MANITOBA PUBLIC UTILITIES BOARD

Re: MANITOBA HYDRO'S APPLICATION
FOR APPROVAL OF NEW ELECTRICITY RATES
FOR 2010/11 AND 2011/12

Before Board Panel:
Graham Lane - Board Chairman
Robert Mayer, Q.C. - Board Member

HELD AT:
Public Utilities Board
400, 330 Portage Avenue
Winnipeg, Manitoba
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Pages 6230 to 6414

APPEARANCES

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Gavin Wood		)Independent Experts

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--- Upon commencing at 9:32 a.m.

THE CHAIRPERSON: Okay. Good morning, everyone. I realize it sounds -- it feels a little bit like Groundhog Day. I don't know if you saw the movie or not, but, Ms. Southall, anytime.

MS. ANITA SOUTHALL: Thank you very much, Mr. Chairman.

INDEPENDENT EXPERTS PANEL:

DR. ATIF KUBURSI, Resumed
DR. LONNIE MAGEE, Resumed

CONTINUED CROSS-EXAMINATION BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Welcome back, Doctors. Kubursi and Magee, and Mr. Wood. I'm going to move on to the -- another NYC assertion that, Doctors Kubursi and Magee, that you examined as part of your analysis under the terms of reference. And this is the assertion that it would not be appropriate to use water level data pre-1942. Do you recall that?

DR. ATIF KUBURSI: Yes, we do.

MS. ANITA SOUTHALL: Specifically though, I'm -- I'm also going to direct you to Tab 16 in the PUB

Council book of documents for this KM cross-examination, PUB Exhibit 20, so Tab 16.

And this is a response of KM to an MH IR, and it's MH-KM 27. And at sub (b) of the response to the question the statement is made:

> "KM statement about water flow data being less accurate (in a relative sense) post-1942 is based on the fact that the earlier series includes intrapolation (phonetic) and extensions that are not based on actual readings and measurements of these flows from monitoring stations."

Is that correct? That was the response?

DR. ATIF KUBURSI: Well, what we found is that the data from 1942 onward was based on readings from a number of gauging stations. The previous years they probably didn't have the same number. They were still based on gauging station -- gauging stations at major locations, but one would easily say yes, the accuracy of the data in 1942 onward is higher, but this is no argument to discard. This is information that will inform and will enrich the basis on which we base decisions and evaluate likelihood of recurrence of droughts.

MR. ROBERT MAYER: Doctor, I'm assuming that that should read, pre-1942.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: That -- sorry, that is the specific issue I -- I wanted to go to.

DR. ATIF KUBURSI: No, no, it should be "pre."

MR. ROBERT MAYER: Yeah, I thought so.

DR. LONNIE MAGEE: Can I add -- add -- can I add something there? I think the -- the -- the way it's -- we've worded it in the very first line:

"The accuracy before 1942 is not high."

It's -- is not quite the right -- the best way of putting it. It's not as accurate as post-1942. And it -- it's probably not even -- focussing on 1942 are -- as we understand it is not really even that appropriate either. It's just that at the beginning of 1912 there were already enough gauging stations, as Atif said, to get a -- a good picture.

And then since then gradually more gauging stations have been added, and the accuracy has increased. So before 1942 it was not as high as it is now but still sufficiently high.

DR. ATIF KUBURSI: I mean, I meant to

really say, you know, less accurate than data -- but anyway.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: I -- I wanted to ask you about the -- whether or not you examined that concept of the gauging stations and the -- and the change in accuracy of the data. And, specifically, my follow-up question is:

Between the period 1950 and 1970, for example, did you turn your mind to the number of gauging stations or how Manitoba Hydro calculated the water flow data in that period?

DR. ATIF KUBURSI: Okay, two (2) -- two (2) things here. Answering directly your question, we did not look at this data as coming from this gauging station, monitoring station, or another. But we looked at the evaluation that KPMG has done of this data because what -- what's the issue. The issue is that does it -- this data before, if it was included, would it bias the flows in any particular way.

If it biases it upward, it would give you a rosier picture. If it bi -- biases it downward, it would be a more conservative and cons -- in a less optimistic way. The record shows that if you take the

averages of this data be -- before 1942 -- before 1942, it's lower than -- okay. Yeah.

So we -- we looked at this data the way it was evaluated by KPMG, who took these numbers and create the averages. Actually, we -- we calculate the average ourselves when we had all the flow data. We calculated the averages on yearly, on group of years. And what we found, that if there is any bias, this bias is towards being on the low side. So this is a kind of bias that would not particularly worry us. It would have worried us a bit if it was more on the optimistic side, on the high side.

MS. ANITA SOUTHALL: Could you just describe what would actually be done in terms of a ba -- calculation; the -- I think the word is "intrapolation" in the response to the IR?

DR. ATIF KUBURSI: This is a typical technique. You have missing data, and you want to see if you can use some proxies to estimate the missing data. So if you really have a trend, and you see everything is rising and there is a missing point, you just go back and put it on the trend in the sense that there is a pattern that you could fall back and use.

So interpolation is basically trying to see if there is any regularity in the data that one can

exploit in order to fill in missing data.

MS. ANITA SOUTHALL: I -- if you wish, refer to your direct examination document for the next point I'm going to reference, which has been -- been marked as KM Exhibit 4, page 45 on this issue of historical water flow data and KM's finding number 2.

MR. GAVIN WOOD: I'm sorry, did you say finding number 2?

MS. ANITA SOUTHALL: Finding number 2, yes, model inputs, historical water flow data, page 45.

DR. ATIF KUBURSI: I have it, yes.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: There is a statement in the second line of that finding, Doctors:

> "The use of the historical series as if it is the only reliable series on which to base calculations of dependable energy is also not recommended."

That's correct?

DR. ATIF KUBURSI: Yes, what we thought, Counsel, is that this data can be used as part of a statistical process, to drive a statistical process, that we can generate -- as you can see, we talked about million runs, so we didn't want to say that this only

reading of a particular chronology is going to be the only one.

What if were to sample it and assume that this is generated by this process, the autoregressive 3, and we test it to see if it has robustness? And I can ask my colleague to corroborate it. And we found that it has very high statistical properties that would make that process a good representation. And then we allowed this process to generate thousands, hundreds of thousands, actually nine hundred ninety-nine thousand nine hundred ninety-six (999,996), just about.

Okay. I'll say a million. All right. And in that respect, we felt that, yes, it is a rich set -- set of data. We like to use it, but we don't want to be solely reliable, as if it's the only one that is possibly representative what might happen in the future. And that's why we -- we went and sampled this.

Maybe, Lonnie, you want to add.

DR. LONNIE MAGEE: Yeah. I don't think we don't want to try to oversell this AR3 as the thing that they should be doing instead, but it's -- it's just kind of illustrating a -- a possibility. And this -- this issue that we're talking about now is a separate issue from the -- the pre versus post-1942. We -- we -- we're just pointing out that, if you use the actual data

set to estimate a statistical model that you assume generate that -- generated that process, it wouldn't have to be AR3. They could experiment and find something they like better.

They could then simulate hypothetical water flows that would have a -- a richer set of possibilities incorporated in their results than just sampling the actual ninety-four (94) years. Even though that seems like a lot, there could easily -- things could easily have turned out differently. And as long as you're willing to make that jump to basing it on a -- a statistical random process rather than on what we actually saw, you -- you'd be comfortable with that.

MS. ANITA SOUTHALL: And perhaps it's -- perhaps you're -- you're really now saying what I'm -- what I'm going to ask you to go to and look at next, but the next question in this -- in this subject matter on this topic, I believe, I want to take you and everyone who's following to page 177 of the main report, so of the KM Report.

(BRIEF PAUSE)

DR. ATIF KUBURSI: Oh, so Section 5212?

MS. ANITA SOUTHALL: It is, that's

correct. Has the panel located their KM Report? Thank you.

Paragraph 2 on page 177 starts out by talking about that pre-1942 data with respect to KPMG's commentary and the elements you mentioned a moment ago about the conservatism in the data, is that fair?

DR. ATIF KUBURSI: It is fair, and -- and it is, Counsel, what we tried to explain, that the issue -- there are two (2) issues here. Suppose that it was a perfect, accurate data and nobody is in doubt and nobody's raising any question on it. We still felt that to use this actual chronological series alone, and not to probe it and see if there could possibly be generated, by this random process that we used, different minimums, so to speak, because the issue here is to see to what extent there could possibly be a drought of longer and more severity than the actual one experienced between 1937 and 1942.

And we said you don't need to base it only on the historical data. Let's see, if we were to probe this with that process and see to what extent can we get a minimum distribution and fit the actual one with it. And we found that it -- it -- the average of the minimum of all these thousands, the numbers that we use to get dependable energy, especially if use 1937-1942, it's

comfortably in -- in that -- close to that minimum.

And this would give you a comfort level that the expectation that there won't be something worse, no, there could be something worse. But on average, that number seems to be very close to what the average is of all these random processes were. We could allow it to do hun -- a million times things -- of possibilities that could be generated. It falls within that average that gives you a level of comfort.

MS. ANITA SOUTHALL: And -- and just to finish off, I -- I think you may have gone on to talk about the second sentence in that paragraph that I was going to take you to, which is the observation by yourselves, the statement:

> "This is an interesting point of view, but does not detract from the seriousness of the claim that the specific constructive series upon which MH bases much of its planning of dependable energy has to be verified statistically."

Is that the same point you've just made?

DR. ATIF KUBURSI: Absolutely. And -- and -- and we felt like we -- we did that verification.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: And -- and the -- the finding then is in -- in simple language, that after the -- after those thousands of runs that what -- what Manitoba Hydro doing is a -- is using -- is a good fit within that distribution?

DR. ATIF KUBURSI: We said we -- we feel comfortable about it. I mean, this does not deny the fact that there may be worse, but the likelihood of something getting worse, it came in under the 2.5 percent in -- in -- interval of the two point five (2.5) of the frequency of these things.

DR. LONNIE MAGEE: There's -- there's a kind of a separate issue about the -- the pre versus post-1942 data and then our simulation exercise. They're kind of separate issues. But just going to the -- the pre-1942 data, if -- if it's -- if we just focus on that word that -- interpolation that you mentioned earlier, just the fact that there was some interpolation doesn't really tell -- that -- that fact in itself doesn't really say exactly how inaccurate or accurate something is.

So for example, if you know 80 percent of what you'd want to know, and the 20 percent left over, let -- which in this case could be measurements from

gauging stations that didn't exist before 1942, those things were not known but you have a good idea of how those were related to the ones you do know from what you've seen since 1942, then you can interpolate those unknown numbers and -- and then you can figure out what the result would have been and be pretty comfortable with it.

On the other hand, if you -- and that I -- I -- that's our impression that -- that's sort of roughly what -- what the actual case is. But just based on the word interpolation alone, you might think, well maybe they only knew 5 percent of what they know now and they had to guess the other 95 percent. But the -- in our opinion that's not the case.

It's more like the first case I mentioned, that even before 1942 what they knew in terms of the important water flow locations, they knew most of it and they just -- to use the data they had to interpolate another -- or estimate a little bit of it.

MR. ROBERT MAYER: Doct -- Doctor, do you know where the pre-1942 gauging --

DR. LONNIE MAGEE: Well --

MR. ROBERT MAYER: -- stations were?

DR. LONNIE MAGEE: They -- they could give a more accurate answer, but I think the key one (1)

is the Lake Winnipeg gauging station, but there were some other important ones that -- that exist right --

MR. ROBERT MAYER: I -- I would expect that they're gauging the Winnipeg River --

DR. LONNIE MAGEE: Okay, yeah.

MR. ROBERT MAYER: -- the Red and Assiniboine River. Some of the rivers -- I know they are now gauging some of the rivers on the east side. I paddled by the one (1) on the Bloodvein, and I think I saw one (1) on the Manigotagon.

DR. LONNIE MAGEE: M-hm.

MR. ROBERT MAYER: I'm assuming that they were gauging the Saskatchewan River. And once you got most of those, it appears to me that you will know where most of your water is coming from. And the extra stations, I'm assuming, gauge somewhat less important inflows. Am I correct in that?

DR. LONNIE MAGEE: That -- that's our impression as well, yeah.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Doctors, in terms of supplementing the historical information with stochastic modelling, I know that's a word that's been used in your recommendations, is that what we've just been talking

about?

DR. ATIF KUBURSI: Part of it. I mean, it's a little bit more general, but definitely this is a stochastic process we used.

MS. ANITA SOUTHALL: Could you comment, Doctors Kubursi and Magee, on whether or not based on the fact that Manitoba Hydro certainly has much more flow information and has been gaining that greater flow information in its system since, for example, Lake Winnipeg regulation, Churchill River diversion in the late '70s, just as picking a point of time, would it make sense and improve the accuracy for Manitoba Hydro if they went back and attempted to reconstruct the earlier flow data using the more accurate data from the modern history of flows? Would that improve the accuracy of what they're doing?

DR. ATIF KUBURSI: Yeah, I mean, the issue of accuracy is -- is a bit technical here. It will enrich the data set, no question about it. Whether it is more accurate or not, I mean, it has to be validated. But the issue here, in our view, is that even when you get the actual data and you extend it by ten (10), twenty (20), thirty (30) years, it -- it's not sufficient.

We wanted to see to what extent we can probe all possible -- manipulate, you know, possible

series of chronologies would come, and then see if this reasonably would approximate where the actual one and how does it fit within that general class that we have created stochastically. And this is really where the level of comfort we got, is that this minimum of the actual series is not far away from all the minimum we get from all these thousands and thousands of chronologies that we created randomly.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Moving off that topic, Doctors Kubursi and Magee, I want to take you to the discussion with respect to the interrelationship between the HERMES and SPLASH models. You, in your direct evidence, commented on the NYC's assertion with respect to that. I want to focus on your recommendation of a common platform for the two (2) models.

Could you just explain what is actually meant by the term "platform" and -- and, in particular, in terms of bringing HERMES and SPLASH to a common platform?

DR. ATIF KUBURSI: As we know, we have several models. And these models are for different chronologies. The most is operational on hourly basis.

HERMES is more on daily, weekly basis. And then SPLASH goes to forty (40) years. So they're different chronologies and different uses. We recognize these differences. I mean, MOST is for control. HERMES is for optimizing releases and operational planning. SPLASH is for planning purposes, for considering alternatives and the economic things.

But despite that, we felt that we can try to integrate them because they have some commonalities. All of them have the same common solvers: they're all linear programming systems. All of them tend to use the same data. I mean, data flows from MOST into HERMES, HERMES into SPLASH, and there is quite a bit of interaction and input and output relationships.

There's an optic here that sometimes they use different assumptions, like on the issue that she has pointed out in terms of two (2) things. One is the ending balances in the lakes, and the other one is the energy coefficient, all right, that translates flows and head into generation.

Let's take, for example, the first question, which is the lake balances. SPLASH makes an assumption that it knows with perfect foresight exactly the amount of water, and we can solve for it, that would be necessarily stored in order to begin the period with

that level of flow that would make sure that it will meet all the load in the critical period.

HERMES gets this number as part of the solution of the optimization. In the energy coefficient, HERMES solves for this and keeps an iterative process until it gets a convergence on this energy coefficient. SPLASH uses an average over the months.

Now, let's say there is a difference between the two. What difference would this make? Look, if -- if you overestimated the energy coefficient, and you assumed the system to be more efficient than it actually is, then you release less water into the system because you're going to get more electricity from it. If you made a mistake, you probably generated less energy that you could have sold, and you lose money. The question is: How much? And those who have done the estimation found that it really is not much, but there is an optic here that you're using the same coefficient in a different way between two (2) models.

We wanted to say, Look, the system is three (3) different systems: there's a financial system, there's a generation system, and there is an operations system. And -- and these cannot be separated. I mean, we went and proved, with our limited knowledge, that we can integrate these things in a set of equations in

Appendix B. And with all the information that resides within Manitoba Hydro, it's a very simple thing to do.

And there would be some compromises, we recognize, because of different purposes, but we felt like these compromises probably are worth it because there are so many, in our view, benefits that could be reaped. You create a common solver. You could -- any changes to one system, it carries to all systems. You create seamless knowledge within the organization and an expertise that is transferrable. If one guy got sick, there is one guy from MOST that could come in here, and there would be a community of models. There is economies of scale and scope. If you want to vet the system with an oversight from outside, it's common to all of them.

And these were basically the reasons we felt strongly that it would be worth looking into this and preventing people raising questions of the sort: Oh, you're using different coefficients. Oh, you know, the generation estimates and the results from HERMES and this are at variance.

In our view, there are tangible and recognizable and reasonable benefits to putting all these things on a common platform.

MR. GAVIN WOOD: Did you have anything to add?

