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Commission canadienne de sûreté nucléaire

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280, rue Slater
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par vidéoconférence

Commission Members present

Ms. Rumina Velshi
Ms. Indra Maharaj
Dr. Marcel Lacroix

Commissaires présents

Mme Rumina Velshi
Mme Indra Maharaj
M. Marcel Lacroix

Secretary:

Mr. Marc Leblanc

Secrétaire:

Me Marc Leblanc

Senior General Counsel:

Ms. Lisa Thiele

Avocate-générale principale :

Me Lisa Thiele

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by videoconference / par videoconference

--- Upon commencing on Friday, November 5, 2021 at 12:45 p.m. / La réunion débute le vendredi 5 novembre 2021 à 12 h 45

THE PRESIDENT: Perfect timing.

Hello, everyone, and thank you for joining us today to answer the questions that the Commission may have.

But let me start off by recognizing that our participants today are located in many different parts of the country. I will pause for a few seconds in silence so that each of us can acknowledge the treaty and/or traditional territory for our locations. Please take this time to provide your gratitude and acknowledgement for the land.

Thank you.

So with me today on the Panel for the Commission, we have Dr. Marcel Lacroix and Ms. Indra Maharaj. And also joining us are Marc Leblanc, the Commission secretary, and Lisa Thiele, the senior general counsel for the CNSC.

We are here to deliberate on the

request from OPG for the Commission's authorization to restart Pickering Units 6 to 8 and Darlington Units 1 and 2 following any unplanned outages and for Darlington 4 and Pickering Unit 7 following their fall 2021 planned outages.

And without further ado, I will open it up for questions from the Commission Members.

We have participants from OPG. We have CNSC staff and we've also got members of our External Advisory Committee here with us. So as you respond to any questions or if you have any comments, please do identify yourself. If you have anything you want to say or ask any questions, just use the hand raise button and I will turn the mic over to you.

But then let me start off by Dr. Marcel Lacroix for any questions you may have, Dr. Lacroix.

MEMBER LACROIX: Well, thank you very much, Madame la Présidente.

Well, first of all, thank you very much to OPG, staff as well as the external advisory group for providing us all this information, quite helpful information.

My first question concerns the -- well, most of my questions will concern the statistical analyses that have been conducted thus far. I understand that the sample size is too small to provide us with, well, information concerning specifically, well, at least a station. So that is why a number of sensitivity cases have been carried out.

And from what I understand is that -- I'm still not comfortable with the fact that some of the sensitivity cases have been examined with reactor configuration and fuel configurations that are quite different. And by that, I mean Darlington versus Pickering. And I also understand that Darlington has provided what is called a fuel carrier as -- and concerning Pickering station, they have a shield plug, which are different.

So what I would like to ask from staff as well as from OPG is that to reassure me that from -- not from a statistical point of view, but from a mechanistic point of view, is it allowable, is it correct, is it justifiable scientifically and technically to merge various type of technologies and perform a statistical analysis?

DR. VIKTOROV: Alex Viktorov.

Perhaps I will start. So good afternoon, everyone.

Of course the details of our specific technical assessment and statistical analysis will be better explained by specialist. But I will assure you that we looked at it from different perspectives. For example, the facts show us zero defects. So that's a deterministic analysis. There have been no active mechanisms leading to flaws in those areas at all. So from deterministic perspective, we could have said the answer is zero defects.

But based on the relatively small sampling size, different approaches were examined, but they didn't all pull all data together. There were Darlington-specific analyses that only looked at the Darlington data. There were analyses incorporating Darlington and Bruce data, which are similar in design, and also analyses for OPG reactors.

So the assessments performed looked at different combinations of data. They all lead essentially to the same results.

And with this, I'll ask our technical specialist to corroborate on your question. Thank you.

MEMBER LACROIX: Okay.

MR. CARROLL: For the record, Blair Carroll, technical specialist with the Operational Engineering Assessment Division.

So I'd just like to echo the comments from Dr. Viktorov, but I would also like to point out that we didn't say that the sample size was too small. We tried to emphasize that we could look at the analyses in different ways, considering different combinations, and that's why the sensitivity analysis was done. It was to look at if we made slightly different assumptions what would the impact be. And generally, there wasn't a significant impact when you made these different assumptions.

