts.

4762. But the statements of risk and determination of risk is part of the QRA, and it was done through a qualitative piece, which is through the HAZID process. Is that correct?

4763. **MR. AUDUN BRANDSAETER:** The identification of a hazard is a main and early part in all risk assessment, be it quantitative or qualitative. The main purpose of the Hazard ID workshop is to identify what can go wrong and to select and also assess how likely is it and how bad could the consequences be; but, primarily, identify the hazards.

4764. **MS. BROWN:** Okay, do you ---

4765. **MR. AUDUN BRANDSAETER:** That is, in itself, normally a qualitative process.

4766. **MS. BROWN:** Do you feel that the number of interviews that you had beyond the professionals, do you feel that there is an adequate sample there along with your expert panel?

4767. **MR. AUDUN BRANDSAETER:** With regard to the participation, both in the Hazard ID workshop and the interviews, it is in fact far beyond what they normally experience. We have -- normally, we are very satisfied. We have the participation of a pilot as a master, and it's quite unique, in fact, that we have innovation, some of my colleagues interviewing or participating in interviews of local people with detailed local knowledge.

4768. Even though it should be said that with regard to the QRA, it was primarily the input from the pilots that was a good basis for doing the assessment because they have detailed experience of vessels of the size of the type that will transit the channels towards Kitimat.

4769. **MS. BROWN:** So I'm just going back to my information request. You indicated there was about 14 people that were interviewed as a total.

4770. **THE CHAIRPERSON:** Ms. Brown, if that's the evidence, there's no need to confirm it, because it's been sworn or affirmed to.

4771. **MS. BROWN:** Okay.

4772. **THE CHAIRPERSON:** So if you want to go to your next question, please.

4773. **MS. BROWN:** Yes. So I guess my next question; so you felt the sample was -- sample of interviewees was adequate. Did you feel that this qualitative exercise that you took these individuals through met the rigour for scientific analysis that you intended?

4774. **MR. AUDUN BRANDSAETER:** As I said, this was even kind of luxury compared to what we are used to. And it added or gave a lot of information from local people to my colleagues, so they were better informed while they were doing legwork later on.

4775. However, that detailed quantitative assessment was a -- or even a task for risk experts, and as such it didn't give specific numbers to put in to a formula but it gave them a better understanding of the whole area and operation that is going to take place.

4776. **MS. BROWN:** So within these groups, did you use a risk matrix when you did the interview; like, how did you define risk for them to give you a number to work from?

4777. **MR. MICHAEL COWDELL:** I think we may have discussed this in previous testimony.

4778. **MS. BROWN:** Okay.

4779. **MR. MICHAEL COWDELL:** And it's described in the QRA, but ---

4780. **MS. BROWN:** Okay. So the risk -- so what you're saying is definitions of risk were given to -- to these individuals to then rate.

4781. **MR. AUDUN BRANDSAETER:** I know that was done in the Hazard ID workshop. In the Hazard ID workshop, risk matrix was presented as explained, and participants there were also asked to give a qualitative in the case (inaudible). I would not expect that that was done in the local interviews but I'm not so familiar with the content of those interviews.

4782. **MS. BROWN:** In your document, you use three levels of risk and you talk about them. You talk about, in your language, that risk is either negligible, as low as reasonably practical, and intolerable. Is that correct?

4783. **MR. AUDUN BRANDSAETER:** Could you refer me to a page, maybe?

4784. **MS. BROWN:** It's just throughout the document. I'm sorry; you use the terms "negligible" or the risk is a -- what's the acronym? A-R -- or A-L-R-P, I think you use the acronym of. And then you may use the risk level of "intolerable."

4785. So those are fairly standard risk measures. Are you incorporating those -- were those risk measures incorporated within this document?

4786. **MR. CROWTHER:** Ms. Brown, could we ---

4787. **MS. BROWN:** Sorry.

4788. **MR. CROWTHER:** --- just for my benefit, you've referred to "this document" or "the document"; can you tell us which document is you're looking at?

4789. **MS. BROWN:** The QRA.

4790. **MR. CROWTHER:** Thank you.

4791. **MR. MICHAEL COWDELL:** I'm not finding reference to those terms necessarily. I mean, maybe you could point us to where you found those?

4792. **MS. BROWN:** I can't give you the exact. I know when you talked about berthing and the ship hitting the pier, the risks at the pier were, "negligible." I know those words were used. I know other -- sorry, I didn't give you specific Adobe pages, but I know you used the acronym, "as low as reasonably practical" throughout. And I'm not sure if you used the word "intolerable," but I know those measures were indicated throughout the document. So are those the measures of risk that were used?

4793. **MR. MICHAEL COWDELL:** I don't think we can respond to the question without knowing where those terms of reference because I'm not finding

all those terms.

4794. **MS. BROWN:** Okay. We'll look for them further on and then we can go back to that.

4795. Okay. Just in Appendix 5 of the FSA, which would be near the end.

4796. So in number 5 there -- I'm sure you've used these. So the current practices or best practice is to recognize that there's three levels of risk; intolerable, as low as reasonable practical, and negligible. And so those are the kinds of terminologies used within the documents. They give various explanations to that. So "intolerable" means that it can't be justified no matter what. Okay, so they give -- the question in here was that I was wondering is whether "tolerable risk" was defined by Northern Gateway.

--- (A short pause/Courte pause)

4797. **MR. KEITH MICHEL:** Northern Gateway did not attempt to define what was intolerable. Northern Gateway performed the quantitative risk assessment and lowered the risk as low as reasonably practicable. It's Northern Gateway's belief that it is a very safe transportation system. But, ultimately, the decision on whether the Project is acceptable rests with the government, not with Northern Gateway.

4798. **MS. BROWN:** So my understanding on that one is -- can you say that again, sorry?

4799. **MR. MICHAEL COWDELL:** I think I explained it clearly.

4800. **MS. BROWN:** I know, but I didn't hear the last part, sorry.

4801. **THE CHAIRPERSON:** Sorry, Ms. Brown, which part are you asking to hear again?

4802. **MS. BROWN:** Just the very last sentence. What he said about -- sorry.

4803. **MR. MICHAEL COWDELL:** The last sentence was that the final determination on what's acceptable for this Project rests with the government not with Northern Gateway.

4804. **MR. JOHN CARRUTHERS:** But, certainly, based on what we know and what we're implementing, we believe the risks are acceptable.

4805. They are -- we've taken what's being done today and enhanced it, in terms of the world has shipping that they move oil around the world and we are looking at best practices and setting up a world class system.

4806. So to the extent that traffic moves in and out of there today, it moves in and out of the West Coast of B.C. regularly, we're taking all those learnings, we're taking what's being done today and we're enhancing that.

4807. So, yes, we believe they are acceptable because they're being done today and accepted today but we're adding a number of measures to make them even safer.

4808. **MS. BROWN:** So though there was no measure of tolerable risk, there is an assumption that the risk is acceptable?

4809. If that makes any sense?

4810. **MR. MICHAEL COWDELL:** Can you repeat the question, please?

4811. **MS. BROWN:** So even though there is no definition or any measure of tolerable risk, it's determined that the risk is acceptable?

4812. **MR. MICHAEL COWDELL:** I think Mr. Michel just answered that question.

4813. **MS. BROWN:** Okay. I'm just sort of summarizing, okay.

4814. I think Mr. Brandsaeter said something similar in the Volume of 158, line 1885, he stated that:

> *"The QRA was to estimate a realistic level of the proposed operation and it was never part of my mandate to consider risk acceptability."*

4815. Would you agree?

4816. **MR. KEITH MICHEL:** That's part of prior testimony.

4817. **MS. BROWN:** Okay.

4818. So I guess -- and maybe this is a leap, but if this is the case, how can the QRA then come to the conclusion that the Project is safe when there is no definition of "tolerable risk"?

--- (A short pause/Courte pause)

4819. **MR. JOHN CARRUTHERS:** Again, this is an activity that's handled worldwide today and we're setting a very high standard.

4820. **MS. BROWN:** Okay.

4821. Just of interest for you, there is in the FSA some definitions of -- if I put it in here -- sorry.

4822. **MR. CROWTHER:** Ms. Brown, are you offering this for information or is there a question?

4823. **MS. BROWN:** There's going to be a question.

4824. In Appendix 5, as well, the measures by the FSA in terms of measurable and tolerable risks, they identify that there's two fundamental measures of risk. both individual and societal.

4825. The question is -- and you haven't had an opportunity to look at this, I know, but what measure of risk does the Northern Gateway consider?

4826. **MR. MICHAEL COWDELL:** I'm not sure we understand the question.

4827. **MS. BROWN:** Oh, sorry. Okay.

4828. So it just states:

> *"There's two fundamental of risk, individual risk and societal risk, and it's necessary for the risk to be both tolerable to the individual and tolerable to society. Individual risk is regarded*

> *as a risk to the individual. The risk of society is a major accident. And there's a clear perception in society that a single accident ..."* (As read)

4829. And so on and so forth.

4830. So, therefore, there's -- a tolerable level of societal risk is usually lower than a tolerable level of individual risk. So I'm just wondering, within the best practices, what consideration of risk did Northern Gateway undertake here?

4831. **MR. MICHAEL COWDELL:** I think we've responded to this morning how we approach risk in the QRA.

4832. And, you know, I would also just go back to even the TERMPOL review report and its summary and conclusion that the focus of the TERMPOL review process is on marine safety and accident prevention to help ensure marine transportation and components of the Northern Gateway Project can be carried out within acceptable risk levels consistent with Canada's regulatory regime ---

4833. **MR. CROWTHER:** Mr. Cowdell, I'm afraid you're going to have to slow down ---

4834. **MR. MICHAEL COWDELL:** Sorry.

4835. **MR. CROWTHER:** --- for the benefit of the court reporter.

4836. **MR. MICHAEL COWDELL:** I apologize.

4837. **THE CHAIRPERSON:** And if you're reading from a document that's in evidence, you could just take us there.

4838. **MR. MICHAEL COWDELL:** I guess the point I wanted to make is that the TERMPOL review process report reviewed our TERMPOL submission, including the quantitative risk assessment, and didn't find the risks associated with the Project to be unacceptable and commented that our risk mitigation measures would improve safety on the B.C. Coast.

--- (A short pause/Courte pause)

4839. **MS. BROWN:** Sorry, I'm just looking for something.

--- (A short pause/Courte pause)

4840. **MS. BROWN:** I'm looking for the QRA document. I've misplaced it on my computer here. Sorry.

4841. **THE CHAIRPERSON:** Are you looking for the reference to it? B23-34.

--- (A short pause/Courte pause)

4842. **MS. BROWN:** Okay, I'm just looking at in -- it's Adobe 21 of the QRA document 2334.

4843. So, in here, you give definitions of consequence and definitions of risk as part of your steps for the QRA, consequences being, likely, damage to the terminal tanker, probability, et cetera, and the risk as well.

4844. So the consequences or the risk -- sorry -- the issues in the definition of "consequences" and "risk", that impact -- sorry, where am I here? I can't find it. I'll just ask the question and maybe you can find it for me. It's in here somewhere. But, anyways, you have definitions of "consequences" and "risk" and that the impact of the environment will be in a separate document and it is not included within the risk piece.

4845. **MR. AUDUN BRANDSAETER:** I could then briefly explain what the scope for the QRA was to estimate probabilities, likelihood, percentage in terms of return periods of accidents, and the related expected or probable outflow or spill of oil to the environment. That further analysis of the effect of a spill on the environment, that is treated in all the documents and was not part of the scope for the DNV.

4846. **MS. BROWN:** Thank you for that, because I understood that from your document. I just wanted to confirm that.

4847. On Adobe 130 -- so on the very top of that you talk about risk assessment has two main purposes; the first is to enable a discussion of risk acceptability.

4848. **THE CHAIRPERSON:** Ms. Brown, again, I can save you some time

reading from that aspect of it. You've focussed the witnesses' attention on this paragraph. You could go ahead and just ask your question.

4849. **MS. BROWN:** Yeah, okay.

4850. Let's see, so the intent is to form an organized platform for selecting risk mitigation and the exact quantification of probability is not as important as ensuring that the relative discussion of risk along the routes is correct so that the effective measures can be used to reduce risk.

4851. Sorry, I'm losing my ability here. It must be getting close to lunch.

4852. Okay. I'm not sure if I'm in the right place. Yeah, just going -- it's going back to the quantitative -- the qualitative piece of the assessment of this document and the human element piece.

4853. Just to skip over to another document -- sorry, I'm not -- my thought processes aren't as good as they should be here. But in -- I'd like to go to the TERMPOL document, TERMPOL Terminal Review Process Document of 2001, which is E11-3-3, Adobe 36.

4854. **THE CHAIRPERSON:** Ms. Brown, it's up to you and Mr. Shannon how you organize your questioning, but we could switch over to Mr. Shannon's questions and then come back to you after you've had a chance to gather your thoughts, if that's helpful. So we'll leave it in your hands.

4855. **MS. BROWN:** Okay. Just going to this one.

4856. So just -- okay, will you take it up to 36, I think. So just going back to the risks and the consequences that Northern Gateway defines within their QRA, and that it is without -- that it is about probability, et cetera.

4857. Just in the TERMPOL, I'd like to have some explanation as to how this piece was incorporated into the QRA, because it indicates that the analysis should not be limited to mathematical index or the probability of an incident, but it all should include perceived risk to the populations within the coastal zones ---

4858. **THE CHAIRPERSON:** Again, Ms. Brown, you could just have the witnesses answer the question because this is already in evidence.

4859. **MS. BROWN:** Al right. So if they can answer that question please.

4860. **MR. KEITH MICHEL:** Could you please repeat the question?

4861. **MS. BROWN:** How it is that this particular element of the TERMPOL process was included in the QRA?

4862. **MR. MICHAEL COWDELL:** Which particular element are you referring to? Are we talking about ---

4863. **MS. BROWN:** The -- 3.15.4.