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: And -- and thank you for that elaboration, Dr. Kubursi. Can I also ask you then what -- what it means to have them? Like what the actual term "platform" specifically means?

DR. ATIF KUBURSI: That you integrate them. They become maybe huge, humongous model, but it would be one (1) model instead of models, yes. And -- and the segments, and time, and uses, would be different where you run the system.

MS. ANITA SOUTHALL: And -- and just on that point, there are a couple of comments that I wanted to bring to your attention.

First at Tab 18. This is an excerpt from the transcript of this hearing, and I believe it's Mr. Cormie's testimony. If you could turn to -- specifically to page 5,662, and lines 2 to 6.

MR. GAVIN WOOD: Could I ask you just -- to give him just a moment just to -- the context.

MS. ANITA SOUTHALL: Absolutely.

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Thank you, Sir. So specifically starting at line 2 on page 5,662, all the way down to Mr. Cormie's commentary at line 14, there's reference to SPLASH and HERMES operating on the same database, as I understand it. And then -- and then reference to SPLASH has to run ten thousand (10,000) times, HERMES has to only run once, and the comment:

> "And Mr. Surminski can't wait. If we were to model the system at the level of HERMES, and run it ten thousand (10,000), he'd -- you know, he'd -- he'd -- he would have to come back in a couple of weeks to get his answer, and that's not very -- not a very practical thing."

And then the separate comment, but carrying on in the same section:

> "And Mr. Rose referred to that as an implementation failure. Great model, but results that, you know, are useless because you wait forever."

So you've had an opportunity to review that section?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: Is it a requirement that -- in other words, will that be a implementation problem in terms of these models being on the same platform? Could you just comment on that?

DR. ATIF KUBURSI: In my opinion, it won't. I mean, I am quite happy to see the recognition here that they have the same common database. And if they're processing the same data, but processing it in a different context, then the same model that I'm talking about is not going to lose this flexibility and this capacity to be run in different ways.

But the issue that I -- I don't think -- I think is wrong here, it's not Mr. Sur -- Surminski can't wait, it's Mr. Cormie can't wait. Mr. Surminski has to wait for ten thousand (10,000). But Mr. Cormie needs it, you know, right now and things. You know, he has forty (40) years to look at -- all right.

So in many respects -- I mean, this issue, I don't think, you know, would -- would in any way compromise the recommendation, or would make it -- all -- all it would do is that there will be different uses of the same model. And -- and that's very natural. I have generated models that can be used for short term, for long term, for medium term. I can solve for output. I can solve for value added. I can solve for prices. I

can solve for an enormous number of things. This doesn't mean I -- every time I want to solve for a particular purpose I have to use a different model.

MS. ANITA SOUTHALL: So -- so on the same platform, you could run HERMES once, and separately you could run SPLASH ten thousand (10,000) times, for example?

DR. ATIF KUBURSI: Yeah, I -- I don't see any difference. The -- the whole thing that would be required here is the way I aggregate the -- the data and the -- the output batch.

MS. ANITA SOUTHALL: Could you comment on whether bringing HERMES and SPLASH together in one (1) platform would improve the IFF forecast process?

DR. ATIF KUBURSI: I'm talking here about different things. We're talking about the way you would deal with the issues that you use these models for. The model accuracy, whether of HERMES and SPLASH, are -- are different matters. These pertain to the actual forecast and looking at the forecast error and trying to see if these forecast errors are coming because of some structural defects or structural -- missing variables, wider lags. These are different issues.

I mean, I could integrate three (3) models and get the same bad forecast than if I had to do them on

one (1) by itself. That's not the issue. Alternatively, I could -- could get -- integrate and get good forecast from the three (3) models. I mean, this is not the issue.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: I -- I specifically turn to the IFF issue, Dr. Kubursi, Dr. Magee. I'll refer you though to a response that Manitoba Hydro's provided in rebuttal on this issue. Do you have access to the Manitoba Hydro rebuttal document? We'll give you a moment, and we'll locate that for you.

DR. ATIF KUBURSI: Yeah, please. We have our response, but we don't have the...

(BRIEF PAUSE)

DR. ATIF KUBURSI: So can I just read it or do you want to refer me to particular points?

MS. ANITA SOUTHALL: I actually would like you -- you know, feel free to read the whole section if you wish, but my questions on the IFF derive from the last paragraph on page 78 of the Manitoba Hydro rebuttal evidence.

(BRIEF PAUSE)

MR. GAVIN WOOD: And, Ms. Southall, I'm just referring him to their -- their response paper, to -- to that page, so he'll just be a second.

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: So, Doctors, in the last paragraph on page 78 of Manitoba Hydro's rebuttal evidence Hydro states:

> "As opposed to KM's opinion that 'the real danger lies in the fact that they can and have produced different results,' Manitoba Hydro is confident that HERMES and SPLASH produce very similar results, as the different groups use the same fundamental input data, compare model outcomes, and annual -- annually explain the variances as part of the IFF process."

That's the section I wanted you to focus on. And -- and in terms of the -- and really, I apologize, I could have referred you to that earlier in

terms of my IFF question, but could you please comment on whether or not, to the extent that they have to consider variances between the models as part of the IFF process, putting them on the same platform addresses that issue, or are you able to comment on that?

DR. ATIF KUBURSI: Okay. Two issues. They use different coefficients. That's in the nature of the system. I mean, this is -- has been verified, they use different coefficients. The next issue is: What difference would this use of different coefficients result in? On the first one, I think, yeah, they're using different coefficients because one is average of months, the other one is a convergence on a shorter period. The results, I agree, did not make much difference, but there's an optic here, as I said, that -- as if you're using different things.

And it would be -- if you do it on -- within a common platform, ultimately the two (2) must have -- must be reconciled. And this reconciliation, it -- it improves the -- not the accuracy, if you want to, but the perception that this is a system that does not have -- the fact that this NYC was really probing for issues, she found one. The question is, it's not important, but it's there. And our argument is that if you put them on a common platform, these issues would not

arise.

MR. ROBERT MAYER: Doctor, if the only issue is one of perception, and the facts are that it really makes no difference, I think Manitoba Hydro might be somewhat justified in saying, Well, why would we bother. Somebody's made an allegation that makes no difference.

Why would we, therefore, change a system that our people all know how to use in order to put it into a common platform?

DR. ATIF KUBURSI: Fair enough, but we -- we gave eight (8) other reasons, all right? We said there is economies of scale and scope, there is now the commonality of experience that would be shared, we talked about the -- easier to make any change to it that would be shared commonly, it would have a common solver, it would bring all this expertise within house to bear on it, it would be an easier process to verify, vet and -- and -- and oversee.

DR. LONNIE MAGEE: Another way to look at it is that the -- in this particular case, the numbers came out much the same, but it could be on a common platform that it's less likely to have a potential for coefficient differences of things that could, in another situation, result in a bigger difference.

THE CHAIRPERSON: If Manitoba Hydro accepted your recommendation and undertook the work and did it, would it provide, in your view, more support for their preferred development plan, or could?

DR. ATIF KUBURSI: As I mentioned, this -- this is an issue that is not related to accuracy of the models. It's more in terms of saving on resources, creating a more comfort level with the fact that you are all using same system and you're on the common page, so to speak, and ability to integrate and create a community of modellers that would be focussed.

The issue of accuracy, I think, is a little bit more difficult here, and I and Lonnie, we -- we felt that maybe we need to move into this more sophisticated system of dynamic programming, stochastic programming, where we think and have some level of experience from which we can talk -- because I've worked with dynamic programming and linear programming, stochastic and deterministic, and I know the complexity of the latter system is far larger than the first one. It would involve more resources, I -- I grant this. And in a perfect world, these wishes would be great, but there may be other compromises.

But in terms of accuracy, and dealing with the kind of issue that you're talking about, Mr.

Chairman, I feel that the non-linear systems, the dynamic programming, the stochastic, would have a bearing on it in a way that the linear system, static system, deterministic system, would not.

THE CHAIRPERSON: In other words, if they did do it, it's -- it potentially could some -- have some bearing on the degree of support, or non-support, for the development plan.

DR. ATIF KUBURSI: A degree, but the issues are how you structure the problem, what data do you use, what discount rate would you use, what is your forecast of the expected prices in the future, what can you generate and encapsulate in your contracts.

There's so many variables on these things, but as far as the models used in order to cho -- choose the preferred sequence, if you use exactly the same sets of data on both sides, the latter are likely to give you a marginal improvement over the former.

THE CHAIRPERSON: What I'm getting at is your -- your recommendation isn't what you would call an academic nicety. You're -- you're suggesting it's a significant improvement in their approach.

DR. ATIF KUBURSI: Yeah. It -- it's not just academic nicety. I am also suggesting that it would handle the kind of problems that you're dealing in a more

legitimate and recognizable way.

THE CHAIRPERSON: What level of effort is required to put into practice what you recommend?

DR. ATIF KUBURSI: I recognize that this would involve resources. It would involve retraining. It will involve quite a bit of a different mindset on things, no question about that.

I mean, this is not something that you could just discard one (1) system, and bring another system, and expect that the capacities are all in place and would not take a learning period before these can be -- can be -- be put in place. But -- but my feeling is that if you're going to go with the trend as most people are now moving into that direction, you have to start someplace, and the better to start now.

THE CHAIRPERSON: So if you -- if you were doing it, and you were part of Manitoba Hydro, just rough estimate, how much resources and how long would it take?

DR. ATIF KUBURSI: Yeah, I -- I need to study this a little bit more carefully, I mean, than just -- you know --

THE CHAIRPERSON: May -- maybe you could think on it.

DR. ATIF KUBURSI: -- but I -- I -- we

should really. I mean, because I have -- we have experience of others who have done it, so maybe I need to go back and see what sort of level of skills and time and resources this had --

THE CHAIRPERSON: Would you take that then as an undertaking? Thank you. And so --

MR. ROBERT MAYER: Doctor, I have a couple -- well, just basically one (1) question. While you're -- while somebody is developing the system that you are suggesting, I have to assume that they must continue to operate the old system because as you know, from day to day, Hydro has to make these decisions. So basically you've got to start over here, and do something else, but you must continue to operate the systems they presently have.

So I have no idea how much space, and how many bodies it takes to operate the equipment that we're presently talking about, nor how much space and how many bodies it would take to construct, operate, and train another group to operate the new system. But it sounds to me like it could be a relatively expensive and time consuming matter.

DR. ATIF KUBURSI: That's why, Mr. Mayer, I was not willing to give you an estimate. But I -- I think there's an issue here. You know, the assumption

here is that you're getting the system, and you're going to get a new system, and you're going to operate them together. Not for long. If the system that we are thinking of bringing in is the way I'm talking about it, it should replace it ultimately.

And it would be the new system. You know, this is -- and it would be probably so, you know, use on the -- you know, you could use the same machinery, same equipment, it's just a different system. It's like taking Excel and using -- give me a name -- I mean, move from Quattro --

MR. ROBERT MAYER: Don't ask me.

DR. ATIF KUBURSI: -- we move from Quattro Pro to Excel. Okay. Or something. Or Lotus, whatever it is. That's what it is.

MR. GAVIN WOOD: Just a moment, please.

(BRIEF PAUSE)

MR. GAVIN WOOD: Sirs, the doctors would, in that undertaking, go so far as if they can talk as they've always been able to with the Manitoba Hydro people, they would be able to give you an estimate of the kind of costs that would be involved as well. So when we're talking resources, they would actually be able to

give you some estimate.

THE CHAIRPERSON: So we're talking about time, money, significance.

MR. GAVIN WOOD: The -- I mean, I appreciate they'll give you some descriptions and such, but I -- I appreciate from your perspective you would really -- yeah, they -- they would -- ultimately, one (1) of the important things for yourselves would be the costs involved, and -- and, for that matter, for Manitoba Hydro too, obviously.

THE CHAIRPERSON: Well, you're contrasting it to the significant plans. But you've under -- the undertaking would be helpful, and we certainly don't have any problem with you consulting with Manitoba Hydro. It makes perfect sense. They've been cooperative before.

Mr. Wood, how do you --

MR. GAVIN WOOD: Yeah.

THE CHAIRPERSON: How would you frame it?

MR. GAVIN WOOD: The -- the doctors are proposing that through consultation with Manitoba Hydro they would give a description of -- of what the process and -- and work would be involved on the part of Manitoba Hydro to bring in the -- the common platform approach to modelling that -- that they're -- they've been proposing

in their -- their various works and as -- as -- in -- in a des -- in a narrative descriptive way, and the practicality of it through talking to Manitoba Hydro. And -- and finally some estimate of the costs that would be involved in that.

THE CHAIRPERSON: And in that report, since you'd be consulting with Manitoba Hydro, you might be able to encapsulate any difficulties that they may --

MR. GAVIN WOOD: And -- and --

THE CHAIRPERSON: -- put forward.

MR. GAVIN WOOD: And so the undertaking would also involve, if -- if through consultations with Manitoba Hydro, there's an indication of -- of difficulties or problems that would be involved in -- in doing so, that -- that they would certainly set those out to the Board as well.

MS. PATTI RAMAGE: If I could just jump in. What I heard also was it wasn't simply common platform, it was to go non-linear, stochastic, and dynamic as part of that approach.

THE CHAIRPERSON: That's a good contribution, yes.

--- UNDERTAKING NO. 141: KM to provide, through consultation with Manitoba

Hydro, a description of what the process and work would be, on the part of Manitoba Hydro, to bring in the common platform approach to modelling that they've been proposing and the practicality of it and to encapsulate any difficulties that Manitoba Hydro may put forward

DR. LONNIE MAGEE: On -- on that --

THE CHAIRPERSON: Dr. Magee, yes.

DR. LONNIE MAGEE: Oh, sorry. Yeah. On -- on that point, I think one (1) thing we could feel comfortable saying right now is that the -- the two (2) separate -- the -- the upgrading of the solvers to dynamic and nonlinear solvers would -- is -- is more something that you could assign a small number of people to work with on the side while everything else is going on as usual, and could be developed and slipped into the -- the system. Whereas the common platform issue, which is related, but it -- it's more of a complicated -- I'd say, logistically complicated thing to -- to figure out

how to do.

THE CHAIRPERSON: Well, you could cover that off in your response. And we're quite aware of the other recommendations which seem consistent with various reports with respect to the documentations of the current systems and things of that particular nature. So I imagine they'd play a role too.

Ms. Southall...?

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Actually, my next series of questions arise from the -- the last part of that interchange with respect to the transformation into the stochastic model. I'm not sure if dynamic modelling is the same thing, but perhaps you could just give a description of -- of -- I see Dr. Kubursi saying no, so could you explain the difference between the change to more dynamic modelling?

And then you've -- you've talked a bit, at my direction, I acknowledge, around the issue of the stochastic change to the model, but could you please just attempt to briefly address both of those items?

DR. ATIF KUBURSI: Okay. We're proposing three (3) things here. One is the current structure of the models is linear, so there is an issue here of moving

towards non-linear systems. This is a very complicated thing, because in a linear system it's very easy to find the solution. Non-linear, there are issues of convergence. If you really don't have a start-up point, the search could take incredible amount of time and we might not get into a basis, which is really what we call a solution, right? So there -- there's an issue of linear versus non-linear.

Then there is issue of static versus dynamic. That's another issue. I mean, you could have a linear system, you could make it dynamic. It's issues about lag, about what would it take for a system to resolve imbalances, what is the time structure of how the system -- I mean, at -- at the moment, most of the linear systems that Manitoba Hydro uses, time is used into sequence of equations, all right? Each time period is considered to be a variable. It's in discrete time, but, I mean, these things can be made a flow system instead of just a discrete system.

Then there is the issue of stochastic, which is versus deterministic. You want to move from a system without any stochastic, any random variables, into incorporating random variables and probability distributions within the system.

So you have literally three (3) separate

issues, three (3) separate questions to deal with. The dynamic versus static, deterministic versus stochastic, linear versus non-linear. And our hope would be is that we will say something and we will discuss with Manitoba Hydro these issues and see how we can deal with this issue.

THE CHAIRPERSON: See, the other part of it, to be direct, is -- is the -- the reference that was made to -- in Manitoba Hydro's rebuttal, to priority. I mean, that -- that's a significant aspect of all this.

DR. ATIF KUBURSI: Yeah, we recognize that. I mean, the -- the issue here involves what resources, what skills, what time, what is available, what complications would it really put in. In our view, I mean, it would be very hard to suggest that we know what the priority is, and we're not going to be presumptuous to tell Manitoba Hydro what -- what we would like to do is to show what other utilities, where they have used some of these systems, what did it take and how this may have improved or not improved. I mean, I'm -- we're trying, you know, here to see and evaluate in an open-mind and objective way.

Always, Mr. Chairman, you told us we have to be helpful. We're going to be helpful.