Again, we as staff didn't make decisions based on pooling data from different technologies. We made our decisions and our recommendations based on the Pickering-only data versus the Darlington-only data. So we didn't combine everything together. We looked at it from a mechanistic perspective in terms of the geometry of the fuel bundle configurations at the outlet end of the pressure tubes, and considered that Darlington has a fuel carrier where Pickering doesn't, and Pickering has a shield plug that extends into the pressure tube farther than it does in the Darlington reactor.

So we didn't look at -- our recommendations were not based on pooling the data. It was we separated the data sets and looked at it -- made recommendations based on Pickering-specific data and Darlington-specific data.

MEMBER LACROIX: Okay. Okay, okay.

And what about from OPG? I would like to hear it from OPG.

MR. KNUTSON: So Mark Knutson, the chief nuclear engineer for OPG, for the record.

To answer your question, again, when we wanted it -- we did do a deterministic method in terms of zero flaws that we did not -- that were -- that we did not know about. And what I mean by that is in all our inspections of the pressure tubes, hundred of pressure tube inspections, these -- the ones we've identified in our report in our submission were dispositional in nature.

However, having said that, because the shield plug design and the fuel carrier design, we don't see this and have not seen an active degradation method in this area of interest. So to support what Alex has said from the CNSC, we see zero; however, we did do a statistical method and analysis that was more of a boundary to make sure that we were not missing anything there in that analysis technique.

MEMBER LACROIX: Okay.

MR. KNUTSON: So we were quite comfortable with the zero, with this extra analysis done to show some level of sensitivity.

MEMBER LACROIX: Okay. Okay.

Furthermore, on the statistical analysis, what I've noticed is that when you came up with the various categories from the sensitivity case A, which is you pool the Pickering A and B, up to the sensitivity case B, where you pool all OPG units as well as the Bruce Power units, I've noticed that when I put down all the numbers, all the predictions for the estimated number of dispositionable flaws, I found out -- and this is what I expected -- that the largest estimated number of dispositional flaws are found for the largest region of interest and the smallest sample size. And at the other end of the spectrum, the smallest estimated number of dispositional flaws is found for the smallest region of interest and the largest sample size. So it makes sense.

So all the predictions are between these two limits, which range from 0.3 to 7.3. That's an order of magnitude. So I understand that you perform all these analyses.

But if I put myself in the shoes of a devil's advocate, and I look at the statistics, I may say bluntly that give me a target estimated number of dispositional flaws and I will come up with a statistical analysis that will justify this number.

So I know I'm sending a wrench in your spokes. But I just want to be reassured that you provide us with all this information to make sure that your statistical analysis is valid.

MR. KNUTSON: No, understood, Commissioner. Mark Knutson, for the record.

Just to reiterate, because the actual findings for us during our inspections is still zero, the statistical analysis, as you identified, it varies based on sample size and how many events you've seen.

But having said that, what I would say is maybe I'll add Trevor Carneiro from OPG will add some additional knowledge in the area of statistics, just to give you some more insight.

And Trevor, can you go ahead?

THE PRESIDENT: You're on mute.

MR. CARNEIRO: Thanks, Mark.

Trevor Carneiro, for the record.

Yeah, that's correct in that as the population of inspected pressure tubes increases and the number of uninspected tubes decreases, the expected number of flaws in the region of interest will decrease as well. And this assumes that the number of observed dispositionable flaws in that region does not increase as well, which has been the case here. We have not seen any flaws in this region.

MEMBER LACROIX: Okay. Okay, okay. That's good. Okay.

I do have other questions, but I think that I'll pass it.

THE PRESIDENT: So, Dr. Lacroix, maybe we can ask EAC members if they have anything they would wish to add to your questions around the statistical analysis and the confidence in the predictions that have come up from that.

Dr. Luxat? Shall I ask you to start off with that?

Marc, are EAC members with us?

MR. LEBLANC: Yes, I was going to suggest that you direct the question to Dr. Spekkens, please.

THE PRESIDENT: Okay. Dr. Spekkens, over to you, then, please.

DR. SPEKKENS: Okay, for the record, Paul Spekkens.

The EAC members shared the same concern as expressed by Dr. Lacroix, specifically mixing the Darlington data, where these flaws are less prevalent than Pickering, we believe that the effect is that you dilute the flaws at Pickering, and so the number comes down. And that is what the various sensitivity cases show.

Now, in all cases there are not huge numbers of flaws, but we still believe that the right approach is to segregate Darlington from Pickering because of the difference in the geometry. So we don't have any concern that's any different from the one that Dr. Lacroix expressed.

MEMBER LACROIX: Okay.