--- (A short pause/Courte pause)

4864. **MR. MICHAEL COWDELL:** So if we're talking about Item 3.15.4, those items are discussed in TERMPOL study 315, they're discussed in Volume 8c of the application, and they're also discussed in some other TDRs, including the Bercha Vapour Cloud TDR.

4865. **MS. BROWN:** So this statement here talks about risks, and they talk about perceived risk. So how was the aspect of perceived risk incorporated into the QRA overall? There seems to be a -- sorry.

4866. **MR. MICHAEL COWDELL:** That was not part of the QRA, but it -- some of these items are discussed in other documents that have been filed.

4867. **MS. BROWN:** So there seems to be a bit of a disconnect, there's almost like two parallel processes, where you have a probability piece based on your definitions of risks and confidence and then another piece out there that looks at the risk to populations, marine environment and fish habitat. Would that be a correct understanding of this?

4868. **MR. KEITH MICHEL:** The QRA assessed both the probabilities, the likelihood of events, and also the expected oil outflow. So in as far as the QRA is concerned, the risk which is the probability times the consequence, in the case of the QRA the consequence is expressed in terms of oil outflow and that's both the likelihood of the spill and the projected sizes of those spills.

4869. That data from the QRA, the spill size and likelihood, was utilized in further studies of trajectory and consequence assessment that are outside the

scope and expertise of this panel. This panel has the expertise to discuss the QRA itself.

4870. **MS. BROWN:** So there seems to be two parallel processes and I'm just trying to figure out how do they come together?

4871. **MR. KEITH MICHEL:** I just explained how they came together.

4872. **MS. BROWN:** But they seem to be still separate. How do you pull them together into one entity that talks of total risk?

4873. **MR. MICHAEL COWDELL:** You'd have to define what you mean by total risk. I mean, the QRA results are discussed in the environmental and socio-economic assessment, in the volumes of the application.

4874. **MS. BROWN:** I'm trying to figure out what you just said, sorry. Can you say that again?

4875. **MR. MICHAEL COWDELL:** I'm just trying to answer your question. The QRA is -- was not -- does not sit alone. The -- some of the results of the QRA are discussed in other file documents, including portions of the environmental and socio-economic assessment.

4876. **MR. JOHN CARRUTHERS:** We specifically sat a panel to talk about the environmental effect associated with a potential accident. So that's how they come together. We understand it and we spoke at length to that.

4877. **MS. BROWN:** So how does the risk piece of all of these factors come together? Like, so we talk about acceptable risk, like, you talk about risk assessment has two main purposes. The first is to enable the discussion of risk acceptability ---

4878. **THE CHAIRPERSON:** Again, you asked a question and then you went on after that.

4879. **MS. BROWN:** Sorry.

4880. **THE CHAIRPERSON:** I wonder if you just asked the question and then let's get the answer.

4881. **MS. BROWN:** Okay.

4882. **MR. JOHN CARRUTHERS:** If I understand the question correctly, the entire process we're going through tries to bring everything together. So we've seated many panels. One of them, you start with a quantitative risk assessment and you look to what mitigation could be, then you looked at the potential impact of any accident. So we've gone through all that process, but to understand it all, you have to sit through that entire process because it is very complex. We have filed a lot of information on this project and we've sat witnesses to answer very specific questions.

4883. So certainly there are opportunities to talk about the potential environmental effects if there was an accident, and we spoke to those, and today we are talking about our assessment, the quantitative risk assessment. But it does come together through the entire project and the panels we've sat.

4884. **MS. BROWN:** So with that paragraph in B23-34, Adobe 130, that I tried to go to before and just floundered on, does that begin to explain a little bit about that?

4885. **MR. KEITH MICHEL:** You have to be clearer in your question.

4886. **MS. BROWN:** Okay. Because you say in there the risk assessment has two main purposes. The first is to enable the discussion of a risk accessibility -- acceptability, sorry. And the second is to provide an informed and organized platform for selecting risk mitigation measures in order to reduce risk in key areas.

4887. And then you go on to say:

> "*In this regard, the exact quantification of probability of events and their consequences is not as important as ensuring that the relative discussion of risk along the routes and at the marine terminal is correct so effective measures can be taken to reduce risk."*

4888. **MR. KEITH MICHEL:** And your question?

4889. **MS. BROWN:** I'm just trying to understand what Northern Gateway meant when they said that in all this issue of risk and quantitative and qualitative

data?

4890. **MR. KEITH MICHEL:** I'll be repeating myself, but I'll briefly summarize one more time what we've done. With the QRA, we've done an assessment of likelihood of a spill and the size of the spill. And that study was sufficient to assess mitigation measures which have been adopted by the project.

4891. We have also -- Northern Gateway has done extensive analysis both in the QRA and in the environmental risk assessments to enable the discussion on acceptability of risk. And that includes the probability data of the spill, the expected size of spills and where they might occur and response issues and trajectories related to those spills. So that data will enable that discussion and, therefore, Northern Gateway believes it's done everything that is defined in that paragraph.

4892. **MS. BROWN:** Okay. So just one area -- I'm still struggling with that. It's okay.

4893. As part of risk analysis, a cost benefit analysis is often done and you alluded to this a little further earlier on.

4894. Why was a cost benefit analysis not done as part of the QRA and the risk mitigation pieces?

4895. **MR. KEITH MICHEL:** Again, the risk mitigations that showed promise in this particular project, Northern Gateway was prepared to adopt those without investigating costs, so there was no need to proceed with a cost benefit analysis.

4896. I used as an example of a cost benefit analysis the Strait of Juan de Fuca study. In that case that study was initiated by the U.S. Coast Guard. They had a decision to make about whether the federal government would mandate a requirement or in fact perhaps pay for rescue tugs. Therefore, they have a threshold that they're willing to accept on cost benefit. The approach for that cost benefit analysis is clearly defined in government documents and that approach was applied in that particular case.

4897. In this case, the risk reduction measures were adopted without having the need to assess the costs.

4898. **MS. BROWN:** But if we do not know what the costs -- even if like Northern Gateway is willing to incur these costs, but if we do not know the baseline of the cost benefit analysis from the get-go, how do we review this as part of your monitoring and feedback to see whether or not they remain cost effective? Like how do you justify that?

4899. **MR. KEITH MICHEL:** I'm not sure it's the concern of either the government or the public if risk reduction measures that have been adopted by the project are cost effective. That's a concern of Northern Gateway. If it's paying too much money for risk reduction measures, I don't believe that's a concern of the public or the government and, therefore, it isn't necessary to produce the cost side of those figures.

4900. We can say that risk reduction measures such as escort tugs are a very costly measure and the determination was made to go forward with it without having done the full cost benefit assessment. In other words, Northern Gateway didn't have a particular number in mind as to what it would take to justify escort tugs. It looked at the mitigation effect, felt that it had to do it in order to bring the risk of spills as low as reasonably practicable and therefore agreed to adopt that measure.

4901. **MS. BROWN:** These measures are not mandatory, though. They are a commitment, but they are a commitment given by Northern Gateway and they are not mandatory.

4902. **MR. KEITH MICHEL:** What measures are you referring to?

4903. **MS. BROWN:** Well, say for example, the tugs.

4904. **MR. KEITH MICHEL:** That's correct. It's not a regulatory requirement; it's a commitment of the project.

4905. **MS. BROWN:** So as a member of the public, when you have not done a baseline for cost benefit analysis and the cost becomes such that, say, perhaps Northern Gateway wants to back away from this, how am I, as the public, to be reassured that the cost benefit analysis is going to indicate that tugs are not necessary?

4906. **MR. JOHN CARRUTHERS:** We're prepared to be held accountable for those commitments.

4907. **MS. BROWN:** Because as we went back to earlier on, it is indicated that tugs, tether tugs and escort tugs, are not required to do these transits?

4908. **MR. JOHN CARRUTHERS:** Correct. You could do a safe transit without them and we're committing as another layer of safety to utilizing not one but two tugs as we're moving loaded product.

4909. **MS. BROWN:** Madam Chair, would this be a good time to break just so I can get organized? I'm sure everybody has been here since 8 o'clock.

4910. **THE CHAIRPERSON:** That sounds like a great idea, if it will help you be efficient in your questions.

4911. **MS. BROWN:** Thank you.

4912. **THE CHAIRPERSON:** So let's break now and come back for 10 to 1:00 please. Thank you, everyone.

--- Upon recessing at 11:50 a.m./L'audience est suspendue à 11h50
--- Upon resuming at 12:52 p.m./L'audience est reprise à 12h52

JOHN CARRUTHERS: Resumed
JERRY ASPLAND: Resumed
JENS BAY: Resumed
AUDUN BRANDSAETER: Resumed
DAVID FISSEL: Resumed
AL FLOTRE: Resumed
KEITH MICHEL: Resumed
STEVEN SCALZO: Resumed
THOMAS WOOD: Resumed
MICHAEL COWDELL: Resumed
HENRIK KOFOED-HANSEN: Resumed

4913. **THE CHAIRPERSON:** Good afternoon, everyone. We're ready to get under way.

4914. Mr. McCormick, did you have something that you wanted to raise as a preliminary matter?

4915. **MR. McCORMICK:** Yes, Madame Chair. Good afternoon.

4916. Just to accommodate the fact that Mr. Brandsaeter will not be available on Saturday, we'd like to make a small change to the order of appearance that would have the Haisla Nation appearing after Douglas Channel Watch, solely for those questions pertaining to the DNV report.

4917. It would then be followed by Heiltsuk and the UFAWU and ultimately by Haisla Nation again with the questions not requiring Mr. Brandsaeter's expertise.

4918. If that pleases the Panel, we would appreciate the opportunity to make that change.

4919. **THE CHAIRPERSON:** Thank you very much, Mr. McCormick. Thank you to the parties for working amongst yourselves to figure out how we can best accommodate Mr. Brandsaeter's schedule. That is entirely acceptable to the Panel, and we'll proceed on that basis.

4920. **MR. McCORMICK:** Thank you, Madam Chair.

4921. **THE CHAIRPERSON:** Thank you.

4922. Are there any other preliminary matters that parties wish to raise?

4923. Ms. Brown, I just want to do another time check with you. Are we expecting that you and Mr. Shannon will complete in the next hour and a half or so based on your time estimate that you provided?

4924. **MS. BROWN:** Perhaps before break.

4925. **THE CHAIRPERSON:** Okay.

4926. **MS. BROWN:** I'm not sure how the questions are going to go here.

4927. **THE CHAIRPERSON:** Okay. That sounds great. Please continue with your questions.

--- EXAMINATION BY/INTERROGATOIRE PAR MS. BROWN:
(Continued/Suite)

4928. **MS. BROWN:** Okay. Just regarding some questions regarding the cost benefit analysis piece that was talked about.

4929. So I understand, am I correct, that Northern Gateway would be paying for the operation of the tugs?

4930. **MR. JOHN CARRUTHERS:** Yes, the project will be paying -- the tugs will be paid through the operation, the project operations.

4931. **MS. BROWN:** So is that -- I'm not -- I don't know how this -- but is it -- I guess is it embedded in the tariffs or how is it out there? Like how does it get paid for? Is it a separate company, or how?

4932. **THE CHAIRPERSON:** Again, Ms. Brown, I'd encourage you to ask the question and then let it be answered, please. Thank you.

4933. **MR. JOHN CARRUTHERS:** We have not finalized the mechanics of cost recovery, but it would be a cost that is recovered through the project either from a Northern Gateway perspective or a marine perspective.

4934. **MS. BROWN:** Okay. So you don't know where it's coming from, in other words, the cost.

4935. **MR. JOHN CARRUTHERS:** We do know that the project is funding those costs.

4936. **MS. BROWN:** Okay. But you don't -- and you don't know what the costs are because you haven't done the cost benefit analysis; correct?

4937. **MR. JOHN CARRUTHERS:** We understand costs for tugs and we know that the project will be paying those costs.

4938. **MS. BROWN:** Okay. The reason I ask is that the tugs you'll design are to ensure a threefold reduction of risk. So there would be specifications required for those particular tugs, and I understand they have to be designed yet. Is that correct?

4939. **MR. STEVEN SCALZO:** The tugs identified in the report referred to as the "Tug Study" provides the preliminary, the detailed design of the tugs, and outlines those characteristics for the purpose of tugs being utilized on this project.

4940. So again, going back to what I said earlier this morning, the tugs are purpose built and designed and they have specific performance capabilities to meet the project needs.

4941. **MS. BROWN:** Okay. So those specifications are outlined as they are required to meet the threefold reduction in risk.

4942. **MR. STEVEN SCALZO:** They're identified in the Tug Study specific to the needs of the project.

4943. **MS. BROWN:** Okay. And we don't know how they're being paid for.

4944. **MR. CROWTHER:** With respect, Ms. Brown, I think the witnesses have been clear that the costs of the tugs will be borne by the project.

4945. **MS. BROWN:** Okay. All right.

4946. I just want to ask a couple of questions on how the tugs operate within the project for standards. Are there standards of compliance that are enforced for tug operation provincially or federally?

4947. **MR. MICHAEL COWDELL:** I think we already answered that question.

4948. **MS. BROWN:** Okay. In a previous panel or previous intervenor?

4949. **MR. STEVEN SCALZO:** Yes, we went into some detail with respect to the requirements of the tugs, but the tugs are highly regulated. There are performance standards. And they will be in full compliance with those requirements and the specific needs of this project.

4950. **MS. BROWN:** Thank you. Sorry to ask so many questions about the tugs, but the use of the tethered and the escort tugs are really an important piece of the Application and a very integral part of building the social licence for Northern Gateway to build this acceptability.

4951. **THE CHAIRPERSON:** Ms. Brown ---

4952. **MS. BROWN:** So as ---

4953. **THE CHAIRPERSON:** --- you'll have your opportunity to present your thoughts and views on the project in final argument. I would encourage you to just go straight to your questions at this point.