(BRIEF PAUSE)

THE CHAIRPERSON: It's okay, Ms. Southall.

MR. GAVIN WOOD: Whenever you're ready. Thanks.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: I just wanted you -- to direct you -- I was locating a section of the report. It's -- it's on the same issue of HERMES -- recommendations for improvements to HERMES. It's in the vicinity of page 180 of your main report, finding -- and related to finding number 4. I don't know that you need to go there, but my next -- my next question, and it may be that it's -- and I apologize for my ignorance on this.

But whether the -- a reference to coupling HERMES with a standard risk tool is the same issue as the stochastic modelling, could you just explain whether or not in fact you're talking about the same issue in terms of adding uncertainties to the model?

DR. ATIF KUBURSI: Certainly PRISM would be a system that, once it's integrated with the rest, would -- would lend an element of stochasticity to the -- to the system. But we're talking about even more general

things, but certainly there's a role here, and maybe when we move into the stochastic specification PRISM would -- would have a very important role to play.

MS. ANITA SOUTHALL: So -- so the risk tool is a separate issue. Is that correct?

DR. ATIF KUBURSI: Would -- it's not a separate issue. I said it would -- it's not the only issue. See, it's not -- it's definitely part of it, but it's not the only one (1) because it's also about the way you specify the equations and how you put them into the model.

MR. GAVIN WOOD: Just -- just a moment, please.

(BRIEF PAUSE)

MR. GAVIN WOOD: And just -- and Ms. Southall, just -- just for your understanding, the way the doctor is understanding the undertaking, he would be dealing with that as part -- as part of it.

MS. ANITA SOUTHALL: That -- specifically the use of PRISM? Thank you.

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: I'm not entirely sure how large this response to the undertaking is meant to be, so bear with me if you could because I had other questions and I'm not sure whether or not you would intend to cover them.

The -- the questions are, if -- if a risk tool is incorporated, or PRISM is somehow integrated, for example, with the other models, is that going to assist Manitoba Hydro in its risk mitigation?

DR. ATIF KUBURSI: Yeah, I mean, we're doing it with a purpose here, is that we're trying to improve the way you deal with -- with risk, and the strategies that probably one (1) can derive from these models. I mean, you're not doing it just for the beauty of it. I mean there is -- it's done with -- with a purpose. And that the understanding we have here is that once you get PRISM to work with other systems, you improve the handling of risk, the identification, the quantification, and these are important ingredients in the way you formulate responses and mitigation.

MS. ANITA SOUTHALL: And PRISM, could you just take a moment and describe what that particular model, to your -- to the best of your knowledge, what it's used for, or what the status of it is right now at

Manitoba Hydro, and what the core, the @RISK core of PRISM could be used for in terms of risk quantification.

DR. ATIF KUBURSI: We've seen already -- we were at Manitoba Hydro, and we've seen twice the use of PRISM. And the way it's used at the moment is that it takes outputs from HERMES and from SPLASH, and estimates the cost of the drought. In the event you have five (5) year drought, or seven (7) year drought, they use the chronology. Once you are in the first year load is a given year. And then the chronology that follows that year is all built in and will estimate exactly the way our chapter 6 is structured, the reference case, and then they change to lower water levels, the way it would affect the generation at given assumptions about prices.

And all these things that we talked about, you fix these numbers. Like if you want to talk about water, you put the water. Every other variable in the system in the way you calculate net revenue becomes a stochastic process. You have a probability density function. And then you get the net revenue from this. And then you use on the net revenue a Monte Carlo 1000 -- exactly the same way that we described we've got our results.

The issue here is I don't want this PRISM to be a separate way of doing things. The question is

how would you integrate PRISM in a way in which these models become all talking to one another, and some of the, for example, forecasting prices of energy is no longer just a string of numbers but maybe a probability solution, and then to see how these might ultimately influence the estimation of net revenues from different strategies, alternative sequences.

And -- and this, in my view, would be an improvement over just taking one (1) single forecast and saying, Well, it is optimistic, you know, it's pessimistic. I mean, I would prefer to see a more sophisticated way of using these things.

MS. ANITA SOUTHALL: I -- I take it that the risk tool, assuming it's PRISM, that -- that would be integrated in accordance with that recommendation, would then become part of the drought risk planning, risk preparedness -- drought risk preparedness process?

DR. ATIF KUBURSI: Yeah, well, certainly it's -- it's a component. But, as you know, the drought-preparedness plan is far more elaborate, about responsibilities, about governance, about vetting. So it's a component, yes.

MS. ANITA SOUTHALL: I'd like to ask you a couple of questions also in finding number 4. I believe it's page 181 of the original KM Report. And the

-- also, if -- if you wish to have reference, it's Tab 15 in our reference book of documents. And in that tab it would be starting at the second page of the tab and the KM response to PUB-KM-35, the IR.

MR. GAVIN WOOD: He's got all of that now.

MS. ANITA SOUTHALL: Thank you.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Here there's a recommendation that Manitoba Hydro consider a hydrological submodel to compliment HERMES and SPLASH as water management issues become more complicated under possible climatic change.

Could you just comment on the underlying rationale, Doctors, as to the benefits of such a submodel?

(BRIEF PAUSE)

DR. ATIF KUBURSI: I'm sure you can appreciate, Counsel, we're not hydrologists, all right. And the issue here is we handled and we examined the antecedent forecasts, right. I mean, the way we now deal with things is that we look at the previous period and

see how it relates to a current period, and we use the current period to forecast the next period.

So it is a hydrology of sorts but literally structured on lags. It may be possible to think that this can be complemented by a precipitation model, prediction of the precipitation. And if we integrate the precipitation, you don't need the past to tell you what's going to be in the future. You might really have a separate forecast on the level of precipitation. So the hydrology we're talking about is the precipitation level.

There may be other variables. I mean, you take a basin of water. There is inflow, right, coming from precipitation. There is outflow as you take it out, plus the evaporation losses. If you take all these variables into account, you could complement this antecedent forecast by this structural forecast that would come from using the information from hydrology on the likelihood of having water at a given level.

MR. ROBERT MAYER: Doctor, again, maybe I'm venturing into something I don't know any -- very much about, but I do know a little bit about weather forecasting, and I know that Environment Canada will tell you that although they can give you reasonably accurate forecasting a couple of days out with respect to your

weather, they can't -- they can't do that with respect to precipitation.

So I'm -- I'm wondering what kind of forecast we're talking about when presumably the agency in Canada that is most responsible for coming up with that information readily admits that they haven't figured out how to do it yet.

DR. ATIF KUBURSI: I hate to tell you, Mr. Mayer, that they are better forecasters than economists --

MR. ROBERT MAYER: That's scary.

DR. ATIF KUBURSI: -- but it doesn't say -- yeah, it is. And their models have improved quite a bit. I mean, what we're suggesting here is that -- and -- and it's worth probing again. I mean, I know resources are not infinite, and one has to balance the benefits from a particular addition to the cost of these, but you're talking about hydrology, and we're talking about some structural breaks that are likely to come into the system because of climatic changes. And therefore the past would become a very poor estimate of the future.

And what we're suggesting here is to probe, to evaluate, to integrate, maybe with the University of Manitoba hydrologists -- I understand now that Manitoba Hydro is already investing quite a bit of

money in a chair and other people -- to what extent some of this information, some of the modelling, some of the abilities and experiences that these people bring to bear, because I don't believe hydrologists are absolutely people without any sufficient or interesting things they can contribute. And these -- these are the kind of things we're talking about.

MR. ROBERT MAYER: Doctor, it may interest you to know that when we heard the Clean Environment Commission hearings with respect to the construction of Wuskwatim, we did get some significant evidence from Manitoba Hydro to the effect, at that time in any event, they were relatively confident with climate change there would be more rain.

The problem was they had no -- were unable to give any estimate as to what would happen as a result of evaporation. That is the evidence we heard. And that was a number of years ago, of course, but I'm not sure that they got that problem solved yet.

DR. ATIF KUBURSI: I -- I mean, nobody is suggesting here that the -- the issue is very simple. I -- as you know, the science is still not very strong on these things, but there is now almost a consensus that -- that the precipitation in the northern part is going to rise, but the temperature is also going to rise, so

you're going to get increase in inflow but also increase in outflow. What is the net balance?

I mean, I'm hanging by the skin of my teeth on issues like this, so I'm not going to pronounce or -- or say things. But all we're really saying is that if there is something that could be gained from hydrologists and they can contribute to this issue here, I want to see that we experiment with models that do not depend purely on historical lags but that they could possibly integrate into them structural variables of the sort, that's all.

DR. LONNIE MAGEE: Can -- can I add -- add --

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: I'm sorry. Yes, of course.

DR. LONNIE MAGEE: So we're -- we're not only talking about using weather forecasts and -- and climate change issues, but just, as economists, we're -- the other -- other social scientists kind of make fun of our tendency to grab everything we can find that's available that might help to predict things. So we -- we had the impression that -- that the model's specification that were being used for these forecasts are -- they're

very similar for -- in structure from one (1) case to the next, which suggests that there's -- there could be more exploring on a case-by-case basis as to maybe the river flow in one (1) system could be -- the -- the water flow could be pre -- predicted better if you use some recent information from some other system, related water system, or it -- since we -- we never saw that sort of thing we just felt in general that there could be more kind of playing around or experimenting, looking for whatever information that's available that could be thrown in to these equations to improve their predictive power.

DR. ATIF KUBURSI: Just to add, you know, because I didn't want to be technical, but let -- let me be technical for just five (5) seconds. In the equations that are used you find that the T-score of the coefficient, which means the significance of a coefficient, like previous year in predicting future years, instead of being zero, there's sufficient reason to believe it's different from zero and, therefore, it's contributing to this.

But there is something called R-squared which is the coefficient of multiple determination in the -- in the sense that whether the -- you have covered all the variables that will help you predict. If you covered them all and the variance in these is explaining the

variance in the dependent variable, the one (1) you want to predict, then you feel comfortable.

In most of the equations that we looked at we found the T-score is high, but the R-squared is not high. This automatically leaves you with the impression, and I'll let my colleague who's far more versed in this than I, it says that there is probably a missing variable, a missed specifications. That there -- there is extra information you could bring to bear into these equations.

And then if you said, Well, there is more information that comes to bear, by God, what is better than looking at some hydrological variables. That's precisely the kind of logic we went through and -- and Lonnie, you know...

DR. LONNIE MAGEE: Just -- yeah, there may be many cases where the R-squared is low and the model doesn't predict that well, but that's just the way it is. There may be no way to predict better, in which case you just go ahead with what you've got. It's better than -- than nothing. So it wouldn't -- I just want to make clear, it wouldn't be wrong to use a model that doesn't predict well as long as it's better than not using it at all.

THE CHAIRPERSON: Okay. I think we'll

take our break now. Thank you.

--- Upon recessing at 10:49 a.m.
--- Upon resuming at 11:12 a.m.

THE CHAIRPERSON: Okay. Welcome back, everyone. Ms. Southall, whenever you're ready.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Just one (1) last specific question on the PRISM model, Doctors Kubursi and Magee. With respect to current input in -- input in PRISM, are there -- are there any inputs which are a prediction of future inflows, a prediction as opposed to an output of one (1) of the other two (2) models?

DR. ATIF KUBURSI: No, not that I know of.

MS. ANITA SOUTHALL: I want to move on to ask you some questions associated with the SPLASH model and your recommendations. And in the main report, the original KM Report, it would be at page 180.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: There's a suggestion

-- oh, first of all, let me confirm that you agree, Doctors Kubursi and Magee, that the SPLASH model is integral to the long-term planning and the financial forecasting of the Corporation, and as well the rate setting by the PUB.

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: You suggest the SPLASH model requires internal and external validation. That's one (1) of the recommendations, correct?

DR. ATIF KUBURSI: Correct.

MS. ANITA SOUTHALL: What would be internal validation in accordance with your recommendation?

DR. ATIF KUBURSI: Validation involves two (2) issues. One (1) is the structure of the model in the sense that you have the correct relationships, the correct inputs. And then there's validation in terms of the output, particularly in terms of some models in terms of their prediction accuracy.

You look at a forecast and see to what extent what you have forecast is consistent with what actually happened. So there are really two (2) issues here. And -- and we wanted basically people to look and see and review and evaluate these models. There should be some sort of a mechanism where peers review the works

of their peers. I mean, this is a well-established criteria for evaluation.

The other one would be to bring outside subject-matter experts who can review these. And we felt that this is an important issue because quite a bit -- a number of these models are internally developed and would always be a good comfort level if they were reviewed, evaluated by outside subject-matter experts, people who are working with these types of models or who have experience in their application, and in running and evaluating results.

MS. ANITA SOUTHALL: And in terms of the internal validation, did -- did you turn your minds and -- to the issue of and are you able to speak to the issue of the -- the frequency of process? Would there be -- would that be done with any particular frequency during the year?

Are you thinking along the lines of some sort of validation reports by -- by a peer at Hydro, for example?

DR. ATIF KUBURSI: There is a number of ways of doing this. I mean, I know that for us professors, whenever we publish things it gets reviewed. I mean, one (1) way would be for members of the staff that use these models to probably publish or go to

conferences and get reviewed and get refereed, but internally there are different ways of -- of doing it.

Departments in the university or sections in the United Nations are reviewed periodically but consistently. Every department knows that they would be reviewed at least once every two (2) years. And these people, wherever you are, is called IOS, Office of Investigation and Oversight. They would come and look at financial and also at intellectual and substantive work.

I mean, they would like to see that your publications and the numbers you use and the procedures you use are all on standards that the United Nations would like things. And I -- I understand in OGS, the graduate schools, the courses, the outlines, the professors, every -- every how many years, Lonnie?

DR. LONNIE MAGEE: Seven (7) years.

DR. ATIF KUBURSI: Every seven (7) years. I mean there should be some sort of a periodic and non-periodic evaluation that we tender as a good procedure to always make sure that you're on the frontier of the developments and that these models are accredited, so to speak, you know.

The word -- I mean, we go through accreditation -- formal accreditation, but, I mean, there is some sort of a vetting process that is periodic,

official, and a procedure that would be carried forward and gives a level of security that what you're doing inside is reviewed inside.

And then you don't want to restrict it to -- just purely to an inside review, that it could also include an outside review.

MS. ANITA SOUTHALL: With respect to SPLASH, you're also recommending, as I believe was the case with HERMES, formal documentation of the model, correct?

DR. ATIF KUBURSI: That's correct.

MS. ANITA SOUTHALL: Was there any formal documentation available or provided to for your review, or did you seek it with respect to the SPLASH model?

DR. ATIF KUBURSI: Yes, we did.

MS. ANITA SOUTHALL: So there -- there was some degree of formal documentation?

DR. ATIF KUBURSI: There is documentation that is used, there is things. I mean, the way we want it to be is a user and a technical manual. I mean, there are some standard ways, but surely -- I mean, we were given a description of the system, the various simulations it goes with, some of the sample results. There is documentation. All we're -- we want is this documentation to be formatted and in a formal way,

consistent with what we call the typical things that are available with any model that you buy. If you buy WordPerfect or you buy Excel, you get a user manual and a technical manual.

MS. ANITA SOUTHALL: There's also a recommendation on page 180 of the KM Report in the last paragraph that SPLASH requires oversight.

Is -- is that a reference, Doctors, to the internal and external validation, or is that a different concept?

DR. ATIF KUBURSI: No, same concept, and it's not only restricted to SPLASH. We thought that it should be done for every one.

MS. ANITA SOUTHALL: And I take it that there are different model operators that do not at present come together for these various models at Manitoba Hydro. I -- I believe that was your observation. There are -- there's a working group for SPLASH, there's a separate working group for HERMES, is that valid?

DR. ATIF KUBURSI: It's not actually because we saw that they come together, and we -- all we wanted to do is to formalize it.

MS. ANITA SOUTHALL: So can the -- can the people who operate HERMES turn to the operation of

SPLASH, if that was required, for instance, at -- the way that it's currently structured?

DR. ATIF KUBURSI: No. I mean, now those who run HERMES are running HERMES, those who run SPLASH run SPLASH, those who run MOST -- we found out that some of the people running MOST were in HERMES, and then some people who are in HERMES are in SPLASH. So there is really some cross-referencing here. What we wanted is this cross-reference to become formalized, that a modelling committee and community can be developed and made a formal structure that they would meet on a regular basis, not an informal one.

I mean, at one time, it was kind of interesting. We wanted to know how many people work with MOST, so we asked Manitoba Hydro to organize it. We all came together. We were -- we got a level of comfort that there are all these people who know each other. I mean, we sat back on the sides and saw what kind of a relationship and how well it's working. We were -- and how many, yes. I mean, okay. How many? How many, yes. Ten (10), twelve (12). We said it yesterday. All right.