THE PRESIDENT: And so Dr. Spekkens, because one of staff's analysis is combining Darlington and Bruce because of the similar geography and the predicted number of flaws there is -- I think it was 0.4. Do you think that is sufficient?

DR. SPEKKENS: I think the blending of Darlington with Bruce is more easily justified because of the similarity in the geometry and the fact that that produces a very small number of predicted flaws, a little bit less than half -- half of one -- I think that's a reassuring number for Darlington.

THE PRESIDENT: Thank you very much.

Dr. Lacroix, did you have a follow-up question?

MEMBER LACROIX: On this very specific matter, no. No, no, I'll leave it and I'll come back later.

THE PRESIDENT: Perfect, thank you.

Ms. Maharaj, over to you, then.

MEMBER MAHARAJ: I'd like to ask a question more with respect to the flaws that were identified in staff's submission on page 5 and how the change -- what has changed so that we don't need to worry about this or be concerned about that incident going forward.

So in staff's submission on page 5, six flaws are identified, and they're historical flaws. They're known flaws and they've been examined.

Now, I think what I'm looking for, just to help me understand the chronology, is were those flaws -- did they occur before there were some changes to the design of the pressure tubes for the fuel carrier in the case of Darlington and the shield plug in the case of Pickering that now result in the genesis of those flaws not being possible in a go-forward analysis?

Perhaps that's a Dr. Viktorov question.

DR. VIKTOROV: Thank you. Alex Viktorov, for the record.

Indeed, Ms. Maharaj, that's exactly

correct interpretation. Those flaws were observed prior to certain modification operations in design being made. So after those changes implemented, no similar flaws have been observed in any inspections. That was the reason why we didn't account for these six flaws in subsequent analyses.

MEMBER MAHARAJ: So if I might just ask a follow-up question, Dr. Viktorov, is it no longer possible for that type of flaw to occur because of the design modification? Or has it just simply coincidentally not occurred?

DR. VIKTOROV: I think the intent of modification was exactly to prevent a reoccurrence of those flaws. And by the evidence, the changes have been successful. Well, theoretically, you may have postulated that something will break down, and it's impossible to absolutely rule out, but experience shows the changes have been efficient.

MEMBER MAHARAJ: Thank you. Thank you very much, Dr. Viktorov.

And then sort of following along that line of thinking, Mr. Knutson said that he hasn't -- that OPG has not seen any degradation, any further degradation of -- and please correct me if I'm wrong, Mr. Knutson -- of any existing flaws. Is that a correct understanding?

MR. KNUTSON: Yeah. So Mark Knutson, for the record.

So for some of these flaws that I'll say have different characteristics, we go back in and inspect them in subsequent outages. In some cases, we've inspected them up to five different outages. So we are -- we do go back and look at those that may change, and we have not seen significant change. And in a lot of cases it's zero change from when we first detected them.

MEMBER MAHARAJ: Thank you, Mr. Knutson.

And then in your statistical analysis, if you've looked at a flaw let's say three times, does that count as three, or does that count as one in your statistical analysis?

MR. KNUTSON: Good point. The overall inspection count -- maybe I'll put this to Trevor Carneiro, just to verify. I believe it counts as one, but I'll let Trevor add any additional detail there on that question.

Trevor?

MR. CARNEIRO: Yeah, Trevor Carneiro, for the record.

Yeah, that's correct, Mark. It's counted as one, and those are unique numbers of channels.

MEMBER MAHARAJ: Okay. Thank you very much.

THE PRESIDENT: Mr. Carroll, you wish to add something?

MR. CARROLL: Yeah, it's Blair Carroll, for the record.

So I just wanted to point out that five of those six flaws that we're referring to right now are attributed to crossflow events during fuelling operations. And OPG is able to identify when those crossflow events are occurring, and they've put steps in place now to limit the duration. That's the intention, to limit the formation of flaws that could cause an issue.

But they're able to identify when these events occur, and then they can go -- and then they subsequently will go in and inspect a tube that has seen a significant crossflow event during fuelling operations in a following outage. So they will be able to identify the tubes that these -- this type of flaw could form in even going forward and inspect that tube and be able to evaluate it.

So it's not a random event that they will not be able to identify. They can identify the conditions that lead to that, and they will be able to follow up with inspections in any tubes that might experience those events in the future.

THE PRESIDENT: Thank you very much.

Dr. Lacroix, back to you.

MEMBER LACROIX: Yes, thank you.