4954. **MS. BROWN:** So I just want to reiterate how comfortable as B.C. citizens the commitment to these tugs by Northern Gateway is ---

4955. **THE CHAIRPERSON:** Ms. Brown, was there a question there?

4956. **MS. BROWN:** Yes.

4957. **THE CHAIRPERSON:** What is the question, please?

4958. **MS. BROWN:** So what is -- I'd like to know the -- is the commitment for the life of the project for the -- and for the tugs?

4959. **MR. JOHN CARRUTHERS:** Yes, fundamentally it's for the life of the project. What we're discussing is, over time, you could see improvements that -- or enhancements to what they are today. So technology may change and you may see improvements.

4960. **MS. BROWN:** This brings me to a question of the unknown of the specifications and the costs of the tugs.

4961. So for public information, would it not -- for public knowledge and scrutiny, would it not be of value to know what those specifications are and costs are so that we can appreciate or understand the improvements as they occur?

4962. **MR. MICHAEL COWDELL:** The specifications, as Mr. Scalzo has discussed, are discussed in project documentation. So it's the intent of the project that tugs with capabilities similar to what's been described would be built for the project.

4963. **MR. JOHN CARRUTHERS:** And those costs will be absorbed by the project.

4964. **MS. BROWN:** And the understanding is that they would remain with the 80 percent or 90 percent impact or the two-third reduction of risk, that that risk factor would remain that low.

4965. **MR. JOHN CARRUTHERS:** The specifications of the tugs will be as per the study that Mr. Scalzo has mentioned.

4966. **MR. MICHAEL COWDELL:** We'd just also add that we have, in an IR response, talked about the cost of the escort tugs.

4967. **MS. BROWN:** Okay. My question is, though, with ongoing of the project, will the risk level remain at the two-thirds?

4968. **MR. MICHAEL COWDELL:** Perhaps you can be more clear and point us to the two-thirds that you're referring to.

4969. **MS. BROWN:** Well, you say that the tugs, when you design them and operate them, there will be a threefold reduction of risk throughout your documents.

4970. Will that threefold reduction of risk remain throughout the length of the project as a guarantee?

4971. So just to be clear, so in other words, let's say you changed the design of the tugs or you have some cost factors that you want to change and you decide that the reduction will only need to be twofold. How would I be guaranteed as a citizen?

4972. **MR. JOHN CARRUTHERS:** I think the best way to look at it is the tugs will be designed as Mr. Scalzo has mentioned. So they will be designed to that specification, to the project needs.

4973. **MS. BROWN:** Are you saying that the two-third reduction of risk will remain throughout the entire length of the project?

4974. **MR. JOHN CARRUTHERS:** The tugs will be part of the Project for their life, yes.

4975. **MS. BROWN:** And -- but designed to a level that will ensure the two-third risk deduction piece?

4976. **MR. JOHN CARRUTHERS:** They'll be designed as per our tug study and they may be -- over time, you may see improvements to those designs.

4977. **MS. BROWN:** Okay.

4978. So you're saying it would be at least two thirds?

4979. **MR. JOHN CARRUTHERS:** I'm saying they'll be designed as we have in the tug study ---

4980. **MS. BROWN:** Okay.

4981. **MR. JOHN CARRUTHERS:** --- and there could be enhancements to technology over time.

4982. **MS. BROWN:** Okay.

4983. Just some other pieces about mitigation measures, in 23-34, Adobe 29 ---

--- (A short pause/Courte pause)

4984. **MS. BROWN:** One twenty-nine (129). No, that's not it. Sorry. Maybe I'll just talk about them.

4985. The additional mitigation pieces that you have looked at -- and this is for Mr. Brandsaeter -- is that they've been qualitatively assessed -- that means that the navigational aids, the effect of the whole AIS and various other items and -- but they have been quantified by percentages.

4986. How was that done, even though they were qualitatively assessed?

4987. **MR. MICHAEL COWDELL:** Sorry, I don't think -- I don't understand the question.

4988. **MS. BROWN:** Maybe Mr. Brandsaeter does?

4989. **MR. MICHAEL COWDELL:** No, we need the reference to, I think, that you're referring to ---

4990. **MS. BROWN:** Oh, okay.

4991. **MR. MICHAEL COWDELL:** --- in ---

4992. **MS. BROWN:** Okay, I'll have to look for it, sorry.

--- (A short pause/Courte pause)

4993. **THE CHAIRPERSON:** Ms. Gilbert, while Ms. Brown is looking up her reference, could we get an AQ number, please, for Douglas Channel Watch?

4994. **THE REGULATORY OFFICER:** AQ77.

---AID TO CROSS-EXAMINATION NO./AIDE AU CONTRE-INTERROGATOIRE No. AQ77:

Douglas Channel Watch - Aids to cross-examination

4995. **THE CHAIRPERSON:** Thanks, Ms. Gilbert.

4996. Ms. Brown, are you ready to go ahead with your question now?

4997. **MS. BROWN:** Yes, I must have written down around the page wrong, sorry. If you'd just let me check one more here.

--- (A short pause/Courte pause)

4998. **MS. BROWN:** Sorry.

4999. Is Mr. Brandsaeter there?

5000. **MR. AUDUN BRANDSAETER:** Yes, Ma'am.

5001. **MS. BROWN:** Hi there.

5002. **MR. AUDUN BRANDSAETER:** Hi.

5003. **MS. BROWN:** So I haven't got the reference, but I remember reading that, in with the QRA, you indicated that the -- such items as the navigational

aids, the AIS system were quantifiably assessed within the Project.

5004. How did you -- how did they factor into the probability?

5005. Like, how did you quantify them?

5006. **MR. MICHAEL COWDELL:** Can we just ---

5007. **MR. AUDUN BRANDSAETER:** In the ---

5008. **MR. MICHAEL COWDELL:** Sorry, Audun, just -- Mr. Brandsaeter, just one second, it's Mr. Cowdell here.

5009. Just -- could we bring up Adobe page 141 in B23-34?

5010. It just might help alleviate some of the confusion here.

5011. **MS. BROWN:** Yes, there he is, okay.

5012. **MR. MICHAEL COWDELL:** Sorry, my apologies, page -- Adobe page 141, thank you.

5013. **MS. BROWN:** Thank you for that, there it is.

5014. So it's just under that chart, on 8.4.1, yeah.

5015. **THE CHAIRPERSON:** So Ms. Brown, in order to move forward here, is your question still the same to Mr. Brandsaeter ---

5016. **MS. BROWN:** Yes.

5017. **THE CHAIRPERSON:** --- based on this?

5018. **MS. BROWN:** It's actually 8.4, yeah.

5019. **THE CHAIRPERSON:** So, Mr. Brandsaeter, are you in a position to answer the question posed by Ms. Brown or do you need it repeated?

5020. **MR. AUDUN BRANDSAETER:** I think we should preferably repeat it because I didn’t really understand it.

5021. **THE CHAIRPERSON:** Ms. Brown, would you, please, repeat your question?

5022. **MS. BROWN:** Okay.

5023. So these measures, as is indicated there, they've -- there's -- these risk mitigation measures have been qualitatively assessed, these additional measures.

5024. And how do they factor into the probability of risk reduction?

5025. I know you give percentages ---

5026. **THE CHAIRPERSON:** Okay, let's stop there because you've asked the question or a question, Ms. Brown. So let's get the answer to the question first.

5027. **MR. AUDUN BRANDSAETER:** Yes, the fact is that we've assessed them qualitatively and they have given some indication on certain of this -- with reference to sources that give some percentage within expected effects on them.

5028. But we have not taken that effect into account at all in the probability, so -- because certain of -- or some of these are, to some extent, already implemented.

5029. So now that I'm assuming that implementation of these would give a significant further reduction, they are just qualitatively described and that's how that would reduce the risk in qualitative terms.

5030. But we haven't taken any benefit from it or credit from it in the estimated return periods.

5031. **MS. BROWN:** So you're saying some of them had limited impact; is that correct?

5032. **MR. AUDUN BRANDSAETER:** Once more, please?

5033. **MS. BROWN:** Say that again?

5034. **THE CHAIRPERSON:** Could you repeat what you've just said?

5035. **MS. BROWN:** Oh!

5036. So you're saying that some of them had limited impact in the probability?

5037. **MR. CROWTHER:** I believe, Ms. Brown, that the evidence ---

5038. **MR. AUDUN BRANDSAETER:** Some of them ---

5039. **MR. CROWTHER:** Sorry, Mr. Brandsaeter.

5040. If I understood the evidence -- I hope this is helpful to you, Ms. Brown -- it was that the mitigation effects of these additional measures were not reflected in the return periods.

5041. **MS. BROWN:** Okay.

5042. **MR. CROWTHER:** If I understood the evidence correctly.

5043. Perhaps Mr. Brandsaeter can confirm that I did?

5044. **MR. AUDUN BRANDSAETER:** Yes, sir, I can confirm that, in the numbers presented in the QRA, they have not been taken into account.

5045. Still, of course, if they are implemented, then they have a reducing effect on the probability of events happening. But, yes, in real life, they did have a risk reducing effect, but we haven't taken any benefit from it or account from that effect when we have presented it in the QRA.

5046. So what's presented are conservative in the way that these effects are not included.

5047. **MS. BROWN:** So that explain the table on 147, 8.6?

5048. Because there's no -- there's no numbers, it's just the effects rated as high or low.

5049. **THE CHAIRPERSON:** So, Ms. Brown, what's your question based on the table?

5050. **MS. BROWN:** I'm just confirming, is that why this table is written as it is, is because there's no effect on the -- there's no account of it being in effect of the probability of returns for risk mitigation?

5051. **MR. AUDUN BRANDSAETER:** We have not calculated any values -- numerical values that we have used in the calculations.

5052. But, here in this table, we indicate which one of these measures that we have "low, medium or high effect" and on what part of the traffic; if it's just traffic to and from the marine terminal or if it's also an effect on all the traffic in the area.

5053. **MS. BROWN:** Thank you for that, it's helpful.

5054. I just want to go to the terminal on Adobe 145 and 148 -- I guess 148, Table 8.7.

5055. Just -- there's some other tables as well but I'm wondering just why the return period is so high for the terminal, both mitigated and unmitigated, for the smaller oil and condensate spill?

5056. **MR. AUDUN BRANDSAETER:** Excuse me; could you explain which numbers are you referring to now?

5057. **MS. BROWN:** Well, there's no in between in the small oil or condensate spill specifically. In the unmitigated and the mitigated there is no difference between the two. Can you tell me what that's representative of?

5058. **MR. AUDUN BRANDSAETER:** That simply represents the fact that the mitigating measures that we have estimated the effect of -- they are effective for the larger spills. Those spills that they would have an effect on was fairly large one. They are for more operational spills, for instance. We don't think the close loading system have that similar effect.

5059. So that has primarily an effect on the larger spills or those in this table considered to be medium sized spills, which is based on the definition of medium spills being between seven and 700 tonnes per ITOPF.

5060. **MS. BROWN:** Just to remind me, I know the difference -- there's a

difference of spill size. What is the spill size for a small oil or condensate?

5061. **THE CHAIRPERSON:** Mr. Brandsaeter, if that's in the report perhaps you can refer us to where that's located.

5062. **MR. MICHAEL COWDELL:** If we go to page ---

5063. **MR. AUDUN BRANDSAETER:** As I just mentioned, the medium spill it's seven to 700 tonnes and then the smaller is less than 7 tonnes.

5064. **MR. MICHAEL COWDELL:** That's described on Adobe page 103 of B23-34.

5065. **MS. BROWN:** Okay. Thank you.

5066. Just one question about the term negligible and the probability of an incident at the berth. Berthing is indicated as negligible I think on Table 612 on Adobe 102 and Table 710 on Adobe 124. Okay, so, and in other areas you talk about the negligibility of this incident.

5067. I just want to bring up an aid to cross-examination that occurred in Kitimat a number of years ago. Like, I don't have it. But -- did you find it? You didn't find it. Okay.

5068. **THE CHAIRPERSON:** If you don't have it we don't have it, Ms. Brown.

5069. **MS. BROWN:** Well, we had sent it in in December, a while ago, as an aid to cross-examination. It must have gotten lost in the shuffle. Yeah.

5070. **THE CHAIRPERSON:** Is there a question that you can ask that would get to whatever you were wanting to bring up with a particular AQ?

5071. **MS. BROWN:** I was just going to ask some questions about the berthing and the mechanisms or the assurances of docking. But I think I'll leave that one, okay.

5072. Just one more area and I don't know if it's to this panel that I should bring it up, but maybe you're ready for it because we deem it as an aid to cross-examination. It was regarding the S curve. I gave some information on the safety

of navigation and referred to some pages, 24 to 25, on the calculations of the manoeuvrability's through the S curve.

5073. **THE CHAIRPERSON:** So, Ms. Brown, if you're planning to refer to an AQ this would be the time to have Ms. Gilbert pull it up and we'll see if the witnesses have had the opportunity to review it.

5074. **MS. BROWN:** It's AQ-2.

5075. **THE CHAIRPERSON:** Is there a specific page on this one, Ms. Brown?

5076. **MS. BROWN:** I haven't got the Adobe on it, sorry. The page number is 26 in actual fact. Well, actually it begins on 24.

5077. **THE CHAIRPERSON:** So here's Adobe page 24. Is this the area that you want to be in?

5078. **MS. BROWN:** No, it's not Adobe it's actually page 24. Right.

5079. **THE CHAIRPERSON:** So we'll just have to work with you to find out what that Adobe page number is.

5080. **MS. BROWN:** There it is.

5081. **THE CHAIRPERSON:** Is that it?

5082. **MS. BROWN:** Yes.

5083. **THE CHAIRPERSON:** Great.

5084. **MS. BROWN:** There we go.