And -- and -- and all we really wanted here is to get just a formal presence and increase the flow of information and the fluidity with these people coming together. They're working almost on a number of

issues where they need to be in a position to exchange information and inputs and review outputs. All what we were asking about is a formalized structure that would bring these people on a regular basis, and there would be attention paid to making sure that this community is formally -- and integrated in a way that would be regular and frequent rather than an informal one.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: You spoke a little bit earlier about -- when we were talking about the bringing together of HERMES and SPLASH on a common platform. I believe, in some of your response, you made passing reference to incorporating up-to-date solvers.

That's a term of art, I take it, Dr. Kubursi, Dr. Magee?

DR. ATIF KUBURSI: Yeah. I mean, we -- we -- we -- we said -- I mean, they're using standard and well-tested systems. I mean, CPLEX and -- and SPLASH, and MINOS, I presume, and HERMES, and -- and -- and these are top of the line things, but there has been new advances in the system that can handle the non-linear and the stochastic. One (1) called General Applied Mathematical Systems, using the world bank, called GAMS,

and I said there is the other one (1), AIMMS, A-I-M-M-S, I think, Advanced Integrated Mathematical something.

MS. ANITA SOUTHALL: So could -- I mean, I'm just looking for a layperson's description of what a solver actually is.

DR. ATIF KUBURSI: Oh, a solver, all right. You see, you formulate your problem and you have a processor, all right, a computer program that would take this data and would find a solution. And then it would give you an ability to process the output and results in tables and graphs, and will allow you a capacity that you want to test sensitivity.

Like in CPLEX, and I could be corrected, MINOS, you really have to go back into the things and do it. In AIMMS you have a picture. You take the mouse and you extend one (1). It would change the constraint and run the system again. I mean, there are some advances and making things faster and generating post-processing utilities that are richer.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: I want to turn now, Doctors Kubursi and Magee to -- it would still be in the last paragraph of your KM Report on page 180. And your

commentary in the last part of the last paragraph on that page on the assumption of perfect foresight in SPLASH.

You make the statement in part that -- if I can paraphrase from the last several lines of the paragraph, perfect foresight leads to solutions that are not relevant in the uncertain real world and may lead to results that would preclude optimal responses. Do you see that? I -- I've definitely not read it as a quote, but I think I've --

DR. ATIF KUBURSI: It's almost a quote.

MS. ANITA SOUTHALL: -- I've -- I've paraphrased it, yes.

DR. ATIF KUBURSI: No, it's almost a quote, yes.

MS. ANITA SOUTHALL: Could you explain that particular statement?

DR. ATIF KUBURSI: I mean, as you know, SPLASH assumes that you know perfectly what is the level of water that you would need to meet the load in a critical period, and assumes that this water is always there and the level of storage is there exactly in sufficient amount to meet all these demands. And they know exactly when the drought is going to happen because they fixed the sequence to be exactly what that drought is.

We felt that this is a bit problematic in the sense that it may lead to different costs. Suppose that the world would be in a way in which you have less water, and then you would end up importing. And you might be really importing at the time that you did not build into the system, and the import costs could be so high that whatever estimate of a drought cost that would come from the perfect foresight would be an underestimate of what the actual cost is going to be because you did not figure correctly the amount of water that you have and generation you can bring forward. And you must import now at prices that probably are far higher.

I mean, it could happen that you would import at cheaper prices, but we're talking about a situation in which you have high import prices and water shortages. And this is a possibility, all right. And -- and -- and we examined the thing. You'll be in a position where you would have an underestimation of the drought costs and, therefore, probably the -- the way we put it, maybe too strongly, that you would not get the proper response and mitigation that would be required, given these escalated costs of the drought.

MR. ROBERT MAYER: Doctor, I'm having a little trouble with this again. And -- and I have to assume that Manitoba Hydro, at any given day and

virtually at any gi -- any given time, if they can't tell you -- tell you right off, they can very quickly determine how much water they have in Lake Winnipeg, how much water they have at Stevens Lake, how much water they have in the forebays at Limestone and -- and Long Spruce, and how much water they got in the Winnipeg River.

Now, I'm assuming that is all measurable at any one of those particular stations, and those stations are all connected in such a way that it would take virtually no time at all to determine that. So why do we have to -- I mean, surely that's in input into a model. If you're doing your -- the one (1) you talked about, MOST, that turns out hourly, I'm assuming that information is available to the people who are using that particular piece of equipment.

I'm having a little trouble understanding why we have to get all fancy about that when, quite frankly, you can measure it within moments.

DR. ATIF KUBURSI: We know it now. We know it yesterday. We don't know very well what's going to be required tomorrow if things change on us. And what happened in a drought is that say April, May, even July, you have a -- given the snow pack and the precipitation, you have some idea. But then things could turn adversely on you.

And if you assume that you have all the water and you continue to operate on the assumption you have all the water that you need, you may mistakes, and that's what we're saying. It's the issue of not what we know now, what we know yesterday, is what we think is going to be the future and the future turns out to be a different one.

MR. ROBERT MAYER: Oh, okay, I understand that, but now we're talking about predictions.

DR. ATIF KUBURSI: Yeah, and that's perfect foresight. They -- you know, what -- what HERM -- what HERMES does -- it doesn't do that. What SPLASH does, it says, Ah, I know exactly how much I need to have water and I'm going to keep it, and I would have it exactly in what the model would do to optimize the net revenue over the stream of years.

MR. ROBERT MAYER: Doctor, this year excluded, I am quite sure that most people at Manitoba Hydro and some of us who just sort of look at it understand that if we don't have any -- if we don't have any rainfall from April to June we might have a problem. I'm assuming that somebody would adjust for that and not rely on the fact that the computer or the model tells you you're going to have it.

I -- I -- perfect foresight is perfect

foresight. I -- I don't think there's any such thing. And if we're going to suggest -- if we're using all possible alternatives, we go to Ouija boards and whatever else, but that doesn't strike me as something that -- that is necessary. You're going to know -- although Environment Canada can't tell you, you'll know if you had any rain and you'll know if you haven't had it.

And at some point in time you're going to realize, relatively soon, I trust, that you might be a little short of water, and what are you going to do about?

DR. ATIF KUBURSI: I -- I mean, I -- I am on -- on your side on this one, all right, and -- but let me tell you where I differ. We're both on the same side. I wish we had perfect foresight, all right. To assume it when -- in a world where it's -- things are uncertain, this is where the problem is. And this is probably because of this and because we know that these models are ultimately going to depend on the amount of information and what you do them.

And just mentioning that, we know -- once we are in April to July, we know exactly what's going to happen and things, or we have a better idea of what's going on. We want a DPP, a drought-preparation plan, with all these triggers, with all these things that will

provoke us to do things, that we are now more certain as we iterate towards -- in time, towards the impending drought or the changes and situation. That's precisely the issue.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: If I could, still on the SPLASH model, it's my understanding that the outputs of the SPLASH model are the basis for the integrated financial forecast that Manitoba Hydro prepares. Do you know that to be the case?

DR. ATIF KUBURSI: I mean, I am familiar enough with these models and with models. They are not a substitute for people's judgment and for people's decisions; they are support systems.

I mean, I find it very difficult for me to believe that these models are entered into the system without any qualification and accepted as they are. They are backstopped by professional, by engineers, by accountants, by economists, by hydrologists. So I would say yes, of course. I mean, what else these models for? I mean, they should help decisions, but they don't replace, and they don't come automatic and without any coherence, acceptance and evaluation into the system.

MS. ANITA SOUTHALL: Is it used in the

IFF, though, Dr. Kubursi?

DR. ATIF KUBURSI: Oh, yeah, precisely, in any place. So the IFF is one (1) important place, yeah.

MS. ANITA SOUTHALL: So to the extent that the SPLASH model based on perfect foresight is used in the IFF, and I accept what you're saying about there has to be a measure of judgment, then, in terms of how those outputs are -- are placed into the forecast, it has the potential to generate overly optimistic forecasts, is that valid?

DR. ATIF KUBURSI: That's valid, but we also know we learn from mistakes, and I'm sure year after year they must have found that this situation is not the correct one, and I'm sure, as any system that learns from the past, they must have made things. And the evidence is -- is that they're not accepting these things totally; they're -- definitely there's no one-to-one correspondence between IFF and the SPLASH.

MS. ANITA SOUTHALL: And did you examine that particular issue?

DR. ATIF KUBURSI: We -- not in the details I would have loved to, or liked to and things, and I admit that, but we've looked to see if there is one-to-one correspondences, and we did not find. If we

did, we could have modelled it. We were trying to model IFF.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Could I ask you -- and -- and I actually think it comes out of a comment you made a few moments ago in terms of perfect foresight and the -- the potential you may run into a situation where you have to end up purchasing higher-cost energy than you would have anticipated. If you could, and those who are following, turn to tab 20 in the reference book of documents.

And I'll -- I'll just give you a moment to review those pages, Doctors Kubursi and Magee.

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Looking at -- first of all, pages 5355 and then turning to 5356, I take Mr. Cormie's answer to Mr. William's discussion about the SPLASH model on these pages to mean that non-firm energy is not included in SPLASH, but would be available to reduce the cost of a drought?

DR. ATIF KUBURSI: I mean, that's exactly the argument here. SPLASH assumes that all you need of imports can be obtained and it's all from firm energy. And there's a general presumption here is that, if we allow for non-firm energy to come, it's usually purchased at lower price and, therefore, that issue of -- of underestimating the cost of a drought would not arise.

MS. ANITA SOUTHALL: And so if the non-firm energy included a higher cost of energy to serve, the inclusion of the hi -- the non-firm energy would not be available to reduce the cost of a drought, I take it?

DR. ATIF KUBURSI: Yeah. I mean, it's based on the presumption here that the non-firm energy is cheaper than firm energy, which is typically the case, except there are changes where this may not be.

MS. ANITA SOUTHALL: I -- I included as well the third page, which you see is not -- doesn't follow in sequence, but it's the last page at Tab 20 and it's an excerpt of page 5349 of the transcript. Again, Mr. Cormie makes the statement starting on line 3:

> "Yes, I think in -- in our forecasts of drought costs we had not, up to that time, included those types of costs in our financial planning. For example, when you realize that you -- you need

to use the firm transmission coming north, and if you have to go and pay a fee for that and you roll that fee into the cost of the energy, the energy starts looking pretty expensive."

Do you see that?

DR. ATIF KUBURSI: Yeah, I see it.

MS. ANITA SOUTHALL: In -- in terms of the current state of affairs for Manitoba Hydro, and -- and when I say "current state of affairs," without that new transmission availability to them under term sheets, for example, and some of those issues associated with their future planning, the -- the same cost of firm transmission would result in -- in higher power costs.

In other words, if they needed it during a drought period, that higher transmission costs, as a result of congestion, for example, would actually lead to a higher power cost.

Is that -- is that true? Can you comment on that?

DR. ATIF KUBURSI: Yeah. I mean, if the transmission costs are really high, this would have to be factored in the cost of energy use and -- and it would raise it.

But the -- the issue here is to what

extent this congestion prices are going to hold in -- in a period of drought year that would be -- one that consists of a time in which there is very limited capacity to transmit energy north.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: I want to turn now to the issue of model governance, please, Doctors Kubursi and Magee. And it's finding number 5. Your reference section, I believe, would be page 182 of your original report. And you've also -- if -- if you wish to have reference to it, at Tab 15, we had looked at that on previous NYC assertions, but you've also provided a response to PUB/KM-35.

So let me state that on your review you noted that,

> "The New York consultant claimed that the front office engages in self-evaluation with -- without any vetting and validation by middle office raising serious issues about the lack of checks and balances in review of validating the model's inconsistencies among the model inputs and outputs."

That's a fair characterization of what you believe the NYC was asserting?

And just -- if you could just answer "yes" or "no" because I have other questions.

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: I'm sorry to be abrupt. Now I want to take you, sirs, to the paragraph above the boxed finding number 5 on page 182, so it would be the third paragraph on page 182. There's a statement made:

> "The front office alone is running the models, interpreting their results, validating the forecasts, reporting on forecasting accuracy, inputting the data, and backstopping the entire systems. The middle office is conspicuously absent from this arena."

Do you see that?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: And is that accurate in terms of what your finding was based on your examination of that matter?

DR. ATIF KUBURSI: It's an exaggerated view of it. We -- we felt ourselves, and that's why our finding is that it would be always nice and comforting to

have two (2) pairs of eyes, two (2) sets of people. The middle office should be involved. But she has gone to hyperbole by suggesting that the front office is cooking the numbers and things. I mean -- I mean, this is totally not our experience and it's not our findings.

But the fact that the front office is doing this without the middle office involved, that's a reality.

MS. ANITA SOUTHALL: I just want to make sure that that was your finding, Dr. Kubursi.

DR. ATIF KUBURSI: That statement?

MS. ANITA SOUTHALL: Yes.

DR. ATIF KUBURSI: No, I'm reporting NYC.

MS. ANITA SOUTHALL: Could you -- yes, please take a moment and review that.

MR. GAVIN WOOD: Sorry, I was just saying I'm just going to get him to go back to the previous page and put it in context.

(BRIEF PAUSE)

DR. ATIF KUBURSI: I -- I'm certainly reporting here the NYC concerns, but it's -- it's ones that we have shared with them on this one.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Is this wha -- is this what you found to be the case? I'm referring you back to that third paragraph.

When you examined the situation at Manitoba Hydro, did you find that to be the case?

DR. ATIF KUBURSI: At that time, we found that the middle office was not involved.

MS. ANITA SOUTHALL: You recommend that the middle office should play a role in the verification and -- and checking of deals that Manitoba Hydro's making.

Could you take a moment to comment on that, please, both, if you wish.

DR. ATIF KUBURSI: I mean, remember here what we were trying to do is to look at best practice, and then see if this best practice that is now confirmed and affirmed different organizations is also the way the risk management is organized at Manitoba Hydro.

The best practice always requires two (2) sets of eyes and that there would be greater involvement of the middle office in vetting and verifying and checking and checking and balancing what comes from the front office.

On that basis, we really made the

recommendation that we wanted the middle office to be involved in this process, and much of what is considered and recognized as the best practice.

MS. ANITA SOUTHALL: Is there a reduction of risk exposure having the middle office involved in terms of those issues that are addressed at paragraph 3 on page 182?

DR. ATIF KUBURSI: I mean, the best practice did not come on a theoretical basis, it came also from reviewing the performance and the ability of different governance structures to deal with risk mitigation.

And the involvement of the middle office has always been seen as a better way of checking and balancing the operations with a view to reducing and minimizing the possibility of laxity in risk management.

MS. ANITA SOUTHALL: Thank you. I'm actually going to turn now to a -- a different subject matter, which is the -- the issue of drought risk, volumetric and drought risk, and -- and cost of drought.

At your direct evidence at page 13, you, it's my understanding, estimated cost of a one (1) year drought, based on your analysis, $748 million, 3.34 billion for a five (5) year drought, and 4.5 billion for a seven (7) year drought. I'll just pause and let you

locate that spot and confirm those numbers.

(BRIEF PAUSE)

DR. LONNIE MAGEE: These various probabilities came from simulating a whole slew of numbers from the model that we've already talked about. The AR(3) model that was fitted to the -- the actual data, and so it -- it's -- it's as if we're pretending that we can see what happens for another million years, according to these assumptions.

And then, once you've got those numbers, you just kind of look at them and count -- count up how many years in a row are below a certain level to -- and -- and mechanically then compute what fraction of the time that happened. So that's the -- the basic method that produced those probability estimates.

So we should mention that -- I mean, we keep saying, you know, a million. This is a big number, but we should note that if you use a different model to generate the numbers, you'd get different answers. It's not -- so the million just means that these probabilities are -- given the model that we estimated, these probabilities are pretty much exactly what that model says what the probabilities are. A different model could

give different probabilities.

DR. ATIF KUBURSI: And then we took these estimates and saw where the minimum water would be, and this is the data that we would fix into the @RISK and then allow all this probability densities on all the other variables, and then compute the net returned earnings that we will end up with. And so the seven eighty-eight (788) that you're talking about in Table 6.2, I presume, would have come from this.

MS. ANITA SOUTHALL: That particular analysis allowed you to be satisfied that Manitoba Hydro's magnitude of drought was closer to the appropriate estimate than the New York Consultant's, for example, that -- that the analysis you did allowed you to draw that particular conclusion, correct?

DR. ATIF KUBURSI: This and other things. I mean -- and -- and certainly we came to a much higher number than actually both Manitoba Hydro and the New York Consultant.

MS. ANITA SOUTHALL: Did the analysis that -- that you've completed, and -- and based on the numbers that I've read into the record and that are found at least in one (1) spot in your direct evidence on page 13, did those particular drought losses include increased finance costs over the years of the drought?