This is a question for OPG. I've noticed in the original submission, the H1-11-4.1, enclosure no. 3, you provided us with an estimated frequency of occurrence of two independent concurrent pressure tube failures. And, well, first of all, I was surprised to find this, that you pay attention to such an event. I do not have your operating experience. But it seems to me -- and correct me if I'm wrong -- but it seems to me that I'm far more concerned with the failure of one pressure tube followed the failure of the calandria tube and possibly the surrounding calandria tube.

So is the estimated frequency of occurrence of two independent pressure tube failures larger than the failure of one pressure tube followed by a calandria tube?

MR. KNUTSON: So Mark Knutson, for the record.

Commissioner, the analysis included there is obviously to the extreme, the extent of review to show where the boundaries are and that even in that extreme, unlikely event, we're still in a good position to manage that event.

What I will add -- I'll let Jack Vecchiarelli add a few extra words to that -- but, you know, as you point out, in our safety analysis and design primarily we do not want a single pressure tube to fail. And that's where we are. That's where we drive towards with our defence in depth and our methodology.

But in this case, this was -- you could treat it as a sensitivity analysis to say how could this impact a second pressure tube and how much worse could you make the event. And that's why we've included that there.

But I'll let Jack Vecchiarelli include some additional words there.

DR. VECCHIARELLI: Thank you, Mark.

For the record, Jack Vecchiarelli. I'm the vice-president of Nuclear Regulatory Affairs for OPG. I just wanted to add a little bit more to what Mark said there.

That enclosure, Dr. Lacroix, that you referred to, as well as some of the other ones related to safety analysis and probabilistic safety analysis, those were simply there to provide a little bit more of a holistic perspective on this matter, to show from a risk-informed perspective that despite all of these or in addition to all of these measures around assurance through inspections and to characterization of flaws and demonstration of fitness for service, even in the highly unlikely event that a leak is formed, you know, what is the likelihood and the risk that this is somehow not arrested, addressed by all of the mitigating measures that are in place at the stations? And that's what the systematic probabilistic safety analysis is demonstrating, is that all these redundant lines of defence in depth provide an additional risk-informed perspective here to show that the risk of what we're concerned about, a pressure tube failure, that that risk is very low.

MEMBER LACROIX: Okay. But which event is more of a concern for you, the failure of two independent pressure tubes or one pressure tube followed by its calandria tube?

DR. VECCHIARELLI: For the record, Jack Vecchiarelli.

Our design basis focuses on a single pressure tube failure, and we do postulate very conservatively that you even have subsequent calandria tube failure --

MEMBER LACROIX: Right.

DR. VECCHIARELLI: -- and that is carried through. The point of showing the probability of two simultaneous pressure tube failures is simply to demonstrate the incredibly low likelihood of that happening and therefore why we should maintain our focus on the single pressure tube failure.

MEMBER LACROIX: Okay. I understand. Okay, okay, okay. You answered my question.

And one final point concerning this matter. Is the likelihood of a pressure tube failure higher during heat-up and cool-down than during the normal operating conditions?

DR. VECCHIARELLI: Jack Vecchiarelli, for the record.

So there is a greater propensity for that to be a little higher during warm-up and cool-down, and that is part of the great focus on making sure that we stay within the operating envelope during those evolutions.

MEMBER LACROIX: Okay. Okay, thank you. Okay, that's good.

THE PRESIDENT: Dr. Luxat, did you wish to add anything to what we just heard from Dr. Vecchiarelli?

DR. LUXAT: Yes. John Luxat, for the record.

I have some -- not concerns, but just observations on the case that was put forward regarding a subsequent failure.

We have experimental evidence of a whole series of tests that were done at Stern Labs in Hamilton where there was an array of nine -- sort of three-by-three array of nine pressure tubes and calandria tubes. Fails were set to one, and what happens is that you get a -- of course it was done at hot conditions relevant to at par conditions -- to develop a two-phase bubble, which in the set analysis is limited because of the direct contact condensation between the discharging hot fluid and the cold moderator. So it limits the size of the bubble.

But you can have that bubble surrounding the neighbouring tubes. But what happens to those tubes is that they actually -- the initial failure gives rise to a rapid pressure impulse stress with it as the bubble forms, and it forms -- it actually deforms the neighbouring calandria tubes onto the pressure tube and therefore -- and it passes very quickly, basically at sonic velocity. It prevents -- even if you did extend the crack due to the impact, it's actually a compressive force on the pressure tube and it also limits the ability to discharge a large amount of fluid into the neighbouring annulus, and as a result of that you don't -- you essentially start to -- you seal, partially seal the crack that originated or which might originate because of the impact. So it's almost physically impossible to get a neighbouring channel to fail in the same way that the first channel failed.