5085. **THE CHAIRPERSON:** And so have you highlighted the document in the areas that you want to bring the witness panel's attention to?

5086. **MS. BROWN:** I'm just looking for a piece of paper here, sorry.

5087. **MR. CROWTHER:** Madam Chair, I stand to be corrected, but I believe that in the covering email Ms. Brown identified pages 24 through 26.

5088. **MS. BROWN:** Right.

5089. **MR. CROWTHER:** Now, I may have the wrong AQ, but I'm prepared to accept that as a substitute for highlighting. She did draw our attention to the specific parts of the exhibit, if in fact it is this one that she wanted to reference in her questioning.

5090. **MS. BROWN:** Yes.

5091. **THE CHAIRPERSON:** And have the witnesses had a chance to review this, pages 24 to 26 of this document?

5092. **MR. AL FLOTRE:** Yes, I have.

5093. **MS. BROWN:** Oh, good. Thank you.

5094. **THE CHAIRPERSON:** So, Ms. Brown, we can proceed effectively and efficiently ---

5095. **MS. BROWN:** Right.

5096. **THE CHAIRPERSON:** --- with your questions based on this please.

5097. **MS. BROWN:** So like they give us -- they give a scale there of channel bend radius. Where on this scale -- go down a little further.

5098. Where on this scale of angle of turn would you say that the S curve in the right channel would be classified?

5099. **MR. AL FLOTRE:** Are you referring to the S turn in Lewis Channel -- oh, in Wright Sound.

5100. **MS. BROWN:** Right. Yeah, there's one in Lewis as well too.

5101. **MR. AL FLOTRE:** So from the studies that I've done you can -- and we use a little different terminology than what this report uses.

5102. When we are investigating whether a turn is safe we utilize the rate of turn required to meet the radius of your turn, and we have a formula much

different than yours for calculating that.

5103. A very easy turn is 10 degrees per minute, and if you required 25 to 30 degrees per minute you would be concerned about the viability of making the turn. Working with the VLCCs we could make those turns using a rate of turn of 10 degrees per minute.

5104. **MS. BROWN:** In the channel?

5105. **MR. AL FLOTRE:** In the channel.

5106. **MS. BROWN:** Okay. All right.

5107. On Adobe -- I guess I do have an Adobe page here, Adobe 27, a little down, a little further.

5108. I just need a clarification on this. And there's very little said about this. It states that the straight section should be:

> *"A straight section should be available between the end of one curve and the start of another curve equal to at least five times the target vessel's length. Further, a reverse curve should be avoided."* (As read)

5109. Can you explain that to me within the Wright channel?

5110. **MR. AL FLOTRE:** I would have to have the author explain it to me because I don't understand it. Why can't you make a turn in the other direction once you've completed a turn in another direction?

5111. **MS. BROWN:** Okay. So is the vessel -- is the length -- is there a straight length between the sections of the curve that is the minimum of five times the length of the vessel?

5112. **MR. AL FLOTRE:** Well, it's -- you bring -- you arrest a turn. You have a turn, a certain rate of turn in progress, and at the correct time you bring that rate of turn to zero and then you can immediately start the rate of turn in the other direction.

5113. **MS. BROWN:** How much distance does it take to go to the zero

before you can begin the next turn?

5114. **MR. AL FLOTRE:** That's dependent of course on the characteristics of a particular vessel.

5115. **MS. BROWN:** Right.

5116. **MR. AL FLOTRE:** But the -- it's not a matter of time. It may be the amount of rudder you have to apply to affect what you want. But once you have reduced the rate of turn to zero you can start to institute a turn in the opposite direction.

5117. **MS. BROWN:** Yeah, understood. So these recommendations by -- I think it's Transport Canada is it not -- they're there but they can be -- it's in the best practices of what you as a pilot understands in terms of your vessel?

5118. **MR. AL FLOTRE:** Yes, I am speaking from experience with vessels in this size range.

5119. But, like I said, if I could have this author or these authors explain to me their reasoning for -- we take cruise ships up the inside passage. We're continuously turning in one direction and the other without leaving a length -- no, five lengths of the ship length before we change the turn in a different direction, so it's -- I don't understand the reasoning.

5120. **MS. BROWN:** Okay.

5121. **MR. MICHAEL COWDELL:** Can we -- if the Regulatory Officer would be so kind, could we bring up Exhibit E11-3-2, Adobe page 25?

5122. This is the TERMPOL review report and it speaks to the document that we were just looking at, I believe. And I won't read -- read what's already written, but if we look at the paragraph under Canadian Coast Guard's Guidelines in Section 3.3.3, we can see the physical characteristics of the route fall within the document that you're -- that you've provided as an AQ, according to the federal agencies.

5123. They also reference the PIANC's guide which was also used by us and referenced in TERMPOL in our assessment of the waterways.

5124. **MS. BROWN:** Okay. Thank you.

5125. That's the end of my questions.

5126. **THE CHAIRPERSON:** Thank you, Ms. Brown.

5127. Mr. Shannon. Okay.

--- (A short pause/Courte pause)

--- EXAMINATION BY/INTERROGATOIRE PAR MR. SHANNON:

5128. **MR. SHANNON:** Yes, good afternoon everybody.

5129. Madam Clerk, could we have evidence B23-3, Adobe page 109, please? Is that B23-3?

5130. **THE CHAIRPERSON:** It is.

5131. **MR. SHANNON:** Adobe 109. Could you go a little lower? Looks like I got it wrong. Anyways.

5132. I'll refer to 6.5.3, it's, "The Effect on Marine Traffic using Wright Sound."

5133. **THE CHAIRPERSON:** Is that what you were looking for that's on the screen now, Mr. Shannon?

5134. **MR. SHANNON:** Yes it is, yeah.

5135. At the bottom of that paragraph:

> *"The proposed projects described...will result in an overall increase of approximately 70 transits per month."*

5136. The last sentence reads:

> *"[this]... traffic associated with Northern Gateway alone represents an increase of [about]...13 percent over*

existing...traffic levels."

5137. To me, on the surface, that 13 percent sounds like a pretty small number. Would it be possible to put that number into a value of increased traffic mass in the Sound; that is, let's say, a tanker's five time -- okay, a VLCC tanker is about five times the dead weight tonne -- tonnage of the largest ships to visit Kitimat right now.

5138. So one VLCC is worth five of the smaller ones. Is there a way to represent the number increase of 13 percent over existing traffic levels in terms other than numbers of ships?

5139. **MR. KEITH MICHEL:** I suppose you could compare it by dead weight or gross tonnage but I'm not sure it adds anything to the overall picture. The principle reason for looking at the number of transits is to assess risk of collision. And -- and that's a function of the number of vessels.

5140. **MR. MICHAEL COWDELL:** I would -- I would also just add that this document describes the various types of shipping in the area and on the coast and to Kitimat. So, I mean, I think that information that you're describing is embedded in that.

5141. **MR. SHANNON:** Okay. I'm interested in all ships that are traversing the Sound, barges, tankers, freighters, all the rest of them down to the small ones. But it seems to me that the large -- more of the larger ones you have in the crowd, the bigger the overall effect, but I'll leave it with that.

5142. With the added increase in barge traffic and other vessels from other sources that -- that appears to me to provide an increase in shipping in the Sound. We have firm evidence that Rio Tinto Alcan proposes or will be putting in 50 percent more production in their plant which represents 50 percent more green coke barges and 50 percent more liquid pitch shipments in tankers, as well as more production leaving. Has any attempt been made to estimate what that increased shipping would amount to in terms of this project?

--- (A short pause/Courte pause)

5143. **MR. THOMAS WOOD:** During the TERMPOL review process that we carried out, which was now some time ago, we looked at the existing proposals at that time, and those included the increase in ships and barges

according to those proposals. The events that have happened since then, new proposals are not included in the TERMPOL document.

5144. **MR. SHANNON:** Okay. So a Rio Tinto increase might not be there, I would propose.

5145. Okay.

5146. There's been some rather ---

5147. **THE CHAIRPERSON:** Mr. Shannon, was that a question?

5148. **MR. SHANNON:** It's -- I guess it's just a reply.

5149. **THE CHAIRPERSON:** And so there's no need to reply at this point. You'll have your opportunity during final argument. The purpose of today is just to test the evidence with your questions.

5150. **MR. SHANNON:** In view of the number of barge loads which will be new to the Sound, how would a barge with -- let's say, carrying gravel, green coke, a collision of one of them with -- in the event of the towing tug's break down or loss of steering or power, what would -- what would a tugboat tethered to a tanker, what action would a tugboat tethered to a tanker take with that situation?

5151. **MR. STEVEN SCALZO:** Yes. Could you restate the question? I don't know that I understood it. Were you talking about the escort tug effect or the effect on the tug towing the barge?

5152. **MR. SHANNON:** Well, I'm presenting a scenario where a separate tug towing a barge, you know, with either gravel or green coke or whatever on board loses its towing tug's power so you've got a barge on the loose, more or less.

5153. With potential for incident with a tanker, let's say, under escort, what action would be taken to prevent that incident from becoming something less than pleasant?

5154. **MR. STEVEN SCALZO:** I don't know if I can respond to, really, a hypothetical. There are so many conditions and circumstances at the time. And it -- you know, it would go to the actions of the ship, the pilot and the escort tug as

well as the tug that -- the tug towing the barge that may have a problem.

5155. So I just don't know how to respond to that type of a hypothetical.

5156. **MR. AL FLOTRE:** Just using your scenario of the probable action, first of all, a pilot would take all methods he could use on board the ship to manoeuvre away from the barge that is not under control. He could send his -- if there was still a danger of collision, he could send the second -- the escort tug, not the tethered tug -- to the barge to push it out of the way so that there was no collision.

5157. And so that's a possible use of his escort tugs. It's not only to attend to the tanker, but to clear any objects out of the way if that was necessary.

5158. **MR. SHANNON:** Could we have D35-14-5, Adobe page 29, please?

5159. This is a table in a report by Gerald Graham as part of evidence given by Living Oceans. The table identifies recent double-hull piercings and resulting outflows.

5160. The one that I'd like to bring everyone's attention to is the Eagle Otome on 23rd January, 2010. It was a ship-barge collision with a tanker in which 10,000 barrels of oil was lost to the river.

5161. My question would be what relative speed would be required to -- this is an incident where the barge pierced the tanker and there was quite a considerable loss of oil.

5162. What relative speed would be required to pierce both hulls of a double tanker -- double-hulled tanker?

5163. **MR. KEITH MICHEL:** There are many factors that would go into whether a striking vessel would penetrate both holds of a double-hulled tanker.

5164. It would depend not only on speed, but on the shape of the bow of the striking vessel, the structure of the double-hulled tanker, the angle at which the obstruction -- the accident occurred. And so it's not possible to give a specific speed.

5165. In this incidence, which I believe occurred in the Gulf of Mexico, there

was a penetration through both halves, both the outer skin and the inner skin, and it penetrated into a single cargo tank.

5166. As discussed previously, this is one of what we believe are five accidents of double-hulled tankers that penetrated into the cargo tanks since 1990.

5167. **MR. SHANNON:** This is one of the two that you identified in the table earlier, I think. Is that correct?

5168. **MR. KEITH MICHEL:** I don't think I identified specific incidents in a table, but this is one of the double-hulled accidents that has occurred. It occurred in 2010.

5169. **MR. MICHAEL COWDELL:** I think it's also worth pointing out that where this incident occurred is a fairly narrow channel with very high traffic density. It's not -- I wouldn't say it's comparable to the approaches to Kitimat.

5170. **MR. SHANNON:** Could we have Adobe -- sorry, D-187-9-1, Adobe page 14, please?

5171. To us, this is -- in the North Coast this is a fairly busy intersection. I think I count six crossings.

5172. My question disappeared with the previous answer. So let's get off that picture for now. Sorry.

5173. Could we have D-187-4-3, please? Adobe page 1. Yes, there it is.

5174. This is an excerpt from the history of "HSC Tug Escort Guideline and Regulation Development for the Port of Los Angeles/Long Beach Harbor". At that time, in 2007, they estimated that from an analysis of marine casualties for the area:

> *"...an average of 1 in 100 commercial vessels [...] sustained some type of steering or propulsion failure during inbound or outbound transit."*

5175. Now, with a loss of power and steering as common as one percent of the time, would you agree that these rates could affect not only general shipping, but also tugboats?

5176. **MR. STEVEN SCALZO:** I can only go to the actual situation in Long Beach Los Angeles harbour for transits. And as I'd mentioned earlier, since the process of escort and assist of tankers in those waters, initially on a voluntary basis and then later on a regulatory driven basis by the state, there have been no incidents or accidents resulting in spills.

5177. **MR. SHANNON:** An example of a tugboat losing control of the ship it was controlling was the Esso Bernicia in Sullom Voe in 1978. In that case, a fire on board the tug caused it to depart.

5178. Could we have D-187-9-1, please, Adobe page 10? A little further down, I think. There it is. That's the Esso Bernicia shown hitting a dolphin after its tug had a fire on board.

5179. In the event of a fire on the tugboat, let's say, what provision would be in place to prevent a situation like this from happening in Northern Gateway?

5180. **MR. STEVEN SCALZO:** I don't know the details associated with this incident, but given the timing of the event, this is prior to when they fully implemented the use of tractor tugs assisting vessels in their ports or full escort and assistance.

5181. But in any case, and specific to your answer, since that time, what has been put into place as we talked about earlier through ISM Code, the International Maritime Safety Code, is a complete process of ship management criteria and standards that go not just to the operation of the tugs, but oversight in the management of the company.

5182. We spent quite a bit of time on previous testimony explaining this process and how it works to develop standards of inspection and third party independent overview to enhance safety, to implement continuous improvement and to reduce the accidental events like you've mentioned here.

5183. So steps in mitigation since 1978 have been fairly significant. Tugs are set up with engine safety alarm systems that alert based on trends of operation, whether it's mechanical, electrical, propulsion, and those systems have worked well to minimize the risk of incidents like the one that you've shown here.