DR. ATIF KUBURSI: Actually, as you can notice in Table 6.2, we ran two (2) types of simulations: one inclusive of the interest rate and one exclusive of the interest rate. All the numbers that you have are in -- exclusive of the finance costs. The -- the -- in Table 6.2, all are exclusive of the interest costs.

MS. ANITA SOUTHALL: And is there another table, then, that we would look to for the inclusion of finance costs?

DR. ATIF KUBURSI: Yeah.

MS. ANITA SOUTHALL: Thank you. I'll just give you a moment.

DR. ATIF KUBURSI: Yeah, please.

(BRIEF PAUSE)

DR. ATIF KUBURSI: Okay. I -- you can find it in our report on page 233, and it's in table 6.3 on 235.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Sorry, Dr. Kubursi, were you referring us to figure 6.5 and indicating that -- I might have misunderstood you, indicating that finance

costs are included there?

DR. ATIF KUBURSI: No. I am asking you to look at figure 6.6 on page 234. But the discussion that preceded it is on page 233. And then the reporting of the data is in table 6.3, which is on page 235.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Would you please undertake to let us know what the cost -- based on your analysis, what the cost of a five (5) year drought and a seven (7) year drought would be with finance costs included?

DR. ATIF KUBURSI: The numbers that you have in our direct on page 13 of a five (5) year drought and a seven (7) year drought are both exclusive of interest costs, exclusive. We did not include the interest costs.

MS. ANITA SOUTHALL: And we'd like the -- the calculation that's inclusive, if you would be prepared to do it by way of undertaking. Yes, you're indicating yes you will?

DR. ATIF KUBURSI: Yes, yes, we will.

MS. ANITA SOUTHALL: Thank you.

--- UNDERTAKING NO. 142: KM to provide what the cost of a five (5) year drought and a seven (7) year drought would be with finance costs included

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: And just -- just to be clear, and maybe this is obvious to you, Doctors Kubursi and Magee, but you'll tell us what your assumption is with respect to what the financing costs would be over that period of time, is that understood?

DR. ATIF KUBURSI: Yes, that's understood. But let me -- let me work with you what we do. The -- that's why the discussion on page 233 is important. We look at the debt of 7.2 billion. We look at the average payment in the period to be four fifty-seven (457). We divide one (1) by the other. We say, this is the effective interest rate, and then we use...

(BRIEF PAUSE)

MR. ROBERT MAYER: Are we all looking at

the same page? There was some confusion yesterday about whether the pages we had and the pages Dr. Kubursi had were the same ones because I'm seeing some confusion over there.

DR. ATIF KUBURSI: Yeah. No, we're -- we're using the same one, right. Our -- our -- our copies were -- were different margins that changed the ru -- the -- the numbering, but we're using exactly the one that you all have, page 233. It's under Figure 6.5, the discussion under 6.5.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Ju -- and just so that you know what I'm talking about, Dr. Kubursi, in terms of what I'm asking for as to the assumption of finance costs, we're -- we're asking you to assume that there will be less money available through the drought period and that more borrowing will have to occur. So we're on the same page on that, sir?

DR. ATIF KUBURSI: Yes. And we will put all our assumptions so you see, and we could also give you different assumptions on the interest rate and see the effects of it.

(BRIEF PAUSE)

THE CHAIRPERSON: Okay, we're going to take the lunch break now. We'll be back at 1:15. Thank you.

--- Upon recessing at 12:00 p.m.
--- Upon resuming at 1:21 p.m.

THE CHAIRPERSON: Okay. Welcome back, everyone. It's Friday afternoon, 1:22. Everybody's seemingly looking forward -- apparently it's 19 degrees above outside and we're in here, but, anyway.

MR. ROBERT MAYER: And the roof -- and the rooftop --

THE CHAIRPERSON: It's not your fault, Doctors Kubursi and Magee. We're not blaming you.

MR. ROBERT MAYER: And the rooftop patio is open.

THE CHAIRPERSON: I think Mr. Mayer is suggesting we retire right there at this point. Ms. Southall, do you want to --

MR. ROBERT MAYER: It would probably solve all the problems.

MR. GAVIN WOOD: Mis -- Mr. Chair, if I could just raise one (1) matter. Ms Ramage was kind enough at -- over the noon hour to point out to Dr.

Kubursi and myself one (1) matter that he spoke about this morning that he -- he was apparently incorrect on, and it's a kind of a matter that it would be better to put it on the record as -- as early we can.

And what she's done is provided the doctor with a co -- copy of a document headed, "Manitoba Hydro Corporate Risk Profile." And it turns out, and Ms. Ramage has confirmed this to us, that there are risk documents in place with regards to a large number of categories, and then a person assigned as accountable with regards to dealing with each of these risks.

And as is turns out, apparently it was just simply something that in all the contacts that the doctors had with Hydro staff it just had never come up that these risk profile documents were available. I've shown it to Dr. Kubursi now, and Ms. Ramage is -- is here now, and I'm sure she can confirm that as well.

THE CHAIRPERSON: Ms. Ramage...?

MS. PATTI RAMAGE: I missed the beginning of that, but yes, I --

THE CHAIRPERSON: He was just indicating that during the break they had been supplied with some information that supplemented their knowledge of Manitoba Hydro's approach to the assignment of responsibility with respect to particular risks.

MS. PATTI RAMAGE: Yes, that's correct. We've provided that to Mr. Wood to provide to his clients and I --

MR. GAVIN WOOD: And I understand there's actual documents in that regard?

MS. PATTI RAMAGE: Yes, for -- there will be long-term profiles for, I believe, each of the risks. And in addition, for some there would be something closer to the binders that Dr. Kubursi referred to. Not binders, but like more detailed for example.

Now I'm going to give evidence for a second. I was involved in the infectious disease one (1) and I know that there's one (1) that's not -- the record could show I'm -- it's about a centimetre thick. You know, that sort of -- yeah, and -- so that's my understanding of them. So for some of those there are in fact something quite substantial.

MR. ROBERT MAYER: When -- when you get them, Dr. Kubursi, I'd really be interested to know -- I know that we are listed as one (1) of Manitoba Hydro's risks. I'd like to know who's in charge of us.

MR. GAVIN WOOD: And -- and there's a big ast -- and there's a big asterisk beside your name.

THE CHAIRPERSON: No, it doesn't have -- hurt to have a little bit of humour. Okay. Ms.

Southall...?

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: If I could, please, just so that I'm of an understanding, is it in the intention of Doctors Kubursi and Magee to examine that information and -- and then comment on whether or not they effectively have the internal responsibility system that was recommended in terms of best practice?

DR. ATIF KUBURSI: Yeah, I guess we'll do that. It seems like there is -- what we have been calling for is a name assigned to every risk category.

MS. ANITA SOUTHALL: That would be an undertaking, correct?

MR. GAVIN WOOD: We -- we can make it so.

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Dr. Kubursi, I take it was a discussion, but that -- with Manitoba Hydro, but that you haven't actually been given the documentation yet, or is that in hand now?

DR. ATIF KUBURSI: Now we just received it.

MR. GAVIN WOOD: But it's just a single sheet. Yeah, but -- but we can -- we can follow up and check on it.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: So you intend to actually obtain whatever the documentation is that Ms. Ramage was referring to?

DR. ATIF KUBURSI: That's correct.

THE CHAIRPERSON: Perhaps in Doctors Kubursi and Magee's response they can indicate whether it covers off the concern that they'd raised before.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: You were nodding and saying you'll do that, sir?

DR. ATIF KUBURSI: Yeah, we'll do that, yes.

--- UNDERTAKING NO. 143: KM to examine recently provided information and to comment on whether or not Manitoba Hydro effectively has the internal responsibility system that

was recommended in terms of best practice and whether it covers off the concern that KM raised before.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Okay. I take it it's been pointing out -- pointed out that what stands between myself and libations at the end of the day are my series of questions this afternoon.

Nevertheless, I intend to plow ahead and I'd left off on a section that was talking about drought costs, Doctor Kubursi and Magee. Is there a way for you to describe what the difference is between your calculation of drought, based on your analysis, which you've already testified about, and Manitoba Hydro's number?

Do they have other factors that aren't taken into account that you take into account, or can you briefly explain what you believe is the difference?

DR. ATIF KUBURSI: I -- I believe we have a number of differences. Let me begin, we're using different data. We use the public-record data of Statistics Canada about the generation, about exports, about the different prices of exports, prices of imports,

and then the detailed accounts that Stat Can lists as for the costs, item by item. So what we have is the same calculation of what we consider to be net income, which is total revenue minus total cost. And the only thing that was excluded from total cost in our calculations was in -- interest costs, but then you're asking us to go back and re-examine this.

The other issue would be the probability distributions that we have assigned to the different components of this equation. We thought we went into a methodical selection of this probability distribution based on statistical criteria, and on the basis of this we generated our results.

I noticed that when we were looking at the PRISM, they do exactly the same thing, but we have chosen different distributions. This would raise some differences, not the full difference. The full difference is going to come primarily because of the different data that we use, but the methodology and the system, they're both the same.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: I realize that -- and that you've answered a number of questions on this

issue of the -- the challenges in looking at probability of combining two (2) variables, being low flow with high prices. And we have heard your testimony, and then I've asked you certain follow-up questions associated with that.

I just have a couple of -- more, if -- if I may. First of all, are you aware if Manitoba Hydro has done the correlation analysis to relate prices to flows? Is such a thing possible?

DR. ATIF KUBURSI: No -- no question, you can run correlation between any two (2) sets of variables. The issue here is that, suppose that you find the correlation high or low. What difference would it make? It -- it makes a difference, but the story here is that, suppose you don't find any causal correlation, and even causal correlation is maybe too strong, significant, say, statistically significant correlation. It doesn't mean that these things may not happen, may not occur.

Our position is that we're agnostic. All what we want to see is what would happen if these two (2) were occurring at the same time, what would be the downside risk to this.

MS. ANITA SOUTHALL: Can you comment on whether or not there's benefit to Manitoba Hydro from running that particular correlation? I -- I'm not sure

if you've already answered. That's why I apologize if -- if that's either implicit or even explicit in your last response.

DR. ATIF KUBURSI: No, no, that's fair. What we're contending with here is a -- is a situation in which we would like to see if there is any joint probability, and correlation would be a -- a way in which you can probe this joint probability.

The issue with us here is that we didn't want to base all this joint probability on this particular correlation. What we want to see is that in the event that these two (2) things, and we ran all these Monte Carlo things, these are the consequences that would follow.

Now, some people might want to raise the question: All right, these two (2) you're assuming happening, with what probability would these two (2) happen? I'm not so sure that the correlation is going to give you the exact probability. It would really tell you to what extent they may or may not be associated. A high correlation that's statistically significant would say that these are likely to be happening at the same time. A low probability would -- would suggest that these two (2) are totally uncorrelated and may be totally independent, all right?

And I'll maybe ask my -- my colleague because there is a bit of an issue here to what extent correlation can be a significant test of independence or not.

DR. LONNIE MAGEE: Atif's been talking about the -- this -- our six point two (6.2), that kind of long -- which is a long-term planning kind of exercise. So for that, I think, yeah, the correlation is one (1) thing, but when you get way out in the extreme values of -- of the two (2) variables, the -- the -- the shape of the distribution matters as well, and the correlation -- interpreting the correlation involves kind of an implicit assumption that the varia -- the -- the relation between the two (2) variables is linear. And it could be that it's not.

So there's a lot of -- of issues there that -- and as you get out in the -- the extreme end of the distribution where you -- even though you might have a lot of data, you don't have a lot of data out there. It's pretty hard to say definitive things about the probabilities.

But I -- I just -- another point too is that form a shorter-term planning perspective, the -- what -- what's implied by those findings, and I suspect that Hydro is already aware of this, but if they see a

drought occurring, then -- or -- or they suspect the probability of a drought is increasing as they monitor weather events, it would -- becomes more important to pay a lot of attention to forecasts over the short-term horizon of -- of energy import prices.

MS. ANITA SOUTHALL: I -- I believe, Dr. Kubursi, when you were testifying on this issue yesterday you made reference to the fact that Manitoba Hydro did face this very same set of circumstances of low water flow conditions and high import prices in 2003/'04, correct?

DR. ATIF KUBURSI: Yeah. Sorry, can you repeat this, Counsel?

MS. ANITA SOUTHALL: Yes. I -- I indicated I believe that when you were testifying on this probability issue, and I believe it was yesterday, that you indicated Manitoba Hydro did face this very same set of circumstances of low water flow conditions and high import prices in 2003/'04. Is that correct?

DR. ATIF KUBURSI: That's correct.

MS. ANITA SOUTHALL: We've included -- let me just locate the tab. Just a moment, please.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: We've included at Tab 24 of the reference book an excerpt of the RiskAdvisory report from January 18, 2005 prepared for Manitoba Hydro.

DR. ATIF KUBURSI: Yeah, I see it.

MS. ANITA SOUTHALL: And there's a statement in the -- I would call it the third paragraph, the second paragraph under the heading "The '03 drought," on page 7 of that document, that is the comment:

> "In January '03, the power sales and operations division had estimated that the potential reduction in net revenue mainly caused by a drought and continued high natural gas prices could reach as much as 700 million."

Do -- do you see that?

DR. ATIF KUBURSI: I see it.

MS. ANITA SOUTHALL: Is that consistent with what information you were able to obtain in terms of the 2003/'04 drought?

DR. ATIF KUBURSI: This is exactly the kind of issues we were really dealing with, yes.

MS. ANITA SOUTHALL: And you may be happy to hear this is my final question on this subject matter. Should Manitoba Hydro be doing a correlation analysis for

other risk factors?

DR. ATIF KUBURSI: I mean, any information you could get and get informed on is absolutely helpful. The issue is what do you do with this information. Suppose that we find a very high correlation or no correlation whatsoever between high import prices and -- or macroeconomic variables and drought. Does this invalidate considering the possibility that these might really happen together? In my view, no.

MS. ANITA SOUTHALL: Thank you. I am going to move on to the concept of enterprise risk management and the risk-management framework and some questions on that subject matter. The reference page in your main report would be page 194. I don't know that you necessarily need to turn there, but, of course, please have it available if you wish. And for those following in our reference book of documents, PUB Exhibit 20, it would be Tab 6.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: You have that available, sir?

DR. ATIF KUBURSI: Yes, I do.

MS. ANITA SOUTHALL: You made some comments in terms of the corporate structure that you found at Manitoba Hydro, and one (1) of the arguments, I believe, or -- or positions you advanced was that the risk function at Manitoba Hydro should be moved up and have greater prominence within the organization, correct?

DR. ATIF KUBURSI: That's correct.

MS. ANITA SOUTHALL: Does Tab 6, the organogram that you refer to on page 194 of your report, indicating that corporate risk management is a -- near the bottom level on the far left-hand side of the schematic, is that the same document you're referring to as organogram?

DR. ATIF KUBURSI: Yeah, that's the same thing.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: And is the suggestion that corporate risk management needs to be moved to the first slot, would that be up at the top of that same column, in the senior vice-president, finance, and administration level?

DR. ATIF KUBURSI: That's correct.

MS. ANITA SOUTHALL: You've also argued

in your report for more visible and credible quantitative assessments of risks. I -- I'm reading what may even be a quote, but it -- it may just be a paraphrase so -- let me just start again:

> "...for a more visible and credible quantitative assessment of risks based on a simultaneous evaluation of the impacts of all identified risks on a coherent basis with focussed approach and integrated administrative structure. And that this could thus be achieved through joint risk-management committees organized and supervised by the middle office through the corporate risk-management committee."

Is -- is that fair?

DR. ATIF KUBURSI: Yeah, that's fair.

MS. ANITA SOUTHALL: Are -- are you able to offer any comments on how the joint risk-management committee should be established or, beyond the comments in your report, how that could be enhanced?

DR. ATIF KUBURSI: The issue here for us was to see that risk identification, measurement, quantification, is not done by only one (1) group, like only by the operation group in the front office, but that

it would really be quite a useful exercise to get subject-matter experts and the middle office to work jointly on these things. So there would be always checks and balances and vetting and reconsideration.

MS. ANITA SOUTHALL: Just taking you to a specific quote on page 194 of your main report, in the second paragraph, there's a sentence towards the end of the paragraph that starts "At this time," and it's -- and the sentence reads:

> "At this time the CRMC is only an advisory body and is without any executive powers."

The next sentence is:

> "The front office argues that it is not needed since 70 percent of the risks are volumetric and these can be easily, more efficiently and effectively, handled by the front office."

Do you see that?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: And that was the position being advanced by the front office during your report work?

DR. ATIF KUBURSI: Only with one (1) discussion.

MS. ANITA SOUTHALL: I take it that in terms of the role of the middle office, you're suggesting not just a role for verification, but a role for -- for an active part of decision making? In other words, there's a -- and the reason I brought your attention to the first sentence was that when you did your study it appears it was only an advisory body and was without executive powers.