THE PRESIDENT: Okay.

DR. LUXAT: So in reality it doesn't happen. If you consider the shutdown conditions when you are cold shutdown and there's more likelihood of a delayed hydride cracking event causing a failure, a leak, there the same batch can cause the calandria -- the failed pressure tube and its calandria tube to fail as it did in Bruce Unit 2, because at cold conditions the fluid is incompressible.

MEMBER LACROIX: Right.

DR. LUXAT: So it doesn't -- it can be discharged, but it's just a flow of liquid as opposed to this two-phase bubble.

MEMBER LACROIX: Right.

DR. LUXAT: So again, the likelihood of getting -- initiating a subsequent failure is not so much the initiating event but a probabilistic random failure and it's very unlikely that it would be initiated by the failure itself because when the heat transfer system is in an incompressible state the pressure drops very rapidly, so you very quickly leave the stresses in other tubes even though you fail the one tube to a large water hammer event, because there's varying clearances between the calandria tube and the liner tube in the tube sheets and that limits the -- very rapidly stops this discharge, giving rise to a large amplitude water hammer and fail the calandria tube as it did in Bruce Unit 2. But the behaviour is very different at cold versus hot operating conditions.

THE PRESIDENT: Dr. Lacroix, any follow-up questions on that?

MEMBER LACROIX: Well, curiosity. Once a pressure tube has failed, what are the difficulties of cooling down this channel? What are the barriers to cooling down this channel?

THE PRESIDENT: Mr. Knutson.

DR. LUXAT: Oh, it's not the cooling down of the channel because the pressure drops so rapidly, so it's really the relieving of the stresses inside any neighbouring fuel channel.

MEMBER LACROIX: Okay. Okay.

MR. KNUTSON: Mark Knutson, for the record, for OPG.

Just to add to John's comments. In cool-up or warm-down it does depend what temperature you're at and how quickly we would respond. The safety systems would be fully available. In come cases if you're less than the boiling temperature you can just depressurize quickly, you know, within seconds, to reduce the leak rate and also reduce possible damage.

MEMBER LACROIX: Okay.

MR. KNUTSON: If you're above the boiling point then you would have to cool down quickly and then let the systems and the makeup of the water, depending how much water you're losing. So there's full structure procedures and it's very timely in terms of the response.

MEMBER LACROIX: Okay. Okay. Thank you, that's good.

THE PRESIDENT: Let's move on then to Ms. Maharaj, please.

MEMBER MAHARAJ: My question is a little bit related to the last conversation. In OPG's application you're seeking permission to restart the unit both after forced or planned outages and I was wondering if there is a technical difference or a change in the risk if the unit is -- undergoes a planned outage or a forced outage.

MR. KNUTSON: Mark Knutson, for the record, for OPG.

In terms of risk differences, obviously a planned outage is laid out a year to two years in advance. So we do have a full structure of planned sequences of events and in some cases people would know what job they're doing in the outage before the outage begins and therefore they're trained on it. The operating crew in the simulator would train on cooldown and warm-up transitions, so therefore they're fully...

In a forced outage that preparation time is greatly reduced. However, the personnel are ongoing training in the simulator on how to handle those events. So from a warm-up and a cooldown point of view, the forced outage is still rehearsed and we do send people for training in the simulator prior to those events, obviously except for a rapid cooldown if it was needed, but that's something we train and practise for on an ongoing basis.

So having said that, obviously fully planned is better and not having forced outages is better, but we are prepared for those forced outages and how we do it. In a lot of events where we shut down the unit we control when we cool down the unit. If it was in a pressure tube failure point of view, we would then cool down quickly to alleviate the need for pressurized heat sink.

MEMBER LACROIX: Right. Okay.

MEMBER MAHARAJ: So if I can ask a follow-up question, Mr. Knutson.

I understand that the risk of crack initiation happens when there is the cooldown. If the unit stays hot, the risk is not present. The interplay between the crack -- or between the flaw and the shape of the flaw and the hydrogen equivalent concentration is what presents the risk of crack initiation. Is there a change in the behaviour of crack initiation if the cooldown is more or less rapid or more or less planned?

MR. KNUTSON: Yeah. Mark Knutson, for the record.