5184. The tugs that will be assisting the operation at the terminal at Kitimat

are all outfitted to operate to those standards as identified in the information submitted, will all be covered by a full ISM Code compliance and will, as a result of that, have a third-party, independent audit through a regulatory agency, someone like DNV or Lloyds or American Bureau of Shipping.

5185. **MR. SHANNON:** To what extent are the propulsion systems on the tractor tugs fully redundant? I'm wondering if a power failure on one side can be rescued by action on the other.

5186. **MR. STEVEN SCALZO:** Your question is a good question. And again, we touched on it a little bit in previous testimony. But the individual tugs have redundant propulsion systems.

5187. Part of the reason why we identified the Voith Schneider Propulsion System because it works independent; as long as the tug has one engine -- one main engine operating, it has full control of itself through that propulsion unit and control of its manoeuvrability and operation. The controls are direct, mechanically linked to the variable pitch propellers that apply thrust and direction and force.

5188. So the tugs themselves are redundant with respect to their propulsion units and can operate safely on one unit. But further, in addition to that, the operation of the escort tugs on fully laden tankers will include the use of two tractor tugs. So one tethered and one not tethered. So they always have the second tug available as a redundant system.

5189. And the simulations that have been developed to look at the performance of the tugs have been based just on the operation of one tug.

5190. **MR. SHANNON:** Thank you.

5191. Expanding the 1 percent loss of power or steering a year, if Northern Gateway, with 220 tankers visiting the port every year, that amounts to about 440 transits a year.

5192. Am I reasonable to -- is it reasonable to expect that given those numbers, that between four and five loss of power or loss of steering incidents a year could occur?

5193. **MR. STEVEN SCALZO:** I think first of all, we -- I would not accept

the fact that 1 percent is the number. As I mentioned, for the most part, experience has shown that that situation has not occurred, first of all.

5194. And secondly, we're looking at a very robust system of redundant systems both driven by maintenance requirement through basic maintenance provisions as well as ISM/ISO requirement and then the redundancy of the operation of the vessels.

5195. **MR. SHANNON:** I'm sorry.

5196. **MR. AL FLOTRE:** Just commenting from my experience on ships, having completed almost 5,000 movements of B.C. ships, I had three instances of engine failure, no instances of rudder failure. Two of those instances -- that word doesn't work very good -- but two of those times, it was approaching the berth when the ship failed to go astern because you change the direction of the engine. And in one case only was it an engine failure while on route.

5197. So I have great difficulty with the 1 percent other than maybe when you take in smaller vessels. That may make up the difference. But B.C. ships, in recent times, have become -- because of regulation and insurance liabilities, they have become very reliable. And that's, as I mentioned earlier this morning, and that is why the assist tugs have yet to be used on the tanker routes from Vancouver to Victoria.

5198. **MR. SHANNON:** The very large tankers have two fuel sources, am I correct? Typically.

5199. **MR. KEITH MICHEL:** Can you explain what you mean by two fuel sources?

5200. **MR. SHANNON:** Well, diesel while in port and bunker C while outside.

5201. **MR. KEITH MICHEL:** Yes. In fact, subject to the ECA, they'll likely be burning diesel oil within 200 miles of shore and then in port as well.

5202. **MR. SHANNON:** So the fuel changeover would occur outside waters not on the inside waters?

5203. **MR. KEITH MICHEL:** That's correct.

5204. **MR. SHANNON:** I understand there's some situations where the changeover from one fuel to the other can be a bit dicey at times.

5205. **MR. KEITH MICHEL:** I think dicey is the -- is not a -- the correct term. There are certain procedures that need to be followed when you change over in fuel. These ECA regulations are relatively recent and so shipping companies have had to implement the training necessary for crossover. And also changes to the ship systems, both related to storage of diesel oil and necessary changeover equipment.

5206. This is being implemented now quite effectively. And ECAs are -- now cover the coast of the U.S. and Canada, but they've been in place for some time in the English Channel and North Sea. It seems to be working quite well.

5207. **MR. SHANNON:** Maybe Mr. Aspland could answer, help me with this one. With your experience with ConocoPhillips fully redundant tankers -- I think that's part of your past, is it not?

5208. **MR. JERRY ASPLAND:** No. But yes.

5209. **MR. SHANNON:** Sorry, I misunderstood your experience, I'm sorry.

5210. **MR. JERRY ASPLAND:** Yes because the ships I operated went to Polar Tankers, which are now part of ConocoPhillips.

5211. **MR. SHANNON:** Okay, Polar ---

5212. **MR. JERRY ASPLAND:** They were part of Atlantic Richfield.

5213. **MR. SHANNON:** That's the connection, sorry.

5214. Can you tell me what happened with the loss of power situation in the Polar Endeavour near Anacortes in 2002?

5215. **MR. JERRY ASPLAND:** No I cannot, I was gone. And the decision to make those into redundant ships was done after I had left in 1995.

5216. **MR. SHANNON:** Okay. So you don't have experience with that one, okay.

5217. **MR. JERRY ASPLAND:** None whatsoever.

5218. **MR. SHANNON:** All right. The reason I brought it up is it appears to me to be one of the better types of ship designs out there. I could be wrong, but that appeared to me to be the case. Is that correct?

5219. **MR. JERRY ASPLAND:** That's good for a debate someday. I did not make that decision, even though the decision to build new ships started when I was there as president. I would point that now another company's come along in the same route and decided not to put in redundant systems.

5220. **MR. STEVEN SCALZO:** Let me just add that though I'm not familiar with that specific incident, we have been doing the vast majority of the escort work for our ConocoPhillips and I can only assure you that if that incident did happen and I just don't recall it, that the tugs, if it was in the escort waters, obviously were in attendance. And I know of no incident that resulted from that situation.

5221. **MR. SHANNON:** Thank you.

5222. Okay, I'll change the attack a little bit here. How well would radar work in a freezing spray or heavy snow situation on the ocean?

5223. **MR. THOMAS WOOD:** There's two types of radar employed upon tankers and other ocean going ships. And these are the 3 centimetre band radar and the 10 centimetre band radar.

5224. In terms of the 3 centimetre band radar, this has been around for the longest time. And in those radars, the effects of the environment, freezing spray and snow and rain, are more pronounced.

5225. In terms of the 10 centimetre radar, this is not so and the ability to get a good, clear picture with the 10 centimetre radar in these conditions is much better.

5226. **MR. STEVEN SCALZO:** And with respect to the tugs, the tugs operate a similar suite of electronics with similar performance, as Captain Wood has mentioned. And the tugs have been continually and routinely operating in conditions where we've had poor visibility or snow or ice or rain.

5227. **MR. AL FLOTRE:** So if I could add, deeming with that case of snow and sleet, you reduce the power. There's a control on the radar, either the anti-sea clutter or the anti-rain clutter. But in the -- particularly in Douglas Channel, the rock faces are so steep that even once you've reduced the -- the control on the radar to get rid of the sleet and snow effect, you still have a very clear picture of the channel and the -- as for navigation purposes.

5228. **MR. SHANNON:** What is the reduction in the effect in snow of the 10-centimetre radar?

5229. **MR. THOMAS WOOD:** As my colleague Captain Al has said, the ability to control the effect of reduction is inherent in the radar set.

5230. The amount of -- of clutter which is caused by snow and ice is quite small on the 10-centimetre radar and is pronounced on the three-centimetre radar. In terms of giving you a quantitative figure I could not do that.

5231. **MR. SHANNON:** Okay. Exposed to freezing -- freezing spray; is there any contingency for a tug tethered to a tanker in freezing spray?

5232. **MR. AL FLOTRE:** Could you define what you were asking? I ---

5233. **MR. SHANNON:** Well, I'm thinking of tow lines that are getting rather heavy and a ship that's getting pretty high on top as well. Any concerns for a tanker? All right. The tug tethered to the ship under these situations?

5234. **MR. THOMAS WOOD:** In terms of the tanker, no. A tanker has inherent stability. In terms of the tow line, the tow line is actually being worked all the time and -- and in my experience does not freeze.

5235. **MR. STEVEN SCALZO:** Yes, in -- in the tow lines that are being utilized today -- again, we got into a fairly good discussion of those in previous testimony -- are really synthetic tow lines of great tensile strength and are highly resistant to conditions like capturing water and adding weight, or having issues with respect to hot -- significantly hot or significantly cold temperatures.

5236. **MR. DAVID FISSEL:** Just on your question about freezing spray too, it should be noted that in the confined channels area freezing spray, you know, from -- coming off waves is very rare, almost non-existent because the

waves are so small in the confined channel area.

5237. **MR. AL FLOTRE:** And one more, tugboats probably have the lowest centre of gravity of any vessel on the water and it would take -- there's no conditions in Kitimat or Douglas Channel that would roll over a tugboat.

5238. **MR. SHANNON:** Could I have DCW AQ4, please?

5239. This is a gale warning in effect, with the freezing spray warning as well for Douglas Channel. It was issued on 18th of January last year. So as uncommon as these events are it's -- they have been shown to occur. And I just wanted to raise the point that it can happen and ask again whether -- let's say a tugboat under those circumstances, forget the tow line; will you have any problems with it?

5240. **MR. STEVEN SCALZO:** We operate tugs around the world but a specific area where we operate includes Alaska, the Arctic, out the Aleutian chain, across the Gulf of Alaska, in the Cook Inlet and -- where an ice load can become an issue.

5241. With the tug it's properly designed to minimize any of that exposure, including heated areas. So that you reduce the risk of ice build-up. And in this particular application the tugs designed for this service will have, you know, little or no exposure to heavy icing and should not be -- should not be an operating problem.

5242. But we do outfit our tugs with heating systems on deck, rails, and other locations to minimize the chance of icing up.

5243. **MR. SHANNON:** The reason I bring up freezing spray a little bit is a friend of mine in the meteorological business once lost the Nanaqua Shoals Buoy because it became top-heavy with an overload of ice. So under those circumstances what does one weather station turned turtle give to your weather forecasting in that case?

5244. **MR. DAVID FISSEL:** Again, I'd have to -- I mean, it's possible and I'm not aware of that specific incidence of losing the -- or having -- I would think it would be that the weather buoy wasn't lost, it was just impeded in its operation, is -- yeah. And then it would have recovered and -- but, you know, that's -- that's part of the operation of buoys.

5245. And the point is that the, you know, the buoys in the -- that buoy in Nanaqua Shoal is -- can be affected by that, but it's rare and it would be less common than other more exposed offshore areas.

5246. **MR. SHANNON:** Another question; I understand it's intended to use laser guidance during tanker berthing at Kitimat; is that correct?

5247. Am I in the right panel? I hope so.

5248. **MR. MICHAEL COWDELL:** Yes, there's -- there's a berthing monitoring system planned for -- planned for the Kitimat terminal.

5249. **MR. SHANNON:** What contingency would there be for berthing with that availability when you had driving snow or heavy fog, et cetera? Would berthing be any less facilitated?

5250. **MR. AL FLOTRE:** I would say, no, that it wouldn't be any less facilitated. It's an aid; it assists you. Pilots are very experienced at judging closing distance to berths with a naked eye, so they do it every day. But it -- here at Roberts -- or at the terminal here in Prince Rupert, the coal terminal, they have a docking system and you just use that as an added aid. But I -- I don't think it would preclude berthing a ship if it wasn't operating.

5251. **MR. SHANNON:** I'm going to turn to the weather in a different way now, I guess.

5252. Could we have D187-8-9, please? This is the first page of a Transport TSB investigation of the sinking of a Panamanian ore carrier; it's called the "Lee Wang Zin". It happened on Christmas day December 1979. The pilot had left the ore carrier at Triple Island. A brief distress call was sent out sometime later. It's believed the ship struck the Celestial Reef.

5253. If we could see D187-8-15? If we move that map around, you see the arrow with a little black dot? That's it. That's -- that's believed to be the course of the ship. There's a lot unknown -- there was a lot of unknown's with this sinking. There weren't many -- there were no crewmen that survived. But it was believed to have been blown into Celestial Reef. So this is on the northern tanker route, and probably occurred during some pretty foul weather.

5254. What would be the contingency with a tanker in distress to this extent in heavy weather on the northern -- on the northern route?

5255. **MR. AL FLOTRE:** I'm very familiar with this incident, and was not involved in the actual incident but I've had many conversations with the pilot who was on board the vessel or boarded it at Triple Island, took it to Tasu and loaded it and brought it back and disembarked.

5256. He -- he's still kicking himself about the fact that he didn't make some attempt to stop them from going to sea because of the condition of the vessel. It was one of the ships of shame that we had in that era that are no longer allowed to sail on the seas.

5257. And since that incident, pilots have been given the opportunity or a method of reporting to the officials when a vessel really should not be going to sea and that one probably -- if that procedure had been in place when that incident occurred, it probably wouldn't have had the accident.

5258. But, apparently, it was -- it shouldn't have been on the water, let alone loaded with iron ore.

5259. **MR. SHANNON:** I see you've had some conversations that weren't in the TSB but that's very interesting background. Thank you.

5260. **MR. THOMAS WOOD:** I would like to add here that we are looking at two vastly different kinds of vessels. An ore carrier and a tanker have very little in comparison when it comes to inherent stability.

5261. The tanker, with its homogeneous cargo spread throughout the ship has always a positive metacentric height; and in the case of even a rupture of the inner hull, where there's an oil spill or water ingress into the tanker, that inherent stability remains as is. With an ore carrier, when the hull is ruptured, this does change the stability and this is the reason why it overturned.

5262. **MR. SHANNON:** Captain Wood, you mentioned the inherent stability with metacentric height.

5263. Is not the metacentric height more stable on a single-hulled than a double-hulled?

5264. **MR. KEITH MICHEL:** I'll speak to that if you would like.