Was -- was there a specific reason why you were making that statement and as part of your recommendation that they be more empowered?

DR. ATIF KUBURSI: When we examined the situation we found that there were three (3) major committees with lots of executive power. All others, including the PRC, Program Review Committee and others, they were advisory. We felt, to a great extent that -- that being advisory but not connected to some power would remain in the realm of optics and not reality. We -- we want them to be substantive. And the argument here is to get the middle office in a substantive position. And there we thought, where it is located is quite indicative.

I mean, I know you'd like me to say things in a brief way, but let me -- let me tell you a little bit about my experience of this, and if you don't think

it's relevant, I'll be quiet. I work for a number of ministries around the world, and usually it's about the Ministry of Planning. And in several governments, this Ministry of Planning is put on the same level as any other ministry. And then the Ministry of Planning is supposed to coordinate other ministries. But then they are exactly on the same level. No ministry would ever listen to them.

And I have really made it a career of going to governments and say, If you really want a Ministry of Planning to coordinate and to bring coherence to your plans, then it has to be in the Prime Minister's office because as long as it is on the same level as anybody else or lower level -- and actually, in several countries, the Ministry of Planning was even at a lower level; it was called Planning Board. It was literally a name. It was a shopping list, a collection of what we'd really like to do. It's pie in the sky. If you really want something effective, you want it to be done, it has to be at a level commensurate with the responsibilities you're going to give it.

In my view, if you keep the risk-management function to be one (1) little committee and done at a very low level that even it doesn't have a -- a single bracket for it, it's not going to be taken

seriously. And if it's going to remain purely advisory but not connected to some decision-making executive power, it would not have the teeth that I'm talking about that risk functions, resilience, and capacity to deal with probabilistic things would require.

MR. ROBERT MAYER: Dr. Kubursi, this Board, having its power restricted to setting Hydro rates, knows exactly what you're talking about when it comes into advisory stuff.

DR. ATIF KUBURSI: I guess, yes.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Doctors Kubursi and Magee, are you in a position to elaborate on what you suggest be done? And this may be, and I believe it is probably, you're recommending that it be lodged in the middle office, but what specifically be done to evolve or grow the ability to quantify risk?

DR. ATIF KUBURSI: It doesn't have to be only at the middle office. I mean, some people in the front office do -- dealing with volumetric things, they can -- they certainly can and should and would make major contributions to this assessment, but it should not reside there. It should also be communicated, and the reactions and maybe double-checking, you know, that

should really be done at the middle office.

The middle office is about risk management, all right? So nothing that should be done in the other places where it could be done because they have the skills and expertise, but this is an argument that you probably have to have the skill and expertise and the tools at the middle office to deal with these issues and responsibilities that you would like to assign to the middle office.

MS. ANITA SOUTHALL: Yes. Now, if I could ask you, then, just to address -- and it's really to the extent that you can, and I appreciate it may be difficult, you know, to feel you would be in a position to do it comprehensively, but what are the details associated with the actual quantification of risk that would be needed?

DR. ATIF KUBURSI: I think Manitoba Hydro has done a great job identifying the qualitative risks, and they have a good listing. Forty-eight (48) categories and -- eleven (11) categories and forty-eight (48) sub-categories. I -- I think maybe one (1) or two (2) or three (3) we can quibble about missing, but they have really very good qualitative things.

They've done what I thought would -- is a nice, interesting colour-coding of these risks, and now I

see that there is an internal responsibility matrix that we would be looking at.

What I really want to see is the use of risk tools, risk procedures, statistical methods, variance, covariance, value at risk, all these techniques and matrix that are typically used to assess the risk exposure of activities and events.

And this -- you could talk about them in qualitative terms, but they would remain very nebulous and would not be taken as seriously and we would not get a handle on them unless you're able to quantify them and put the stress test and the confidence levels on them.

So what we're asking here is for quantification, the use of statistical tools and risk tools and getting these estimates in the proper language that risk managers and risk management would entail.

MR. ROBERT MAYER: Dr. Kubursi, the Chair and I have just been going over the tab that Board counsel referred us all to, Tab 6 of the book of documents, Hydro's organizational chart. And we have noticed with interest that the corporate planning is as you say it shouldn't be, right along that line of vice-presidents, second from the extreme right.

We also appear to note that corporate risk management doesn't even have a box around it, and we're

assuming that might be the middle office there, right at the bottom under the senior vice-president and financial administration and chief financial officer. I take it that isn't where you suspect either of these two (2) positions ought to be?

DR. ATIF KUBURSI: Mr. Mayer, you're getting me in trouble. But let me say we -- we focussed on the risk management, and we don't like it to be there. I did not go to the risk planning because I really don't know fully the kind of roles you would. But I -- I certainly think that a planning function that coordinates, if this is exactly what it is, and it's not done in -- by the senior vice-presidents in other places. There is always room here to look to see to what extent you're asking people to coordinate, and they don't have the capacity or the authority to do it.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: If I could ask the doctors, please, and those following to turn to Tab 8 of the reference book of documents. Doctors Kubursi and Magee, you may be aware that KPMG did a middle and back-office assessment for Manitoba Hydro as an adjunct project for Manitoba Hydro in May, 2010. Were you aware of that or have you subsequently seen that particular

assessment?

DR. ATIF KUBURSI: I'm -- I'm not aware of it, unless I've seen it in a different thing. Is it in any -- was -- just a matter of query here. Was it in any of the appendices to the final report, or this was totally separate?

MS. ANITA SOUTHALL: Yes, it was totally separate, and it was marked as a separate exhibit when KPMG testified, so it would have been at the end of February/early March that it was tabled in this hearing process.

DR. ATIF KUBURSI: Yeah. I've seen the transcripts, but I have not really zeroed on this one in any particular way.

MS. ANITA SOUTHALL: I'm just going to ask you then, if I could, please, to -- maybe the first question's going to be easier, and then the second I'm not sure. But if you want time for both of them, please indicate that. First, I wanted to ask you to turn to the -- what I believe is the third page in the tab, which is a chart that's from page 37 of this document that I've referred to as KPMG middle and back-office assessment, May 20, 2010. And it's a recommended middle office structure. My understanding is KPMG depicts a current structure, and then a proposed structure.

Do you see that, sir?

DR. ATIF KUBURSI: Yes, I do.

MS. ANITA SOUTHALL: I know this is the first time you've seen it. Would you be able to comment on whether or not you agree with what KPMG is proposing?

DR. ATIF KUBURSI: It -- it would be very cursory and, if Counsel doesn't mind, I would like to take my time reviewing this.

MS. ANITA SOUTHALL: Yes, please. If you could just undertake to provide us with an answer to that we'd appreciate it. And that's a yes?

DR. ATIF KUBURSI: Yes.

MR. GAVIN WOOD: Once again for the wording, the wording of the -- of the undertaking, please.

MS. ANITA SOUTHALL: We've asked Doctors Kubursi and Magee to examine page 37 from the KPMG middle and back-office assessment, to examine the current and proposed recommended middle-office structures, and to indicate whether or not Doctors KM agree with the recommendations of KPMG. Thank you.

THE CHAIRPERSON: Could that be extended to get their opinion of the recommendations on page 6 of the KPMG Report?

MS. ANITA SOUTHALL: Absolutely. Let's

add that because that, I think, Mr. Chairman, would speed things up. Doctors Kubursi and Magee, did that make sense to you what we were talking about in that last exchange?

DR. ATIF KUBURSI: It does.

MS. ANITA SOUTHALL: And the undertaking will be made?

DR. ATIF KUBURSI: It will be made.

MS. ANITA SOUTHALL: Thank you.

--- UNDERTAKING NO. 144: KM to examine page 37 from the KPMG middle and back-office assessment, to examine the current and proposed recommended middle-office structures, and to indicate whether or not KM agree with the recommendations of KPMG, also their opinion of the recommendations on page 6 of the KPMG Report

(BRIEF PAUSE)

MR. ROBERT MAYER: While -- while we

appear to having a brief interlude here, as you know, I read your report. But unfortunately, I hadn't noticed it until just now, and it's the last page in what I have, page 313, Table C-1, Manitoba Hydro System Uncontrolled Inflow KCFS. Is that redacted and that's why it's blank on the page I have?

DR. ATIF KUBURSI: Yes, sir.

MR. ROBERT MAYER: Manitoba Hydro System Uncontrolled Inflows. I -- I'm assuming that's -- that's streams, that it -- it's water coming into somewhere?

DR. ATIF KUBURSI: We have all the data by months of the streams from 1912 all the way to 2005.

MR. ROBERT MAYER: I've seen some of that stuff before and I don't understand why it's been redacted, but -- I haven't seen all of it, but I've seen some of it. I've seen inflows from the various rivers, as a matter of fact, that I like to paddle.

MS. PATTI RAMAGE: I think you have see -- I -- well, I don't know what you've seen actually, but you probably have seen the historic inflows. This is manipulated data by Manitoba Hydro.

MR. ROBERT MAYER: Manipulated data, okay.

MS. PATTI RAMAGE: Yeah --

MR. ROBERT MAYER: Okay, I'll --

MS. PATTI RAMAGE: -- to -- to represent present-use conditions. That would -- it represents the -- the -- Lake Winnipeg regulation and -- and controls outside the province, that sort of -- so -- which wouldn't have existed at one (1) time, but it's manipulated so --

MR. ROBERT MAYER: I'm not that old.

(BRIEF PAUSE)

THE CHAIRPERSON: All right. Just another sideline question and I -- I apologize if it's a stupid question, but from the -- and I -- and I did look at the KPMG Report, but at the top of the proposed schedule, what's CF?

(BRIEF PAUSE)

THE CHAIRPERSON: Just -- what does CF stand for?

MS. PATTI RAMAGE: I would -- looking at what's there, I'm thinking chief financial officer.

THE CHAIRPERSON: If there was an 'O' there I would -- I would agree that...

(BRIEF PAUSE)

THE CHAIRPERSON: Well, we'll assume it's the chief financial officer unless you come back and tell us different, okay?

(BRIEF PAUSE)

MS. PATTI RAMAGE: For what it's worth -- I like testifying. The -- under the current -- the current, that's definitely the org chart that would end up with the chief financial officer at the top, so I'm going to -- I think it's safe to assume --

THE CHAIRPERSON: They just left off the 'O'?

MS. PATTI RAMAGE: Yes.

THE CHAIRPERSON: Thank you.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Just -- just carrying on, Doctors Kubursi and Magee, can -- can you explain specifically what role the middle office ought to have, in your opinion, with respect to review of long-term contracts?

DR. ATIF KUBURSI: I mean, one (1) of the

major criticisms that have been voiced by KPMG, by ICF, and we concurred with it, is that long-term contracts involve risks, and these risks should be identified, measured, quantified, and strategies to deal with them, whether it is allocation of risk capital or whatever the way one would deal.

This is a very crucial element of risk, and if the middle office is going to be entrusted with the authority and responsibility for risk management, then it can't possibly be excluded from this position. It has to be involved in identifying the kind of exposure, measuring this exposure, and dealing with ways and evaluate even contracts in terms of whether they address and sufficiently capture what would it take and what would be an appropriate response to the risk exposure.

MS. ANITA SOUTHALL: You've spoken a few times about the concept of value at risk. Are you able to comment as to the -- describe the concept and what value that particular analysis brings to the risk measurement?

DR. ATIF KUBURSI: Yeah. Actually, we have a discussion of this in chapter 2 of our report, but let me briefly -- and in layman's terms, what you try to do is to find that side of the distribution where the

largest exposure of risk is likely to be, and you try to give a confidence interval within which this risk is, like exposures, lies, and the probability of it happening. And then this would also give you a chance to see what would it entail in terms of your risk management.

Okay. Take a corporation, for example, and distribute all its returns. Anything positive you're happy with, you're not going to be worried about. What would grab your attention is the possibility that your returns are going to be negative. So you plot all these frequencies where you expect that your returns could be negative. And then you would like to see that you don't want to be negative by more than, say, 4 percent that you could tolerate. Then you'd like to know in what confidence level does this 4 percent exposure and loss lies. And then you would really know that you have a 95 percent confidence that you're going to get a return higher than it.

So it would give you a partitioning of the level at which your concern can be bracketed, at what level of frequency it will happen, and what is that maximum level that you have to worry about. So in -- in one (1) way, this value at risk is a quantitative measure of the exposure, the extent of which, and the probability

of it happening.

MS. ANITA SOUTHALL: What is the actual output of a value at risk calculation? What is the result?

DR. ATIF KUBURSI: Counsel, if I may ask you to look at our report, there is a page in which I can probably walk you through the example.

MS. ANITA SOUTHALL: Yes, please.

(BRIEF PAUSE)

MR. ROBERT MAYER: Don't let it be page 302.

DR. ATIF KUBURSI: Page 41. The example is on page 42. We look at a company on the ticker tape and look at their returns at the particular time. The month was March, 1999, and there were fourteen hundred (1400) points, and you look at the frequency distribution. And you can see that the average is about the 1 percent level. And then you get negative returns and you get positive returns.

You don't find it to be something you worry about if you have positive returns, so you're going to only look at the tail to the left of the 1 percent. And there, you're going to look and see the worst 5

percent of these daily returns. You're going to find them into that area to the left of the 5 percent, okay. And you'll find there they go between 4 percent and 8 percent. Can you see that?

MS. ANITA SOUTHALL: Yes.

DR. ATIF KUBURSI: All right. I wish it -- if you have it in colour it would really be nice, but if it's not in colour, it's all right. So the la -- the lowest 5 percent to daily returns are in this, and you could have seen them if it was in colour. If anybody has in colour, it is in red; everything else is in green.

And then you know that you can you say that with 95 percent confidence that the worst daily loss will not exceed 4 percent.

MR. GAVIN WOOD: He's on page 43 at the top now.

DR. ATIF KUBURSI: Yeah. I mean, this would really tell you that if you are worried about your exposure to loss, that you have 95 percent confidence that your losses will never be larger than 4 percent. I mean, that's a very important piece of information to know. You really want to know what's your downside risk, and you want to bracket it at what level of confidence can you say I would not slip into that downside risk.

So value at risk is basically a

quantification of the confidence interval, the likelihood of a particular loss, and the magnitude of this loss. In that respect, I mean, this is useful. Now, there are lots of provisos about this. This is a frequency distribution. Some people say, Well, can we generalize it. And some people -- it so happens here it looks so beautifully it's standard normal distribution, and standard normal distribution is a beautiful distribution. You only need two (2) parameters to characterize everything: the average, the mean, and the standard deviation.

And there is something called Chebychev inequality that will tell you that the mean plus one point nine six (1.96) of the standard deviation would capture 67 percent of the observations. And if you took three (3) standard deviations from it, which would be really on the left, your worst, worst case, you're 99 percent confident that it would not really be more than that.

No, three (3) is ninety-nine (99), right?

DR. LONNIE MAGEE: Even -- even more than that.

DR. ATIF KUBURSI: Even more than that.

DR. LONNIE MAGEE: Yeah, even more than that.

DR. ATIF KUBURSI: Even more; ninety-nine point (99.) something, yeah. So these are the kind of issues your manager -- you're dealing with risk. You would like to know what's your worst situation to be and at what level of confidence you'd like to be that you would not slip into this kind of loss.

Some people say, Well, the VAR is very much contingent on the distribution, and sometimes the assumption of a normal distribution is too far-fetched for it, unless there is sy -- symmetry in the way the returns fall, as in this simple case.

Some people say that even VAR is a short-term thing; you can't really use it. Systems are so unstable, and you could get them to be stable within a very bracketed short period, that if you extend this analysis to cover all time and all eventualities, it breaks down. No.

But with these provisos all what we're really saying here is that we'd like to see some metrics. We'd like to see some tools. We'd like to see PRISM used more. We'd like to variance/covariance estimation. And any statistician, even just with a undergraduate degree, would be quite helpful. What we have asked for are two (2) things. We said that this middle office should have a statistician or actuarial people, and we'd like them to

get a variety of risk tools that can aid them, help them, bracket specified exposures to every one (1) of these risks that they have identified that could be quantified.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: I am still in the -- in the risk-governance area, and I -- I would turn away from that subject matter for a moment and back to one (1) of the comments that the New York consultant -- or one (1) of the assertions that were made was that -- was that there was concealment and manipulation of data, and that's in terms of the operation of the models is my -- my best recollection.

Doctors, you examined that issue and concluded that there was no foundation for that allegation?

DR. ATIF KUBURSI: I would like to re-assert it, there is no foundation to this.

MS. ANITA SOUTHALL: And was it based on your questioning of the persons involved in operation of the models, and maybe others, or did you have any ability to verify that independently?