A cooldown and warm-up is controlled. We control pressure and temperature. So we slowly raise pressure based on the temperature. The warmer the temperature, the higher the pressure we can raise, and that's proceduralized and controlled.

In an event where a rapid cooldown occurs and you're still at pressure, that's a risk and that's why we would normally depressurize -- lower the pressure as we cool down.

In an extreme event we may crash cool, which we've not done, but that's an extreme event in our operating procedures. What we call crash cool, that's a rapid cooling down and you may not have time to depressurize.

So those are events, again, practised and in procedures, but they're heading in the right direction to allow for depressurization of the system based on the reduction in temperature and that's ultimately where you want to end in the event, is in a controlled make-up of water and we can operate like that for an extended period of time because we have systems to manage that.

I'm not sure if I fully answered your question, but...

MEMBER MAHARAJ: I think so. I just have one point of point of clarification -- I apologize in advance -- just for my own clarity.

So then if you have a hydrogen equivalent concentration that is below 120 ppm, the risk of crack initiation as a result of those flaws, whether it's rapidly cooled or crash cooled or controlled, is minimal relative to if there was a higher hydrogen equivalent concentration; is that correct?

MR. KNUTSON: Mark Knutson, for the record.

That is correct. The position for the 120 is the agreed to Heq limit that we've agreed to and we've heavily tested, burst tests, and we have high confidence that that is acceptable. And we've obviously done recently sensitivity analysis and other work that shows, we believe, the risk is still very low even up to readings of 350 and 400 ppm, based on the fact that the flaws are controlled, known and minimal in the tube.

What I would also add to this is in the event you're describing we predict and believe in the leak-before-break scenario where we would detect a leak before it actually failed. In other words, we would be taking action far before it got to the state of a failure or a crack, through-wall crack on the tube. So there is still some redundancy there in that depth.

MEMBER MAHARAJ: Okay. Thank you very much.

THE PRESIDENT: Dr. Viktorov.

DR. VIKTOROV: Thank you.

Alex Viktorov for CNSC.

Just to bring maybe some additional clarification.

For the restart after the planned or unplanned outage the pressure tube has essential identical conditions. It's a warm-up process that respects all the restrictions necessary to assure that it's done safely. So from the pressure tube going from cold to hot conditions it's no different essentially for planned or unplanned outages. Of course if in the unplanned outage the shutting down process was fast, like a crash cooldown process which is expedited to make sure the reactor is shut down quickly, then there is an assessment of the impact of such process on the pressure tubes. The pressure tubes are assessed to make sure that it's safe to restart. In fact it's part of the design envelope for pressure tubes to make sure that such conditions are accounted for in the original design. Thank you.

THE PRESIDENT: Thank you, Dr. Viktorov.

Maybe again a related question for you, Mr. Knutson.

It's not often that the Commission gets a recommendation from staff that is recommending that we authorize more than what the licensee has asked for and in this particular case OPG had asked authorization to restart from any unplanned outages, any forced outages but only the spring planned outages, and we've just heard that if anything the unplanned ones are the ones we should be more concerned about. Tell me why you hadn't asked for restart from any planned outages and why restrict it to just the fall outages for the Pickering and Darlington units.

MR. KNUTSON: Mark Knutson, for the record.

We believe we have compelling evidence why we should have and could have asked for full approval for all units, planned and forced, all at the same time. We did do this in a controlled manner and we submitted our request in an attempt to somewhat be reasonable, but we believe we have compelling evidence. In some of our earlier submissions in later July and August we did make those statements at that time, to allow us to be alleviated from the orders.

Maybe I'll let Jack Vecchiarelli add a few more details to this.

Jack.

MR. VECCHIARELLI: Thank you, Mark.

For the record, Jack Vecchiarelli.

President Velshi, I just wanted to add that the reason we focussed on the two ongoing planned outages and forced outages is that those are the most time-sensitive scenarios and we didn't want to prejudge the outcome of your deliberations in case there were some other aspects that needed to be addressed for future consideration of other planned outages, but as Mark indicated, our supporting argument applies across the board to all planned outages and forced outages. Thank you.

THE PRESIDENT: Thank you.

Dr. Lacroix, back to you.

MEMBER LACROIX: Thank you.

This time I have a question for staff.