5265. The stability of a tanker is influenced by many items: the shape of the hull and the centre of gravity of the ship and its contents and then, also, the free surface of the fluids in the tanks.

5266. And in double-hulled tankers of certain designs, you can have a -- the free surface come to such an extent that a ship could become unstable which means that it could take an angle of heel.

5267. And that did in fact occur in the early 1990s. A couple incidences at terminals, and these ships were all -- are called "single tank across cargo tankers", that is, they have a single cargo tank that expands the full breadth of the ship which gives it very high free surface effect.

5268. Subsequent changes to IMO rules do not allow single tank across tankers. Basically, there is now a calculation required for accidental oil outflow that would preclude such a design. Also, IMO has adopted requirements for intact stability for tankers which are very unique. They require that a tanker be stable. That it be stable by design, inherently stable, so no matter how you place fluids in any of the tanks, these tankers will always be stable.

5269. And there were just a few ships built in the early '90s that had this single tank across design and Northern Gateway has made a commitment already that it would not utilize any of these tankers.

5270. **MR. SHANNON:** I think you're speaking of the sloshing effect across the -- without the central portion.

5271. Is that correct?

5272. **MR. KEITH MICHEL:** Yeah, sloshing is thought of as the dynamic impact of the fluid. Free surface is the shifting of the fluid and when we think of stability we think of free surface.

5273. As the ship heels, the fluid will shift to one side which tends to increase the heel and it effectively -- the free surface tends to lower the GM, the metacentric height, which is a measure of the stability of the ship and, therefore, you have to watch how much free surface you get.

5274. And most ships -- you know, container ships are a good example -- they can easily become unstable and, therefore, the ship's crew has to be careful how it loads the tanks and the cargo on a container ship. And, as I said, a few tankers could become unstable but it was determined that, through design, we could completely eliminate that possibility in tankers, and that's been done.

5275. **MR. SHANNON:** There's a 6 to 10-foot gap between the inner and outer hull on double- hulls; is that correct?

5276. **MR. KEITH MICHEL:** That's correct.

5277. In the sizes of tankers that are anticipated in this Project, Aframax to VLCC, the typical range is as low as 2.2 metres wing tank width in an Aframax up to, say, three and a half metres, or even a little bit more in a VLCC.

5278. **MR. SHANNON:** So I guess -- this is an interesting learning experience for me right now.

5279. I understood some of the metacentric difficulties to be the vacant space between the two hulls; am I not correct?

5280. **MR. KEITH MICHEL:** Well, again, the fluid in the outer hulls can contribute to this free surface effect.

5281. And, for instance, some tanks on tankers may be a single U-tank where the wing tanks on either side are connected through the inner bottom and this would have a higher free surface effect than, say, what's called a "J-tank" where there's a bulkhead in the inner bottom that separates the port and starboard tanks.

5282. And there's reasons to use U-tanks. They tend to mitigate heel in the case of a damage.

5283. But again, the requirements now require that you have to use them judiciously so that, no matter how you load a tanker, it cannot become unstable in an intact condition.

5284. **MR. SHANNON:** Thank you.

5285. Could we now have DCWAQ8, please?

5286. These are some pages I extracted from an Environment Canada publication called "Marine Weather Hazards Manual".

5287. Could we go to Adobe page 2, please?

5288. Highlighted here in yellow is details of a storm that built on the -- I think they call it the "equinoctial storm", on about September 28th, 1990, in the Dixon entrance. The wind rose from light to 54 knots and the seas changed from two and a half metres to 10 metres -- sorry, to 11.4 metres in just 10 hours.

5289. If these were represented as significant waves, I believe the maximum wave height could be roughly twice that, or say, 23 metres; is that about -- is that a reasonable approximation?

5290. **MR. KEITH MICHEL:** As far -- your question is regarding how high the maximum wave would be?

5291. **MR. SHANNON:** Yes.

5292. **MR. KEITH MICHEL:** Yes, so for 11.4 metres, statistically, the maximum wave height -- the maximum individual wave height relative to the significant wave height is a scaling factor of 1.85 to 1.9. So that would make it about 20 -- just doing this in my head -- 20 to 21 metres.

5293. **MR. SHANNON:** How would a tanker find itself in the situation like that, bearing in mind the speed at which this storm developed?

5294. Ten hours is not a long time without a lot of warning, how would a tanker behave in this?

5295. **MR. KEITH MICHEL:** Tankers are designed for extreme weather.

5296. The wave statistics that are used for the design of tankers are global wave statistics and, from those global wave statistics, the classification society has selected a few areas that represent the most extreme wave environments and those happen to be in the North Atlantic and those exceed 14 metres in the significant seas, in the extreme case.

5297. These wave statistics are applied in the design of the ships and there are significant factors of safety put on top of those loads when we design the ship

structure.

5298. So tankers are, in fact, designed for these extreme wave environments.

5299. **MR. THOMAS WOOD:** In terms of practical experience, I would have no problem at all with this kind of weather in a tanker.

5300. **THE CHAIRPERSON:** Mr. Shannon, is this an appropriate time to take our afternoon break?

5301. **MR. SHANNON:** It sure would be good.

5302. **THE CHAIRPERSON:** Okay, that's great.

5303. **MR. SHANNON:** Thank you.

5304. **THE CHAIRPERSON:** And can you give us an estimate as to how much longer you believe your questions will be?

5305. **MR. SHANNON:** Oh, I would say three quarters of an hour, an hour.

5306. **THE CHAIRPERSON:** Thank you, Mr. Shannon.

5307. Let's be back for 2:30, please.

--- Upon recessing at 2:14 p.m./L'audience est suspendue à 14h14
--- Upon resuming at 2:30 p.m./L'audience est reprise à 14h30

5308. **THE CHAIRPERSON:** I believe we're ready to resume.

5309. Mr. Shannon, please continue with your questions.

JOHN CARRUTHERS: Resumed
JERRY ASPLAND: Resumed
JENS BAY: Resumed
AUDUN BRANDSAETER: Resumed
DAVID FISSEL: Resumed
AL FLOTRE: Resumed
KEITH MICHEL: Resumed
STEVEN SCALZO: Resumed

THOMAS WOOD: Resumed
MICHAEL COWDELL: Resumed
HENRIK KOFOED-HANSEN: Resumed

--- EXAMINATION BY/INTERROGATOIRE PAR MR. SHANNON: (Continued/Suite)

5310. **MR. SHANNON:** Okay, welcome back.

5311. Mr. Michel, I believe you've stated before, the importance of cargo tank coatings on the bottom of oil tank cargos or oil cargo tanks; is that correct?

5312. **MR. KEITH MICHEL:** I -- earlier in the hearings, I described the international regulations that have gone into effect in recent years both for coating of ballast tanks and of cargo tanks.

5313. And I expressed my opinion that the coating of ballast tanks is absolutely critical to the safety of the ships and that the coating of cargo tanks is important if the tanks are subject to certain types of products over an extended period of time that could lead to corrosion of the bottoms and tops of those tanks.

5314. Again, I also explained that the mitigation of risk related to corrosion is a two-fold effort; one is maintenance of the coatings and proper application, and the other is the inspection regime that's in place to ensure that if there is corrosion exceeding limits, that that steel is replaced.

5315. So that was discussed in-depth a week ago.

5316. **MR. SHANNON:** When I considered undercoating my car, I was aware of the fact that you wanted to have a continuous coating or you'd better have a continuous coating or nothing at all. If there were gaps in it you could be more open to difficulty with corrosion products I believe.

5317. **THE CHAIRPERSON:** Mr. Shannon, is there a question?

5318. **MR. SHANNON:** That was it I believe. Is that correct?

5319. No, I'm sorry. I'm drawing an analogy between a continuous coating on the bottom of a cargo tank with respect to corrosion that could form there. Would that be a reasonable statement?

5320. **MR. KEITH MICHEL:** As I explained, not all tankers are coated in the cargo tanks. And where they are coated -- and the majority are today, even though they weren't subject to regulation. Where they are coated, it is the tops and bottoms of the tanks, which are the area where they're most subject to corrosion.

5321. And when you do coat tanks, be it the ballast tanks which are coated throughout or the cargo tanks which are coated top and bottom for crude oil carriers on many of them, then it's important to maintain that coating. And once the coating is damaged, then you can get accelerated corrosion.

5322. So it's important that a maintenance regime be in place to maintain the coatings.

5323. **MR. SHANNON:** I believe with oil cargos containing more sulphur, one of the species you want to keep off your cargo tank bottom is a sulphate reducing bacteria. Is that correct?

5324. **MR. KEITH MICHEL:** Yes. One of the concerns with the bottom of cargo tanks is microbial induced corrosion. MIC it's often referred to. And this type of corrosion is -- well, factors include sediment and the amount of water in the oil and the properties of the oil.

5325. **MR. SHANNON:** Could we go to Panel Transcript Volume 156, please, line 31619.

5326. Yes, I believe this discusses a "Port State Control Inspection by Transport Canada" official perhaps.

5327. What would -- what would actually be physically inspected by a visit? Could the representative actually visit the cargo tank bottom or would that be out of bounds for him?

5328. **MR. KEITH MICHEL:** Yeah, at this time we discuss the multiple levels of inspection a tanker undergoes and the close-up inspection of cargo tanks and fuel oil tanks, and the thickness measurements that are done on a regular basis. That's done under the oversight of the Classification Societies and their surveyors.

5329. The level of inspection that Transport Canada would do under Port State Control, I think it's best to refer to their documents. I'm not in a position to say what level of inspection they would carry out.

5330. **MR. SHANNON:** I agree with what Mr. Michel just said. I would note, however, in Transport Canada's written evidence they do talk about Port State Control -- the Port State Control Inspection Program, including inspectors look at, among other things, Item 2, "Structural Condition".

5331. A question on cargo inerting; what's the reason that a cargo is inert gas above the cargo?

5332. **MR. THOMAS WOOD:** The inerting of the ullage space, which is the space above the oil in a cargo tank, is a two-fold purpose. Primarily, it's for the safety of the vessel because the reduction of oxygen in the space reduces the possibility of explosive atmosphere, and this is a safety.

5333. Secondly, the reduction of oxygen also reduces the ability for oxidization or corrosion.

5334. **MR. SHANNON:** What inert gas atmospheres are put in the ullage space. What's the typical?

5335. **MR. THOMAS WOOD:** I can speak of experience. The minimum requirement is 8 percent O_2. But more recently than that terminals around the world have required 4 percent O_2. We typically, in the companies that I worked for, which was British Petroleum and TK Shipping, we used to bring this level down to below 2 percent.

5336. **MR. SHANNON:** With what gas?

5337. **MR. THOMAS WOOD:** The gases we used was scrubbed funnel gases.

5338. **MR. SHANNON:** How often is nitrogen used as an inert gas medium?

5339. **MR. THOMAS WOOD:** Nitrogen banking is used usually primarily on small products carriers, chemical carriers, et cetera, et cetera.

5340. **MR. SHANNON:** If a ship's boiler exhaust is used what's in place to remove SO_2 emissions in the boiler gas?

5341. **MR. THOMAS WOOD:** What is in place is the -- the control of the boiler gas emissions by the boiler controls, firstly. And, secondly, by the scrubbing of the gases in the scrubbing tower, which is basically sea water.

5342. **MR. SHANNON:** So you're pumping wet boiler gas on top of the cargo?

5343. **MR. THOMAS WOOD:** When you say, "wet boiler gas," yes, there is a certain amount of -- of condensation involved in this process.

5344. **MR. SHANNON:** If you've got a carbon dioxide and the carbon monoxide mix in with your boiler gas and it's moist, is there any attempt to dry that gas before you put it on top of the cargo?

5345. **MR. THOMAS WOOD:** The process is, basically, the scrubbing tower and then this -- these gases are hot and they're meeting cold; there is condensation, as I say.

5346. I'm not a chemist, nor an engineer. I do know that the gases coming through from the -- the boiler to the cargo deck area are controlled by a system. And that system also ensures not only the temperature but the validity of the gas in terms of O_2 content and in moisture control.

5347. What goes into the -- into the cargo tanks is -- is safe gas, in terms of the system and what the system is there to provide.

5348. **MR. SHANNON:** I believe you were trying to put it between the upper and lower explosive limit between -- that's where you control the oxygen for the stuff on top of the cargo tank; is that correct?

5349. **MR. THOMAS WOOD:** Not entirely. Yes, we do maintain the tanks outside of the explosive limit. We maintain the contents below the explosive limit. But we maintain the cargo tanks with a very, very low percentage of oxygen as I've stated. In our ships we used under 2 percent.

5350. **MR. SHANNON:** With water vapour and carbon dioxide gases present on top of the cargo, I believe there's an -- a facility to produce carbonic

acid with those constituents; is that correct?

5351. **MR. THOMAS WOOD:** I would hand this over to my colleague, Keith Michel, as he's more apt to answer this question than I am.

5352. **MR. KEITH MICHEL:** Could you please repeat the question?

5353. **MR. SHANNON:** Water vapour and carbon dioxide will react under -- under the circumstances in the cargo tank to produce carbonic acid; is that correct?

5354. **MR. KEITH MICHEL:** Carbonic acid can be generated from water and -- and CO_2; yes, that's a chemical reaction.

5355. **MR. SHANNON:** Would you find this on the bottom of the oil in the tank? Or, I mean, the -- water goes down there, it's light -- or sorry, it's heavier than the -- it's heavier than the oil. You'll also find carbonic acids down there if they form; is that correct?

5356. **MR. KEITH MICHEL:** I don't know of any significant corrosion problems related to carbonic acid. You do get water in the bottom of cargo tanks; it separates from the cargo itself. There's a certain percentage of water in the cargo. I think it's less so from the inert gassing. But there is some water that gets into the bottom of tanks.

5357. The cargo tanks themselves though are cleaned using high-pressure washing of crude oil. And this is done on a regular basis, which helps remove the water.