DR. ATIF KUBURSI: Well, I mean the people were willing to run the system in front of us, we've seen the numbers, we asked questions. We could go

to the board and ask, do this, do that. I mean, anybody who's trying to conceal things is not going to share these impromptu demonstration of the system, I think. And knowing enough now about the NYC and having talked to her and try to pry things from her, she has a, unfortunately, a proclivity to hyperbole.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: To the extent that there is any kind of risk exposure from -- from those -- from the conditions that would allow for that kind of activity, and I acknowledge you said you've seen no evidence of it, greater risk control and verification and independent oversight would eliminate the conditions that would allow those things to develop, I take it?

DR. ATIF KUBURSI: Absolutely. I mean, this is why you want always two (2) pair of eyes and oversight verification, more than one (1) office looking at things. All these things are basically to prepare the situation in a way that would not permit things like this, not that they exist, that you would even work on the remote possibility that they may exist.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: And perhaps this would be a fruitful spot for a further undertaking because I think you will need to be afforded the opportunity to examine it. I ask you to turn to Tab 10 of the reference materials.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: And at Tab 10 of the PUB reference materials for this cross-examination, Manitoba Hydro has undertaken to file, and -- and this is the filing, Exhibit MH-88, a table detailing each of the recommendations made by KPMG and the Corporation's position relative to each. And this is a three (3) page document.

Do you see that, Dr. Kubursi, Dr. Magee?

DR. ATIF KUBURSI: Yes, I see it.

MS. ANITA SOUTHALL: If you could please review those recommendations, perhaps in conjunction with the earlier undertaking. And here specifically though, the undertaking is to comment on the action plan being undertaken by Manitoba Hydro, in your view, would that be in accordance with your recommendation or would you have anything further to add once you examine Manitoba Hydro Exhibit 88.

Would you undertake to do that?

DR. ATIF KUBURSI: We will.

MS. ANITA SOUTHALL: Thank you.

--- UNDERTAKING NO. 145: KM to, after reviewing Manitoba Hydro Exhibit 88, comment on the action plan being undertaken by Manitoba Hydro and determine whether it would be in accordance with KM's recommendations

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Thank you. I'm just organizing my documents here for the next set of questions.

I'm now going to turn to finding 12 in the direct evidence of Doctors KM. It would be page 53. This is the document that's been marked KM Exhibit 4.

MR. GAVIN WOOD: That would be page 53 of the direct exam.

MS. ANITA SOUTHALL: Yes, correct.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Have you got that available?

DR. ATIF KUBURSI: Yes, we have.

MS. ANITA SOUTHALL: There's the statement made at the beginning of finding 12:

> "Contract prices embedded in long-term contracts are sufficiently higher than historical average spot MISO prices. These prices are carefully constructed using weighted long-term forecasts and hopefully estimates of the long-run marginal cost of counterparties."

Is -- is that an accurate read-in of the first part of that finding?

DR. ATIF KUBURSI: Yeah. Counsel, I just want to let you know here that there may be some confidential material that we're not allowed to talk about.

MS. ANITA SOUTHALL: Yes, and -- and thank you, actually, Dr. Kubursi, for being mindful of that. As I said when I started the cross-examination, if -- if there is anything you cannot respond to on that basis, please, either consult with your counsel or just let us know. Thank you.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Were you able to review the long-run marginal cost calculations of Manitoba Hydro?

DR. ATIF KUBURSI: We did not.

MS. ANITA SOUTHALL: And can you explain why you didn't examine that?

DR. ATIF KUBURSI: We -- we did not look into details of these calculations. We know of the methodology that is used. What we're trying here was to look at what's known as the avoided-cost system, avoided costs of the counterparty. And there is an elaborate procedure that Manitoba Hydro shared with us on this, but I cannot really go with the details of these things. And we did not pursue this matter sufficiently.

We knew that they're using an avoided cost, long-term avoided cost, but we did not follow through. We read from KPMG is that they shared the same thing with KPMG, the methodology, and that in one (1) instance they have provided, you know, the procedure of the calculation. We did not see this.

MS. ANITA SOUTHALL: Are you able to comment on how the long-run marginal cost compares with the incremental cost of the new generation and

transmission assets?

DR. ATIF KUBURSI: No, we're not in a position to do that, or to discuss it, actually.

MS. ANITA SOUTHALL: Are you aware that the incremental costs of the projects are over ten (10) cents a kilowatt hour, including Bipole 3?

DR. ATIF KUBURSI: I've seen some, you know, reference to this in the transcript, yes.

MS. ANITA SOUTHALL: Since -- in the preferred development plan, these projects are being advanced for export.

Should the proposed term sheet or contract prices be designed to recover a portion or all of the incremental cost of the new generation and transmission investments?

DR. ATIF KUBURSI: Yes. I mean, I would recommend that the long-term prices should be high enough not only to recover the incremental costs, but also some of the fixed costs.

MS. ANITA SOUTHALL: If the prices in the contracts are designed to recover only a portion of the incremental generation and transmission investment costs, the shortfall must be picked up by domestic ratepayers.

Is that fair to say?

DR. ATIF KUBURSI: I mean, there is a

total cost, and you have to allocate it. If you don't get the export to pay for it, then somebody else. But the issue here is an appropriate assessment of the independent incremental and fixed cost allocated to exports.

MS. ANITA SOUTHALL: I don't -- is that all you wanted to say on that subject? Okay, thank you. I did -- I didn't want you to...

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Manitoba Hydro has regularly described its hydro generation as low cost electricity.

While that is clearly the case with respect to generation stations and accompanying transmission and distribution assets constructed in the late 1980s and before that, is it still the case with the preferred development plan? Are you able to address that?

DR. ATIF KUBURSI: No, I -- I just want to say that there is no question about it, and this is universally recognized that Manitoba Hydro is one (1) of the lowest cost utilities in North America.

MS. ANITA SOUTHALL: But will it still be

low cost electricity after the preferred development plan? Are you able to comment on where that will put the electricity costs?

DR. ATIF KUBURSI: I mean, I -- I need to know a little bit more about the final cost, capital cost, of the preferred plan.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Doctors Kubursi and Magee, in your direct evidence at page 53 I understand there's a reference to an expected decline in the MISO spot market beyond 2011 that would make these planned contracts for Manitoba Hydro more valuable.

Is that fair to say? Is that a conclusion you make?

DR. ATIF KUBURSI: Yes. I mean, you know that you have really two (2) prices; you know, the prices that are a day ahead, realtime, and you have the long-term prices negotiated. It's quite important that the negotiated long-term prices be much higher -- let's say higher than the MISO prices. I mean, this is an expectation that people would like to have.

But the way things are now, it seems very easy for these negotiated prices to be higher because the

spot prices and the day ahead -- the whole MI -- MISO opportunity sales prices have been considerably lower than previous years.

MS. ANITA SOUTHALL: And have you examined forecasts that indicate declining MISO spot prices beyond 2011?

DR. ATIF KUBURSI: I've seen a few of these, yes.

MS. ANITA SOUTHALL: Can you indicate if you believe these MISO spot prices are predicated on the availability of inexpensive shale gas? Is that one (1) of the factors that's going to affect them?

DR. ATIF KUBURSI: There is no question the decline in the natural gas prices because of shale gas discoveries and technology have put a very strong downward pressure on these prices.

MS. ANITA SOUTHALL: If you could turn the page and in your direct evidence look at the top of page 54 of your direct evidence. There's a statement:

> "The inclusion of wind and out-of-money thermal energy in dependable energy is a stretch, but they represent such a small portion of total generation that their inclusion or exclusion is not a material concern."

Do you see that?

DR. ATIF KUBURSI: Yes, I do.

MS. ANITA SOUTHALL: And I believe we've given -- put it in front of you in preparation for this afternoons testimony, but if you could please access the regular series book of documents for this hearing process of PUB counsel. It would be Tab 32 of that book.

DR. ATIF KUBURSI: I have it.

MR. BYRON WILLIAMS: Ms. Southall, which exhibit number, PUB...

(BRIEF PAUSE)

MR. GAVIN WOOD: PUB-60.

MR. BYRON WILLIAMS: Thank you.

(BRIEF PAUSE)

MR. GAVIN WOOD: He's got it and he's just reviewing it.

(BRIEF PAUSE)

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Yes, I'm sorry, if I

could direct you specifically to a page, it's the table 1A, Recommended Development Plan System Firm Energy Demand and Dependable Resources 2009 Base Load Forecast.

(BRIEF PAUSE)

DR. ATIF KUBURSI: No, we have it. Yes.

MS. ANITA SOUTHALL: And if you could look, Doctors Kubursi and Magee, specifically to the column that addresses the 2012/'13 year.

Would you agree that thermal and wind represent a significant component approximately 5,000 gigawatt hours of Manitoba Hydro's total dependable energy of approximately 31,000 gigawatt hours?

(BRIEF PAUSE)

DR. ATIF KUBURSI: Yes, we have 811 Brandon, 953 Selkirk. Brandon Unit 6 and 7, 2354, 1254 from wind and demand-side management 819, but between these, you see, you have around three thousand five hundred (3,500), yeah, about five thousand (5,000) something.

MS. ANITA SOUTHALL: Given that firm commitments including firm export contracts and domestic

are about 29,000 gigawatt hours, would you agree that both wind and thermal represent a material portion of Manitoba Hydro's energy available for export?

DR. ATIF KUBURSI: I mean, it's part of the dependable, but I don't know whether it's just available for export.

MS. ANITA SOUTHALL: Total domestic demand is -- is about twenty-nine thousand (29,000) in that year?

DR. ATIF KUBURSI: 2013 --

MS. ANITA SOUTHALL: With exports, sorry. At the --

DR. ATIF KUBURSI: I mean, the way I... Oh, sorry, twenty-five seven eight three (25,783).

MS. ANITA SOUTHALL: And then with exports the total demand is twenty-nine thousand fifty-two (29,052)?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: So on that basis, without wind and thermal, would you be able to deliver the twenty-nine thousand (29,000)?

DR. ATIF KUBURSI: I mean, the calculation here is -- depends how much imports you're getting from this. I mean, you could easily think you have firm imports. They may be cheaper than running your

own thermal. So, I mean, this is an open question in terms of what would it take in terms of a choice between thermal and imports.

I mean, I -- I can -- I can deliver this and I import. I don't need to get it from the thermal. But in a -- in an event of a situation of a shortfall, there is this potential existing capacity that you could go to.

MS. ANITA SOUTHALL: Thank you.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: I want to turn to some questions associated with negotiated contract price and your evidence on page -- sorry, Direct Evidence page 54, please.

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: Again, sir, I'm not asking you to divulge any confidential information.

Understood; yes?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: Your conclusion that the prices in the term sheets are higher than forecasts, are they based on 2008 vintage forecasts?

DR. ATIF KUBURSI: Actually, they were

basically the 2008 forecasts.

MS. ANITA SOUTHALL: Can you confirm that only a portion of the negotiated price is fixed?

DR. ATIF KUBURSI: I don't know what you mean, Counsel, by "a portion." What portion?

MS. ANITA SOUTHALL: A portion of the price in the negotiated contracts, is it a fixed price?

DR. ATIF KUBURSI: There is -- there are escalators, if this is what you mean. There is fixed price, plus escalators.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: The specific question is: Are you aware whether or not, in the term sheets, a portion of the negotiated price is at a fixed price, and a portion is at market price?

DR. ATIF KUBURSI: My understanding is that the contract that I looked at, and some of the term sheets that I looked at, it looked like the largest proportion is fixed.

MS. ANITA SOUTHALL: Which means a portion of it is market?

DR. ATIF KUBURSI: There was one (1) question that I can't recall at the moment, Counsel, that

might have involved this, but I knew that all the way, even one (1) of the escalator options was to use, say, energy price escalators and was discounted because it would have detracted from the fact they wanted a fixed-price contract.

MS. ANITA SOUTHALL: Can you confirm that the prices in the term sheets are not settled as yet into contracts, and Manitoba Hydro has indicated that the term sheets are subject to still further negotiation?

DR. ATIF KUBURSI: That's my understanding.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: I'm just going to sum up and -- and comment and bring -- bring your thoughts back to the changes since 2008; the advent of shale gas and its impact on electricity prices; the fact that carbon regulation has yet to develop as envisioned in 2008; the 30 to 40 percent lower prices forecasted by ICF, we talked about that in earlier cross-examination.

Would you agree that a change in forecasts of export prices could have some bearing on what the prices that are ultimately negotiated from those term sheets?

DR. ATIF KUBURSI: I hope not.

MS. ANITA SOUTHALL: Could they have a bearing, sir?

DR. ATIF KUBURSI: I mean, it may, but the advantage is the -- the rent that has been always the strategy of Manitoba Hydro to negotiate would make these a bit independent of any particular set of conditions that would be the conditions that would influence the negotiation. I mean, you're talking about fifteen (15), twenty (20) years.

If I were negotiating, I certainly would not allow the present circumstances that could very easily change to be the determining factors, and that I would position, and I'm sure Manitoba Hydro is positioning itself in the negotiation that it's offering something of such a benefit, access to clean energy, that may really be the possibility of and has done it in the past, to negotiate comfortable prices.

MS. ANITA SOUTHALL: Thank you. I'd like to ask everyone and Doctors Kubursi and Magee to turn to our reference book of documents for this cross-examination to tab 25. And here, Doctors Kubursi and Magee, we have excerpted out a series of your tables from your original report.

Can you just take a moment to confirm? I

believe we've included here Tables 3.1, over a series of pages, through to Table 3.5. Do you see that?

DR. ATIF KUBURSI: Yes, I see.

MS. ANITA SOUTHALL: First I -- I would like you to turn your attention to Table 3.1 on the first page at this tab, which is excerpted from page 72 of your report. The table is entitled, "Forecast and actual generation 1999 to 2009," agreed?

DR. ATIF KUBURSI: Agree.

MS. ANITA SOUTHALL: We have forecasted an actual generation, and then variances shown, and the percentage variance. Is that correct?

DR. ATIF KUBURSI: That's correct.

MS. ANITA SOUTHALL: Would you agree that post-1999/2000 the HERMES model under predicted total generation in five (5) of ten (10) years for an aggregate of 300,974 gigawatt hours? So that's under prediction of total generation, where the variances are positive.

I'll just give you a moment.

DR. ATIF KUBURSI: Yeah, the -- the negative numbers are under predictions, all right. But I -- I'm not here to calculate these things. All I recognize here is that we have calculated the absolute errors of 3.3 percent. The absolute errors of forecast, you take the forecast value minus the actual. You take

the absolute value of it because any error above or below is considered to be an error, and then you average them; it is only 3.3 percent.

But I did not take these numbers. You know, I look at them. I can see that the average would be three thousand (3,000). I mean, you have eight hundred (800), eight sixty-two (862), two four five one (2,451), one three nine four (1,394). My God, no, I can't corroborate that three thousand (3,000) would be the average.

MS. ANITA SOUTHALL: No, I don't think I said average. I think I said aggregate.

DR. ATIF KUBURSI: Oh, aggregate. That -- yeah, they could add to it.

MS. ANITA SOUTHALL: Five (5) of -- five (5) of the ten (10) years of under prediction of total generation shown on this chart --

DR. ATIF KUBURSI: Yeah, I agree --

MS. ANITA SOUTHALL: -- in the aggregate.

DR. ATIF KUBURSI: Yeah. I agree that the under prediction is one (1), two (2), three (3), four (4), five (5), yes. The total is the summation of these things, but that total is not meaningful.

MS. ANITA SOUTHALL: And why is that?

DR. ATIF KUBURSI: Because you really

need the average of the forecast and percentage them at 3.3 percent. This is because -- more restrict than what you're talking. I'm -- I'm considering a positive error. You know, if you over predict is equally a bad error, all right, and that's why I don't think you add the negatives, and then you can arrive to a good judgment.

MS. ANITA SOUTHALL: I want to talk to you about -- about the years when there's a under prediction variance.

Would you agree that with existing tie line limits on peak energy sales the consequences of under forecasting would not have been large; no additional firm or peak sales would have been possible, in any event?

DR. ATIF KUBURSI: I mean, if you have restrictions, yes.

MS. ANITA SOUTHALL: Now I'd like to ask you about the same table and the over prediction of generation. Post-1999/2000, over prediction of generation occurred in four (4) of ten (10) years?

DR. ATIF KUBURSI: Correct.

MS. ANITA SOUTHALL: And the aggregate, by our calculations, is 5,513 gigawatt hours?

DR. ATIF KUBURSI: Yeah, but again I'm -- Counsel, I'm saying that the aggregate is not that

meaningful.

MS. ANITA SOUTHALL: For the same reasons you commented on a moment ago?

DR. ATIF KUBURSI: Yeah, absolutely. I mean, what you really need is to know what's the average error, positive or negative, that -- of equal value.