In your response to the External Advisory Group, the latest document that you provided us, well probably yesterday, at the end of answer number 1, the very last sentence says that:

> "If the region of interest was located in a different position along the length of the pressure tubes, where flaws are more likely to occur, it would have been much more challenging for the licensee to confirm pressure tube fitness for service."
> (as read)

I would like you to elaborate on the part of the sentence that says "where flaws are more likely to occur" and also to elaborate on the challenge that would face the licensee in this case. Could you expound on this matter, please?

DR. VIKTOROV: Alex Viktorov. Allow me to lead the CNSC response, but our specialist will be able to elaborate.

Inspection results show that flaws may occur along the pressure tube length. Actually there are observed flaws along the pressure tube where bundles reside for the duration and this may result in fret marks or some flaw generated by debris caught in the channel. But it's the end of pressure tubes where the original interest is. We have not seen flaws as shown by results.

I'll ask our specialist to elaborate on the point.

MR. CARROLL: Blair Carroll, for the record.

So, yes. I think we were trying to point out with that statement that we wouldn't necessarily get as good an answer if the region of interest was in another region of the pressure tube because we do know that there are more flaws outside of the current region of interest where the high Heq has been observed. So that's why the challenge would have been in place, because we know there are dispositionable flaws in other regions of the pressure tube.

In this case the scenario is where the elevated Heq has been observed there are no flaws of concern, so the point being that this is not a universal guarantee that the same analysis would generate the same results if we were concerned about hydrogen equivalent concentration being higher in other parts of the pressure tube. For instance, at the inlet end of the pressure tubes there are flaws within the region of, say, 75 millimetres from the burnish mark. It just happens that it's fortunate that in this case where the high hydrogen equivalent concentration concern is there's not a concern of flaws existing.

MEMBER LACROIX: Okay. Okay. And what about the challenges for the licensee, is it a question of taking samples, scrape samples? Is it more complicated to take samples in the bulk of the pressure tube rather than at the -- near the end fittings?

MR. CARROLL: Blair Carroll, for the record.

No. Actually it's probably easier for them to take hydrogen measurements. They have more hydrogen measurements from what we call the body of the tube --

MEMBER LACROIX: Right.

MR. CARROLL: -- which is outside of the region of interest.

The challenge just would be that we don't have enough information at this point in time as to what the effect of the elevated hydrogen equivalent concentration is on crack initiation, on the fracture toughness, because we don't have the models that are validated to these high ranges yet.

So if the high hydrogen equivalent concentration had been observed somewhere else, there would have been challenges in terms of determining what the impact would be on crack initiation because we don't have those models.

MEMBER LACROIX: Okay.

MR. CARROLL: If cracks were to initiate, what would be the consequence of failure. Because the fracture toughness model hasn't been fully validated out to hydrogen equivalent concentrations as high as has been measured in the region of interest.

MEMBER LACROIX: Okay, that's good. Okay, I understand. Thank you very much. I have no further question.

THE PRESIDENT: Thank you.

I understand that Dr. Daymond of the External Advisory Committee is with us for the next few minutes and so, Dr. Daymond, I'll turn it over to you.

The EAC started off their opinion to us or submission to us with, you know, there's a compelling argument for the Commission to authorize these units, but you had a number of questions, to which both the licensee as well as staff have provided answers.

Having reviewed these, any thoughts, anything else you'd want to leave the Commission with on areas that we either need to be concerned about or should be further investigating and pursuing or requiring?

DR. DAYMOND: Mark Daymond, for the record. Thank you for the question.

Having reviewed the responses to our comments, I think the responses are reasonable and cover the -- at least show that OPG has been thinking about the responses appropriately. So no, I don't think I have any additional comments or concerns beyond what has already been said and what has already been covered today.

THE PRESIDENT: Thank you very much for that.

And maybe I'll take this same opportunity to ask Dr. Spekkens and then Dr. Luxat that very same question.

Dr. Spekkens, any thoughts on the responses we have received to your questions?

DR. SPEKKENS: Paul Spekkens, for the record.

I agree with Mark Daymond. The answers to the questions are reasonable. Sometimes the answer isn't absolute if there is an absolute answer, but the material that was provided by the utilities and by the staff seem to address the questions that we had sufficiently.

THE PRESIDENT: Excellent. Thank you.

And Dr. Luxat, anything that you want to add?

DR. LUXAT: John Luxat, for the record.

I have read the responses and I agree with Dr. Daymond's comments.

I would just make a comment that the -- it was very difficult to follow the track of the response of the original staff CMD in that there's a lot of cross-referencing of key information, in particular the 60-millimetre region of interest being reduced from 75. So the licensee continued to use the 75, which was conservative, exceptionally so, but it didn't -- the logic was not apparent or thought very careful understanding of the basis for reducing it down to 60.