5358. **MR. SHANNON:** But each cargo, let's say, dilbit has a certain water -- water component present so I don't -- would it be incorrect to say you can't remove the oil -- the water from the dilbit in the first place, so there's bound to be some on the bottom?

5359. **MR. KEITH MICHEL:** There's always some water on the bottom of cargo tanks.

5360. Tankers are designed to carry a wide range of products. You know, crude oils that have a -- a large range of properties, acidity, tan values, water content, sulphur content; they vary significantly and tankers are designed to carry

this range of cargos.

5361. And if a particularly corrosive cargo is carried in a tank, it would accelerate corrosion over that period of time but in no way put the tanker at risk. There is significant corrosion margins in -- in the -- the steel on the tank vessels.

5362. And, again, as we discussed last week, there have been regulatory changes implemented over the last decade that require more continuous monitoring of ship structure. And to the extent that for ships over 10-years old you're doing close-up visual inspection and targeted thickness measurements every two and a half years, and if coatings aren't in good condition in the ballast tanks, and any tanks where they're found not to be in a good condition, you're doing that every year. And these inspection regimes will be effective in further mitigating the risk of any extended corrosion.

5363. So corrosion occurs over time, and the ships are designed with the expectation you will not have to replace any steel over the 20-year life of that ship, or 25-year life which is the typical design life in this -- for this project it would be no more than 20 years.

5364. And -- but, again, the inspection regimes are in place to ensure that if there is accelerated corrosion, that that steel is then replaced.

5365. **MR. SHANNON:** Could we return to Panel Transcript 156, please, line 31554? This is Mr. -- this is Mr. Michel, I believe. Am I reading it right? Yes.

5366. In this line you identify fatigue cracks that occasionally occur between cargo tank and ballast tank showing up as oil leaks into the ballast region.

5367. My question is, is there an -- are the cargo -- sorry, are the tankers cargo -- sorry, are the cargos -- sorry, are the tanker's ballast tanks inerted?

5368. **MR. KEITH MICHEL:** No, tanker ballast tanks are -- are not inerted. There's generally the capability to inert by attaching hoses from the inert system to the ballast tank in an emergency condition. But they're not inerted as a matter of course.

5369. **MR. SHANNON:** The reason I bring it up is that the very reason you should put an inert gas on top of the cargo tank to prevent explosions might exist

in the ballast regions, given enough of an oil leak down there.

5370. Would that be correct?

5371. **MR. KEITH MICHEL:** It would take an extensive oil leak into a ballast tank before you'd have any risk of explosion due -- of static electric condition, and again if you had such a leak you could inert that tank on an emergency basis.

5372. Generally the leaks, fatigue crack leaks, are very small and would create no risk of explosion at all.

5373. The risk there is that if the ballast was discharged overboard you'd have a pollution incident and for that reason, prior to discharge, the tanks are inspected and the ballast discharges run through a monitor to ensure that the -- there is not an oil content.

5374. **MR. THOMAS WOOD:** In my experience the monitoring of the ballast tanks is -- for hydrocarbons is done on a continuous basis.

5375. And also in my experience, and going back as far as the sixties, ballast tanks I have actually never encountered one instance of oil leaking into a ballast tank on the tankers that I've been on.

5376. **MR. SHANNON:** Let me get this straight, in the sixties that would have been the cargo tank would it not? The ballast is ---

5377. **MR. THOMAS WOOD:** No, we -- BP had some ships. We've had separate ballast tanks, totally segregated from the cargo. They were not double-hulled, they were single-hulled.

5378. **MR. SHANNON:** That's double bottomed is that correct?

5379. **MR. THOMAS WOOD:** Negative, no.

5380. **MR. SHANNON:** No?

5381. **MR. THOMAS WOOD:** Conventional tankers. They had -- they had tanks which only were available to ballast not cargo.

5382. **MR. SHANNON:** Okay.

5383. Now, a question on cargo tank coating. It's my understanding that protective coatings like epoxies have been shown to creep back due to surface tension on any sharp steel surfaces; is that correct?

5384. Surface tension.

5385. **MR. KEITH MICHEL:** Creep back? Could you explain what you mean by that?

5386. **MR. SHANNON:** You paint a point and the paint will -- by surface tension draw away from the point.

5387. **MR. KEITH MICHEL:** Yes, adhesion of appropriate thickness of the epoxy paints to the edge of -- to the corners of steel shapes for instance and flame cut edges is a concern. And for that reason the IMO requirements that have been adopted require that the -- those edges be prepared -- ground smooth.

5388. In fact for ballast tanks they require a multiple pass grinding and then those edges are stripe coated which means there is a separate hand coat put around the edges and then they're coated.

5389. And the IMO requirement is for also a very high level standard of coating the epoxy -- bleached tar epoxy coating, a minimum of two coats to at least 300 micron thickness.

5390. So there is a very high standard that's been placed on the coating of ballast tanks and the regulation also deals with the requirement of an independent inspector and defines the qualifications for that inspector.

5391. **MR. SHANNON:** Could I please have DCW AQ-7?

5392. This briefly describes a conference of -- this is the report -- topics ship building technology discussing the proper edge treatment prior to painting. So if I read the first line -- I can't see. Hang on.

> *"To avoid insufficient coating film thickness in certain areas such as corners, edges and weld seams in the ballast tanks mechanical grinding of edge area is required since stripe*

> *coatings applied on a smoother edge profile will retain liquid paints longer than sharper edge does."* (As read)

5393. That's exactly what you were just saying.

> *"However coating application revealed that actual coating thickness at these areas tend to be thicker than flat areas which makes those vulnerable to coating cracking during service."* (As read)

5394. That's with ships flexing and so on. So there's some parts of the -- some parts of the early coating of ballast tanks that were done far too thick and this was a -- I guess this is a recent discovery.

5395. So I believe that that makes the paint coating discontinuous in a spot location. Is that correct?

5396. **MR. KEITH MICHEL:** There is discussion within industry as to the best way to prepare the edges of, say, flame cut openings. As I mentioned, the requirements that are in the IMO regulations require multi-pass grinding and that's -- you grind it -- the corner three times and that effectively rounds the corner.

5397. This particular paper is proposing single-pass grinding and the argument made in this paper -- and it's based on laboratory tests is that the stripe coats tend to round the surface and the argument given in this paper is that if you round it first and then apply the stripe coats and the top coats that you could get, based on laboratory testing, some cracking of the paint itself.

5398. We should note that this paper was written by folks that work for a shipyard that would very much like to see the regulations change from three pass grinding to single-pass because it would be significantly less expensive.

5399. If you asked a ship owner which one they would prefer they'd clearly say the three pass grinding because based on extensive experience of ship owners that works best.

5400. So it's an item under discussion but I don't expect the regulation to be changed soon.

5401. **MR. SHANNON:** Okay, thank you.

5402. How would an inspection detect, let's say, compromised coatings to the extent this report is discussed?

5403. I mean a cracked coating, to me, that provides ingress for the nasty one I recall is microbial induced corrosion, (MIC). So that's a question. I don't know how to put a question mark at the end of it.

5404. **MR. KEITH MICHEL:** Inspections are done close-up, visual inspections are done of coatings. And this is a real advantage of double-hulled tankers, especially those built in the last 10 years which have been subject to IMO requirements for permanent means of access.

5405. And what IMO has introduced is a regulation that requires that there be a horizontal platform within 20 feet of all structure in ballast tanks and at the top of cargo tanks to allow for close-up visual inspections of the coatings in these critical areas.

5406. So, with that close-up inspection you can detect breakdown in the coatings and these are then required to be repaired.

5407. **MR. THOMAS WOOD:** I would add to that that it is actually very easy to see these particular cracks and I've observed them myself because the coatings that we use on the inside of cargo tanks and ballast tanks are generally a lighter colour.

5408. And when you do get this kind of cracking you get the -- some iron oxide coming out of that, it stains it brown, very, very easy to see and very, very easy to repair.

5409. **MR. SHANNON:** So you've seen them up close?

5410. **MR. THOMAS WOOD:** I've seen them up close, very close. Myself personally yes, on more than one occasion, yes.

5411. **MR. SHANNON:** Okay.

5412. **MR. THOMAS WOOD:** And it isn't a problem. It is definitely not a kind of a problem that cannot be handled by the people on the ship.

5413. **MR. AL FLOTRE:** I'll add that, in my career, I've done the same thing way back when. So you can see them up close anywhere you want.

5414. **MR. SHANNON:** Would you agree that, when it comes to corrosion, one of the more predominant locations for corrosion would be at the dissimilar metal interfaces between a weld and the parent metal? Let's put water down there and set up an ionic transport. I think you'd find most of your corrosion occurring where metals are not the same, Mr. Michel?

5415. **MR. KEITH MICHEL:** Not necessarily. I find inspections I've been involved with, and I've gone on many, it's generally areas where there is horizontal plate where the sediment and the moisture can sit. It may occur at welds; it may occur in open plating, and so it varies. But I don't think welds alone are the biggest single concern. It's, you know, throughout the ship structure that you inspect the coatings and the corrosion.

5416. **MR. SHANNON:** The reason I brought it up that way was I owned a Toyota, which was welded all over, and that's where it started to fall apart. So my impression was that welds were a place to watch very carefully.

5417. **MR. KEITH MICHEL:** Well, they are to some extent, but I think it's for a different reason. It's that the welds tend to be a little bit rough. And for the same reason that we discussed the importance of how you prepare the edge of plating, the same is true for welds.

5418. So they need to be properly coated or you can get corrosion initiated at the welds.

5419. **MR. SHANNON:** I'm going to jump over that one.

5420. I'm going to weather and weather monitoring right now. Could we have B17-19, Adobe 36, please?

5421. I've been to this photograph before, and it was in two panels ago, I think.

5422. So shown here is a photograph of one of the six Gateway environmental monitoring stations set up in the CCAA. A 10-metre tower is shown with a forest in the background.

5423. My question is, what is the height of the forest relative to the tower and how far away is the stand of trees in the background? Can somebody tell me?

5424. **MR. DAVID FISSEL:** I think if -- I don't think I can tell you exactly, but if you could go down a little bit further on that page, you'll see a national topographic series map and you'll see the contours there.

5425. So this is the Kersey Point met station in Douglas Channel and you'll see that the anemometer tower is placed at the very edge of that island, Maitland Island, and to get the best exposure and furthest away from the forest. So it's the best placement that's possible on that particular island in terms of getting the most representative winds at the standard anemometer height of 10 metres.

5426. **MR. SHANNON:** Could we have a look at DCW AQ1, please, Adobe page 42. Bottom of the page, I think. Yes.

5427. This describes a guideline for the relative -- the height of a tower and distance from -- this describes what open ground means for an anemometer exposed to wind.

5428. And the top of the next page mentions clearance from nearby obstructions ought to be 10 times removed. Take the height of any obstruction in the background and plant the tower 10 times that height away from it.

5429. My understanding is that's to -- that would be an effect on the leeward side of the wind blowing. You probably wouldn't catch it as well if you didn't have that stipulation in place. Is that correct? Do you understand?

5430. **MR. DAVID FISSEL:** Yes, I think I understand. The terrain itself, the land itself and as well as any forest or any other obstacles certainly affects the wind field, and that's very well known. Under these guidelines -- these are the guidelines of the World Meteorological Organization.

5431. This is the -- this would be the ideal situation for placing an anemometer to get the best possible wind measurements and the most representative winds that could be measured at that given site.

5432. The reality, though, is that for coastal weather stations, you cannot always achieve the guidelines. It says preferably 20 times the height of the

obstruction.

5433. In many cases, including many Environment Canada weather stations along the coast, that's just not possible to do with the -- given the terrain and the vegetation that occurs in this whole area.

5434. As we well know, this area is very mountainous. It's just the nature of this part of the world. And it's something that you -- for making meteorological measurements, you choose the best possible sites that are available, but you can't change what nature gives you.

5435. **MR. SHANNON:** Could I please have DCW AQ3, Adobe page 2? A little further.

5436. This is a topic -- this is by a firm called Barani Design, and it's talking about anemometer accuracy. And the situation described as a good place to set one up is at least three times -- in this case, the house is, in my mind, the forest. So you would rather be three times the height of the house away upwind of the forest and 10 times away the height of the house -- away -- on the downwind side of the forest.

5437. So to my mind, that tells me that you're influenced whether you're too close on the leeward side or the windward side if you're not further away than three times the height. Would I be reading that incorrectly?

5438. **MR. DAVID FISSEL:** Well, I think I take issue with calling a house a forest or a forest a house, but those are somewhat different. A house is a single obstacle and a forest is many individual trees, and so there are differences in the way air flow responds to going around those different types of solid objects.

5439. This is -- this document is in reference to guidelines for anemometers placement for wind turbines, I believe. It's dealing here with finding the optimal place to put an anemometer in terms of servicing or informing on the wind turbine generation potential.

5440. So -- but again, you know, it comes back to my previous comment that when there are obstacles, you choose the best possible site you can given the obstacles, and then you make adjustments based on the terrain, the obstacles and allow for those in interpreting the data. And this has been done for many -- decades and decades.

5441. If you look at the historical weather data, and I think some of that's been referred to in one of your other AQs, for example, Cape St. James on South Moresby Island. And I think we had an extensive discussion about this on March the 22nd with another questioner, Mr. Gunn, I believe, from CJ Peters.

5442. And this is -- these are Environment Canada wind data sets and they are -- they're placed in the best possible place, given the conditions, the terrain conditions.

5443. And then, in understanding and using that data, one has to make interpretations and adjustments based on the placements of those anemometers.

5444. **MR. SHANNON:** How do you make an adjustment for the, let's say, less than optimal location of an anemometer?

5445. What adjustments would you make?

5446. **MR. DAVE FISSEL:** Well, there's a number of adjustments one can make and are routinely made based on the siting of the anemometer and the terrain and obstacle conditions that are around it.

5447. I think we've already touched on one and that would be the prevailing -- the direction of the wind system, the overall direction of the wind system. If the wind is coming from -- if the exposed area that the wind is coming from, let me say, is from the exposed area over the open water then the adjustments are minor.

5448. On the other hand, if the wind is coming at a different -- from a different direction then one has to allow for the fact that the winds will need to be scaled up because of the sheltering effect. So that's one type of adjustment just based on the overall direction of the wind pattern or the airflow in the larger scale.

5449. There's adjustments that have to be made for the height of the anemometer, not above the -- above the local ground elevation but, then, also the height of the anemometer relative to the open water situation. And that's certainly a factor at Cape St. James, which we went into some detail about on March the 22nd.

5450. There's also adjustments that have to be made for local obstacles

which are within the two times or three times distances as well and that again is dependent on the particular direction of the winds and so on.

5451. So those are some of the -- some of the considerations that would have to be brought into play when looking at the winds.

5452. And what we're trying to do here in this is look at estimating what the winds are in the navigation channels. And that's the type of adjustment we need to deal with in this Project.

5453. **MR. SHANNON:** Would these adjustments be a numerical multiplication or something to that extent?

5454. **MR. DAVE FISSEL:** Yes.

5455. For example, the -- and that's -- I think it's touched on in some of these documents and it's already in testimony and in some of our evidence -- the adjustment due to the height of the anemometer above sea level, above the water level, is based on the logarithmic boundary layer of the marine atmosphere, the marine surface layer. And that's a well-known adjustment that's made.

5456. And the standards and the calculations that we used to make that calculation is in the International Standards Organization, ISO 19901-1, Mid-Ocean Applications to Engineering Applications.

5457. **MR. SHANNON:** Okay.

5458. I live on a forested five acres and I know I can get shelter from the wind if I'm standing with the forest at my back and it's blowing to me because there's a pressure wave that causes the wind to blow over me. So I'm getting shelter even with the forest at my back with a face-on wind.

5459. So that's my -- that's the reason for my concern and asking the questions about the leeward and windward side and then the effect.

5460. **MR. DAVE FISSEL:** Yes, you're right.

5461. And -- but the thing we've got to keep in mind here is that when -- our understanding of winds and weather conditions in the area is not based on just one particular site, we have many measurement sites that we can bring into play here.

5462. And actually, in this project, as you probably know, the Northern Gateway established a network of six weather stations in going back to 2005. So I think we're going into eight years now of observations from those weather stations; that previous AQ was one of those weather stations.

5463. So -- plus we have the Nanakwa Shoal, which is an Environment Canada weather station. So we have those and we can -- depending on the prevailing direction of the air flow, the wind directions, we can use all of those to come up with a better understanding -- and I would think a good understanding -- of the wind regime based on six or seven weather stations in the confined channel area.

5464. The other thing that's important to realize here is that weather isn't, especially for navigation in terms of forecasting, the weather observations are just one part of the system.

5465. When we're looking at weather, the forecast are really based on numerical weather prediction models, which use the observations as part of the ongoing calculations of the weather but they also use the physics of the atmosphere to determine what the weather will be going out for the next two, three and more days.

5466. So our knowledge and our understanding of weather comes from many observational sites and it comes from our predictive weather models.

5467. **MR. SHANNON:** Even with, let's say, correction factors applied to windward leeward side considerations, has any attempt been made to validate the overall output of the sixth GEMS stations with respect to, I don't know, a neutral point somewhere in the water -- in the open -- no obstructions?

5468. **MR. DAVE FISSEL:** Yes.

5469. And I think that's been addressed in some of the weather studies that have been done specifically for this Project.

5470. There was a kinematic wind model that was used and these data from the Northern Gateway weather stations were compared with that. And that's a simple weather model. It's a kinematic weather model.

5471. There's -- certainly, there have been studies, validation studies of the winds measured at Nanakwa Shoal and compared to weather predictions. And that's done routinely by Environment Canada.

5472. This is something that's part -- it's part of the ongoing system is to validate the predictions against the observations in order to improve on our predictive systems and to evaluate how well our models -- our weather prediction models are doing.

5473. **MR. SHANNON:** Isn't the kinematic model more intended to replicate the output from the six monitoring stations?

5474. **MR. DAVE FISSEL:** Yes, that's correct.

5475. And that was -- I think it's in that document ---

5476. **MR. SHANNON:** M'hm.

5477. **MR. DAVE FISSEL:** --- and the subsequent ones that -- where's that -- B17-19, B17-20, and so on.

5478. That was -- specifically, that kind of kinematic modelling is specifically applied to allow for combining the information from the six weather stations to better represent the winds.

5479. And I think -- and in fact, I know that was applied to looking at some of the oil spill issues.

5480. And I think there was an extensive discussion already on that -- in the panel on Marine Emergency Preparedness. I believe if you looked at Volume 137, you'll see a pretty extensive discussion of that that was already addressed in these hearings.

5481. **MR. SHANNON:** Could we go to B17-21, Adobe page 23?

5482. This is the kinematic model discussion you were referring to. I'm interested in the paragraph that's got in its wordings:

> *"Elevations less than 200 m were assigned a value of zero, and elevations greater than 200 m [were assigned] a very large*

> *value, so that the result was an interconnected network of channels of uniform depth, bounded by high cliffs. This approach is somewhat simplistic, but gave good results and executed [relatively] rapidly."*

5483. What does "good results" mean?

5484. **MR. DAVID FISSEL:** Well, I don't think it's possible to give you a single number. I think the comparisons are shown in this document and some of the other volumes of this document, and it shows -- but I think that the context here -- and this is really not my evidence because it was part of the marine emergency preparedness but it was all -- it was good in the context of how this informed the oil spill modelling.

5485. **MR. SHANNON:** Yeah, I apologize for -- although I shouldn't because it's fair game to bring it up here as it is included in the shipping and navigation evidence so that's why I do bring it here.

5486. Could we have ---

5487. **MR. DAVID FISSEL:** Just if I could explain though. In terms of shipping and navigation here, this is part of our -- here the context is how we are measuring the winds in relation -- and weather pattern winds and so on, in relation to the effects of shipping and navigation. And that's somewhat different than it is in relation to oil spill cleanup activities.

5488. **MR. SHANNON:** Just for my final series of cartoons, could we have DCW AQ5? This is best seen at about -- that's it, that's a good -- this is Kersey Point and Emelia Rock. So we go to the next slide and you'll see them appear. So Kersey Rock (sic) is the star on the right and Emelia Rock -- sorry, Kersey Point, star on the right; Emelia Rock the star on the left. And the 200 metre cut-off zone is shown in dark blue. So what the kinematic model does with this set of land masses is it turns it into a set of very high cliffs bounded by the blue region and anywhere else is roughly considered to be sea level.

5489. So in my simple mind I look at this picture and I imagine that it artificially widens the channels to -- I don't know. When you put wind through that, it would be artificially slowed down. Would that not be a correct way to look at that? I mean, you pass wind through a narrow channel, that's quicker; you pass the same wind through a wider channel and it's slower. Would I be

misinterpreting that? I know it's not your model but I'm trying something here.

5490. **MR. DAVID FISSEL:** I see what you're saying. But I suspect in the kinematic -- I'm pretty sure in the kinematic modelling adjustments were made for that effect because you're applying sort of a conservation of the amount of -- the volume of air moving through these channels, and that would be an adjustment that could be made.

5491. The point is for shipping and navigation, for example here, the Emelia Rock weather station, as you can see on the map in front of us, is actually very well exposed. That's one of the best we have, you know, that nature gives us, because it is on a rock and it's well-exposed from all sides. So the direct measurements that were made from Emelia Rock are very applicable to shipping and navigation issues.

5492. **MR. SHANNON:** Okay. Could we go to -- just carrying on here, to the next slide, please. This shows lonely little Dorothy Island without any dressing. Could we have the next picture, please? There's Dorothy Island shown with the 200 metre cut-offs as well. So in this case the appearance of Dorothy Island would be, to my mind, a buoy sitting in the middle of the water because there's no point of -- on the land it's higher than 200 metres.

5493. So again I'm sorry to do this, but, to me, the way this model has been constructed it more or less validates what I would suspect to be slower wind speeds that were measured. Do you see what I'm saying? I think it's almost a self-fulfilling manipulation of land masses.

5494. **MR. DAVID FISSEL:** I think -- I do -- I think I do see what you're saying but I think the effect is small, because in a lot of that area there, if you look at the total surface area and the difference between the surface area that's over water and the surface area within those 200-metre contours, the difference is quite small and adjustments can easily be made to account for that within the kinematic wind model.

5495. So the kinematic wind model was a useful thing to apply for the application of the marine emergency preparedness and oil spill modelling. Again, for shipping and navigation it's not a key issue here. I don't think it really has any bearing on the way we would use those winds for the purposes of shipping and navigation. Actually -- and Dorothy Island I think -- I believe is in a channel that's not even going to be used for shipping under the present project plan.

5496. **MR. SHANNON:** Okay.

5497. **MR. MICHAEL COWDELL:** I think it may also be worth pointing out -- and one of my colleagues might have something to add here, perhaps Captain Flotre -- but the stations we're talking about our GEM stations. These are in addition to the current Environment Canada stations that have -- and some private terminal stations up in Kitimat that have served the industry quite well for the last 20 or more years. So shipping has been carried out very safely up until this point. I think the weather forecasting has worked.

5498. There are, you know, currently -- you know, looking at the coast of B.C., the pilots have certain limitations on boarding at certain pilot stations and things like that, and I would say the weather forecasting seems to have been working and shipping's been carried out safely. So not -- I think this additional information would only help further that cause, and the environmental limits that we plan on employing for the project.

5499. **MR. SHANNON:** My dilemma in mentioning it in the way I am now would have been better placed on the panel in looking at oil spill trajectories and so on, but it's fair game in this and I didn't know any other way to bring it up.

5500. So one more slide, please. And this is Wright Sound. And the next slide shows Wright Sound weather -- GEM station with similar 200-metre contours. But, once again, I know it doesn't dramatically identify high winds in these areas for shipping and navigation, but I still have a problem with the use that was made of the model and it doesn't address shipping and navigation so much as it would have oil spill trajectories. So I'm out of luck in the timing of this presentation, and I thank you for your indulgence.

5501. **MR. DAVID FISSEL:** Let me try. Maybe I can add a little more information that might be useful to help you here. What we -- what's important here for this shipping -- in consideration of shipping and navigation, is that we understand the winds throughout the confined channels. And as Mr. Cowdell mentioned, shipping is going -- has been successfully carried out for decades and decades along this route. However, that's at Kitimat Arm. Here we're down at Wright Sound. So this is a case where having more information on winds is useful for this project.

5502. And this anemometer that's on a very exposed site in Wright Sound is

information that's being collected now for going on eight years. I think it will be eight years this September. So we can now bring the information that we collected here. This is the direct measurements that's important here for shipping and navigation. The kinematic model is not something that I -- I just don't see how we would -- why we would use that for the purposes of shipping and navigation.

5503. I would -- this -- it's the data here itself. And as we go forward, if the project's approved and it becomes a reality, then sites like this will be used to provide real-time information in support of shipping and navigation. Not necessarily the sites that are -- all the sites that are in place now and maybe there will be some additional sites. That's -- I believe, yet to be determined by the project.

5504. An optimization has to be done on that but that's the value of the information is the data that's collected , understanding the factors that we talked about before and then making those adjustments but it's not the kinematic model.

5505. That was a particular analysis that was brought to bear on the -- in relation to oil spill modelling and I think that did really inform and helped understand the fate of oil but that's not related, except through the weather stations themselves, to the shipping and navigation issues.

5506. Does that help? Or does that make ---

5507. **MR. SHANNON:** Yeah I think I agree -- I believe that this Wright Sound weather station is probably one of the more valuable in that it gives a pretty good depiction of winds whipping up and down the Grenville Channel unobstructed. So I agree with you. Thank you.

5508. Okay, that's it. I'm done.

5509. **THE CHAIRPERSON:** Thank you very much, Mr. Shannon.

5510. So we'll close off shortly for today. Based on the calculations that I've been making, it doesn't look like we will finish with the questions of this panel by Saturday, according to the current projections that remain. And so we will need to recall this panel on Friday, the 12th of April.

5511. I understand the way the set-up is right now is that there's only one

hour of questions of the Union on Friday, April 12th. So again, according to the calculations I've been making so far, there should be no trouble in completing this panel on the 12th of April. And then there's also the aspect of if Michel First Nation has any questions of Mr. Carruthers before we finish.

5512. So I would encourage Northern Gateway to work with the Secretariat staff in terms of facilitating witness panel members joining in remotely as much as is feasible.

5513. So just wanted to make sure that we had a chance to sort of lay out that aspect of it. It looks like we were over time what we expected to be today on some of the parts of the questioning and that has meant that we will not finish by Saturday.

5514. Now, that could change again because it could be that some numbers will go down but on a planning assumption going forward that's the way it looks to me.

5515. Again, I would encourage all parties, we do take very seriously the estimates that are provided. And if anybody has any further adjustments to make to their estimates going forward, especially with respect to the Government of Canada panels, it would be very helpful to the JRP if you would identify those sooner, rather than later, so that we can all be prepared and plan for what's coming ahead.

5516. So with that, we'll start tomorrow morning with the Haisla Nation questioning, Mr. Brandsaeter only so that we make sure that we cover that part off of Haisla Nation. We'll then go to the Heiltsuk Tribal Council and then the United Fisherman and Allied Workers' Union and then that -- then we will come back to the remaining questions of the Haisla Nation, as well as questions from secretariat staff and the Panel.

5517. So thank you very much, everyone. Good evening. We'll see you at 8 o'clock tomorrow morning please.

5518. Thank you. Good night.

--- Upon adjourning at 3:31 p.m./L'audience est ajournée à 15h31