So that was just, if you wish, a comment on the documentation integrity. You find pieces, you've got to go back and look and then figure out what is being proposed and what was the justification. On second examination, it looks a little unclear. So it's just a clarity issue which made following the train of the logic was not there. So just a suggestion. On any item that is really key, it doesn't hurt to repeat that in the CMD so that you don't have to keep going from one to another. That's more the format of the documentation, if you wish.

But otherwise, I have no other concerns with the ultimate conclusions and the responses to our comments.

THE PRESIDENT: Thank you very much for that, Dr. Luxat.

Ms. Maharaj, do you have any further questions?

MEMBER MAHARAJ: No. I'm satisfied, thank you.

THE PRESIDENT: Okay.

Dr. Lacroix, one last chance, anything else?

MEMBER LACROIX: Well, I totally agree with Dr. Luxat. I was a bit confused with the fact that we went from 75 millimetres to 60 millimetres to

50 millimetres and 120 degrees to 360 degrees. I mean that's a lot of data. I understand performing all the sensitivity analyses, but I would have preferred to stick to one length for the region of interest and one angular size and then, you know, perform the calculation. But anyhow, it's done.

THE PRESIDENT: But I think, Dr. Lacroix, your point is a little different than Dr. Luxat's. Dr. Luxat said that this wasn't a standalone document and we had to go and --

MEMBER LACROIX: Right.

THE PRESIDENT: I mean these were things we had to address for the Pickering 5 restart request, where they did explain why with the full circumference and also 120 --

MEMBER LACROIX: That's right, yeah.

THE PRESIDENT: -- and 60 millimetres as opposed to 75. But the point on try to have it all in one place would make life so much easier --

MEMBER LACROIX: Exactly.

THE PRESIDENT: -- and I think it's a point well made. Thank you, Dr. Luxat.

Dr. Viktorov, to you, please.

DR. VIKTOROV: Alex Viktorov.

The point is taken and thank you for the feedback. We will agree that having the information in one place facilitates an understanding of the points we're making. So we will certainly account for this should we need to come back.

I would also like to make a couple of other points, if I may.

One is there may have been a bit of slight misconception. Our recommendation was not based on saying that it's okay to have one pressure tube failure or even two. Our recommendation is based on the case it's very unlikely to have a single pressure tube failure. We are satisfied that there is evidence that no failures will occur, but in defence of that approach we also say what if we are wrong, then what, and we're saying that yes, we have accounted for the safety analysis, safety design. The licensees have accounted even for this eventuality. It's not something that we are not prepared to deal with. That's our line of reasoning. We believe it will not happen. If we are wrong and it happens, it's still safe.

The other point. Of course we are sensitized to this issue. The oversight of pressure tube performance isn't going away and there will be focussed attention paid to inspection results, identification of flaws and assessment. Should there be any deviation from the expected results, staff will bring this information to the Commission to examine its impact on pressure tube fitness for service. That is our commitment to you. Thank you.

THE PRESIDENT: Thank you, Dr. Viktorov.

Mr. Knutson, any final words from OPG?

MR. KNUTSON: Mark Knutson, for the record.

The reason I have comfort in going 50 millimetres in is because we sample at that location, the body of tube, and we do scrape samples there.

The other is I would want to emphasize that we do take fitness for service very seriously. Obviously we are doing a lot of work in this area, inspections during outages, analysis, scrape samples, modelling, and further work as required.

We do treat pressure tube integrity as

a significant thing to manage and to invest in and that's what we're doing and we do appreciate being heard today.

THE PRESIDENT: Okay.

Before we sign off, we recognize the time sensitivity around this issue and getting timely authorization and I want to extend on behalf of my fellow Commission Members a special thanks to in particular CNSC staff and the External Advisory Committee and to the licensee for the very quick and thorough assessment and just getting the questions from the EAC and having the responses up the next day.

And a special thanks to Ms. Maharaj and Dr. Lacroix as well because I think everyone on the screen has shown an incredible amount of flexibility and agility in making sure that we get our questions answered in a timely and thorough manner, and for that we are very, very grateful. So thank you for that.

And with that, we will sign off. Everyone, stay well. Have a good weekend. Thank you.

MEMBER LACROIX: Thank you. Bye-bye.

--- Whereupon the meeting concluded at 1:42 p.m. / La réunion se termine à 13 h 42