MS. ANITA SOUTHALL: Would you agree that overestimating surplus energy has potentially high consequence when energy from storage is used for low price off-peak sales but must be replaced by significantly higher priced winter off-peak and winter peak energy?

DR. ATIF KUBURSI: Yeah. If you put it that way, yes.

MS. ANITA SOUTHALL: Did KM also examine the hydraulic generation component as opposed to total generation in this table?

DR. ATIF KUBURSI: No, we took the exact numbers that we were given.

MS. ANITA SOUTHALL: If thermal generation was used in low flow years, would the over prediction of hydraulic generation have been even greater?

DR. ATIF KUBURSI: I -- I can't really comment on this without knowing what the facts are

exactly.

MS. ANITA SOUTHALL: If you could turn to table 3.2, please, which is the next page in the tab on page -- an excerpt from page 73 of your report.

DR. ATIF KUBURSI: I have it.

MS. ANITA SOUTHALL: Table 3.2 is forecast an actual total export revenue, 1999 to 2009, correct?

DR. ATIF KUBURSI: Correct.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Were you aware whether or not the export IFF revenue forecast included merchant trading sales?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: Yes, it did include merchant trading sales?

DR. ATIF KUBURSI: Yeah, I believe so.

MS. ANITA SOUTHALL: In the absence of merchant sales, would the revenue forecast variance be greater?

DR. ATIF KUBURSI: I -- I have to look at these things in details. At this moment with what I have here, I cannot make this estimation.

MS. ANITA SOUTHALL: You didn't turn your mind to it when you were preparing the table, I take it?

DR. ATIF KUBURSI: No. I mean, I have to basically work with numbers I have.

MS. ANITA SOUTHALL: Could you turn to table 3.3, please. And this would be an excerpt from page 75 of your report.

DR. ATIF KUBURSI: Yes, I have it.

MS. ANITA SOUTHALL: It's entitled, Forecast and Actual Total Cost 1999 to 2009, correct?

DR. ATIF KUBURSI: Correct.

MS. ANITA SOUTHALL: Did you -- when you reviewed Manitoba Hydro's total cost with respect to exports, did you recognize that these included all fuel and power purchases?

DR. ATIF KUBURSI: No -- yes. I mean, this is total cost.

MS. ANITA SOUTHALL: Did it include export and domestic water rentals?

DR. ATIF KUBURSI: I'm sure it does.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Could you please turn to table 3.4 on the excerpt from page 76 of your

report. It's at the same tab. It's entitled Forecast and Actual Net Revenue 1999 to 2009.

DR. ATIF KUBURSI: Yes. Just one (1) correction here. It's Actual Net Export Revenue.

MS. ANITA SOUTHALL: Thank you for that. Can you confirm, Doctors Kubursi and Magee, that Manitoba Hydro's forecasts of net export revenue were understated in four (4) of ten (10) years and that aggregate amount of the understatements is 198 million?

DR. ATIF KUBURSI: It's understated in how many years? Sorry, Counsel.

MS. ANITA SOUTHALL: Yes, four (4) of ten (10) years understated.

DR. ATIF KUBURSI: Four (4), yeah. Yeah, four (4). Yes, maybe five (5). No, four (4). Wait, one (1), two (2) -- one (1), two (2), three (3), four (4). Four (4), yes.

MS. ANITA SOUTHALL: And subject to your check, are aggregation of the understatement of those amounts for those years was $198 million?

DR. ATIF KUBURSI: Yeah, yeah, you could. You see, but there is -- there is an issue here which is interesting, is that you don't mind underestimating, because, I mean, you -- these are revenues. You under estimate, you get better, that's -- that's even something

that you should be happy about.

I wish all our models underestimate our revenues. It becomes a problem when it's costs, but when it's revenues, underestimation -- overestimation would be a problem, but not underestimation.

MS. ANITA SOUTHALL: Right. And let's talk about overestimation.

MS. ANITA SOUTHALL: Right, and let's talk about overestimation. In six (6) of the ten (10) years, it's overestimation, in accordance with this Table 3.4, correct?

DR. ATIF KUBURSI: That's correct.

MS. ANITA SOUTHALL: And the aggregation of the overestimation of those six (6) years is 367 million?

DR. ATIF KUBURSI: Subject to the appropriate --

MS. ANITA SOUTHALL: Subject to the check?

DR. ATIF KUBURSI: Yeah.

MS. ANITA SOUTHALL: This table shows that the largest variances were negative variances. I'll ask you to confirm that by looking at year 2002/'03, a minus 20 percent variance; 2003/'04, a minus 79 percent variance; 2006/'07, a minus 29 percent variance.

DR. ATIF KUBURSI: Yeah, these are correct numbers.

DR. LONNIE MAGEE: Just if I could interject briefly, I think for -- for something like net revenue, it would be more appropriate to look at the -- the size of the variance rather than the percentage difference between the two (2) because it's a difference between costs and revenues rather than -- so -- so you could have, for example, an actual that's zero, and you get a percentage where you're dividing by zero and get a -- a number that's very unreliable in -- in percentage terms.

MS. ANITA SOUTHALL: And so, if we were looking at the actual variance, it would be the -- the fourth column, the first column being the fiscal year, then forecasted, actual, and then the actual variance. Is that what you're commenting on, Dr. Magee?

DR. LONNIE MAGEE: Yeah. I'd be more comfortable looking at the actual, yeah, the second-last column than -- than the last column.

MS. ANITA SOUTHALL: And -- and in this case, it happens that we actually have one (1) variance in 2005/''06 in terms of an absolute value that falls in the high range as well, correct?

DR. LONNIE MAGEE: Yes.

MS. ANITA SOUTHALL: If I could ask you to please turn to Table 3.5 at page 77, which -- sorry, it's page 77, which is an excerpt from your main report, and it's the last page in this particular Tab 25 of PUB Exhibit 20. Table 3.5 is forecast and actual exports, '99 -- 1999 to 2009, correct?

DR. ATIF KUBURSI: It is.

MS. ANITA SOUTHALL: Can we agree that Table 3.5 indicates greatly improved accuracy for summer export forecasts as compared to the previous fall's export forecasts?

DR. ATIF KUBURSI: Yes.

MS. ANITA SOUTHALL: Would you agree that it's appropriate to assume that the April to July runoff is derived from snow melt and spring rain, that in most years the peak Lake Winnipeg inflow has occurred by the end of June?

DR. ATIF KUBURSI: Yeah, that's correct.

MS. ANITA SOUTHALL: Would you agree that because Churchill River diversion outflows are relatively constant, Manitoba Hydro could reliably base total hydraulic generation output projections in any given year on Lake Winnipeg inflows available for outflow in the last four (4) months of the fiscal year?

DR. ATIF KUBURSI: We're not in a

position to affirm this.

MR. ROBERT MAYER: Would you repeat that question, please? I didn't understand it. I thought we were -- started talking about Churchill River diversion and it ended up talking about Lake Winnipeg regulation.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: The -- the specific question was: Would you agree that because Churchill River diversion outflows are relatively constant, Manitoba Hydro could reliably base total hydraulic generation output projections in any given year on Lake Winnipeg inflows available for outflow in the last four (4) months of the fiscal year? And I believe Doctors Kubursi and Magee are not in a position to address that.

DR. ATIF KUBURSI: And I tell you why. I mean, in some sense, the issue here, no question about it, Lake Winnipeg is a more variable situation than the diversion. The -- the only issue here is that -- and -- and what you phrased it is available because sometimes there are issues about how much you can -- you have enough elevation to take it out or not depending on the amount of ice that's left and other considerations.

MS. ANITA SOUTHALL: Would you agree that one (1) problem Manitoba Hydro faces is that while the

first four (4) months of the fiscal year of average flow may suggest maximum exports the entire summer, subsequent low flows in the next four (4) months could still result in a significant winter energy shortfall?

DR. ATIF KUBURSI: I mean, we -- we -- the numbers themselves speak up. That once you do forecasts in July when you have the hindsight of what happened in the spring, you have a much better forecast.

MS. ANITA SOUTHALL: But you could have the situation I just posed?

DR. ATIF KUBURSI: If exactly the way you put it, yes.

MS. ANITA SOUTHALL: Would you agree that Manitoba Hydro's first forecast, being in the fall of the prior year, as reflected in Table 3.5, reflects mean or average flow conditions without recognition of actual watershed conditions?

DR. ATIF KUBURSI: I mean, we're comparing actual numbers here.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Mr. Chairman, I -- I'm not sure what we're doing today in terms of afternoon break or...?

THE CHAIRPERSON: I think that's probably a good idea.

MS. ANITA SOUTHALL: Okay. Thank you.

--- Upon recessing at 2:50 p.m.

--- Upon resuming at 3:14 p.m.

THE CHAIRPERSON: Okay, welcome back. Ms. Southall...?

MS. ANITA SOUTHALL: I'm just going to pause for a moment and turn to Ms. Ramage. I believe she wants to put a KM pre-ask on the record.

MS. PATTI RAMAGE: Yes.

THE CHAIRPERSON: Ms. Ramage...?

MS. PATTI RAMAGE: At the break Manitoba Hydro distributed a pre-ask it's been working on, and it -- it appears timely in terms of the questions this afternoon. And now the question is does the Board have the pre-ask? We just thought we'd put it on the record this afternoon. And Ms. Murphy will also send -- distribute it by --

THE CHAIRPERSON: Thanks.

MS. PATTI RAMAGE: -- email. And --

THE CHAIRPERSON: Unfortunately, Mr. Singh's attending to another function. We don't have a

large staff, as you know, so we'll make due with this. Thank you very much.

MS. PATTI RAMAGE: Okay. Ms. Murphy -- Ms. Boyd, I'm sorry, advises me that it's on Mr. Singh's chair, the copies, just so the -- the Board has it. And we'll be distributing by email also, but we thought we'd get it out this afternoon so parties would see, and then they could prepare accordingly, knowing that these questions were being asked.

THE CHAIRPERSON: We should give it an exhibit number.

(BRIEF PAUSE)

MS. PATTI RAMAGE: And I guess we did provide these to Mr. Wood and his clients. And I guess the -- the one (1) thing we didn't discuss, and I -- I don't mean to put you on the spot, but it was our hope and, I -- I believe, this side of the room's hope, that we'd be able to get the responses with -- before we're back on again if -- if that's possible.

DR. ATIF KUBURSI: No.

MR. GAVIN WOOD: We'll certainly -- we'll certainly try.

THE CHAIRPERSON: I suppose it'd probably

be best if you could take it as an undertaking.

MS. PATTI RAMAGE: And that should probably be given a Manitoba Hydro exhibit number, which --

THE CHAIRPERSON: Would mis --

MS. PATTI RAMAGE: No Mr. Singh. No Ms. Fernandez. Let me just turn -- Ms. Boyd is not on top of this one, so we'll get that done.

THE CHAIRPERSON: We'll -- we'll give it a number when we have someone that can put a number to it.

(BRIEF PAUSE)

MS. PATTI RAMAGE: We believe that's Exhibit 145.

THE CHAIRPERSON: Check then, MH-145.

--- EXHIBIT NO. MH-145: MH-KM Pre-ask 1 and 2

THE CHAIRPERSON: And for the record it is -- it is MH-KM Pre-ask 1 and MH-KM Pre-ask 2. Pre-ask 1 the reference is determination of cost for a five (5) year and seven (7) year drought. The MH-KM Pre-ask 2 is -- reference is estimate of annual drought losses in 2015

and 2020. Thank you.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Thank you, Mr. Chairman. I'd -- I'd like to ask Doctors Kubursi and Magee to turn their minds back to the issue of use of -- their recommendation regarding use of storage reserve and the concept of how that should work in conjunction with retained earnings. Specifically, there is some reference to this, and -- and I don't need you necessarily to look at it, but if you wish to, in your main report, to page 245.

And you certainly have testified on this already in -- in your direct evidence, correct?

DR. ATIF KUBURSI: Correct.

MS. ANITA SOUTHALL: Could you add any further detail on how a proposed rate rider would be developed? I'm sorry, that's a different issue. I apologize.

I wanted to bring your attention though to -- to this concept and -- and then if you don't mind I -- that was context. I wanted to turn to the issue of the rate rider though, in particular, so I apologize for that misdirection. But just on that specific issue of the rate rider, if you could address that question, thank

you.

DR. ATIF KUBURSI: The real issue here is that we don't -- we did not think it is appropriate or reasonable or productive to keep all the insurance against drought or other risks to fall only on the retained earnings.

We felt the retained earnings play multiple functions and we wanted to complement the mitigation capacities and abilities by adding other riders or other sources, one (1) of which you mentioned was the water. But then we thought that you could split the rates into two (2) parts. A part that would be the one (1) that you'd typically and usually use, and the Board gives these increases. But that if you were to also leave room here for an additional value, and you allocated over the different parties the way you allocate the general rate. But that rate we thought would be important because it would invite the ratepayers to become partners in protecting themselves against rate shocks, and the necessity at one (1) time to increase the debt.

So it was a precautionary type of arrangement. And we thought along lines that we as ratepayers in Ontario have had to do for years, as I mentioned, that there is now this debt that Manitoba

Hydro had incurred. And now it's asking ratepayers to have a rider on the actual rates they pay where they break it into the regular payments and another section which is just simply money earmarked to pay the debt.

So we thought, to a great extent, we have an issue here. The ratepayers, in the absence of any insurance, would have themselves to pay for these. And then ultimately there may be a situation which may arise from a very long drought or a very severe drought that would require large increases.

So as a protection against these rate shocks, and as a protection against major borrowing that may be required, that there will be a proactive way in which you could design these rates that would allow the ratepayers to participate as stakeholders in protecting themselves. I mean, they -- yes, they're giving it to the Utility, but in some sense, this is themselves insuring, or taking insurance, by paying some very little, limited amount that would accumulate over time that would protect them against these rate shocks or having to contend with larger debts that they ultimately would pay as taxpayers.

MS. ANITA SOUTHALL: Would the -- the additional charge, which would compose the rate rider, would you be recommending that that be held as a separate

reserve or would it simply fall into retained earnings?

DR. ATIF KUBURSI: I mean, these issues of financial management may have to really be ultimately decided by people who have more knowledge than we do on these things. But our recommendation -- and I understand there is a reticence here to have sink -- you know, sinking funds.

What really counts here is that this money should be available when it's needed, particularly as an insurance against sudden shortfalls of revenues, be it from long-term contracts, from drought, but basically and fundamentally, things that would preclude the possibility of having to shake and shock the ratepayers with large increases to cover the operations.

THE CHAIRPERSON: Does your proposal have anything to do with the -- the issue of intergenerational equity, the fact that the current generation takes on risks that potentially could be -- fall to future ratepayers to assume?

DR. ATIF KUBURSI: Absolutely, Mr. Chairman. I mean, this is one (1) also of the considerations is that now we're going to do something that -- the consequences of which, if we are not prepared, is going to fall on future generations. So in some sense, this is particularly this generation trying

to protect itself and the future generations from having to pay rates that are not considered to be reasonable or -- or equitable.

MR. ROBERT MAYER: But, Dr. Kubursi, let's look at the other side of the equation. If Hydro is correct and this -- this future project turns out to be another Limestone, then the future generations will reap the benefits for which this generation will have paid for.

DR. ATIF KUBURSI: But -- but this is the flip side, but -- but I'm talking about also the flip side is that we didn't get any preparation, and now we're going to say to the future generations, You pay for our mistakes for not really taking the precaution and the necessary step to mitigate these risks.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: And I told you just prior to completion of the break this afternoon that if -- if you didn't appreciate how brave a person I was, that I was going to go to page 246 of your main report and ask you about the equation there.

(BRIEF PAUSE)

DR. ATIF KUBURSI: Well, I -- I thought you were going to be more brave than this. This is the easiest equation, all right? I mean, this is a very simple, linear -- what we call linear, which means -- oh. Oh, sorry. I'm happy to answer it.

MS. ANITA SOUTHALL: You -- you can go on and finish that explanation, Dr. Kubursi, but maybe I could ask my question and you could combine it with what you were about to address.

You've certainly identified the variables immediately below the equation on page 246. What I am asking, and you'll see maybe I'm not so brave, is the rationale for that particular equation. In other words, what were you hoping to offer to Manitoba Hydro and its stakeholders in terms of offering up that particular equation in terms of the way that all of those variables could coalesce.

DR. ATIF KUBURSI: Sorry, Counsel, but as you notice, I have more answers even when there are no questions. But, I mean, this is qui -- quite simple. I mean, what we're really saying is that we don't want to depend on only one (1) mechanism, which is the retained earnings, so we added three (3) others.

And the other one is a water system above a certain amount that is considered to be the minimum you

need in order to meet in the critical period. The other one is to have this rider over what is the typical ride -- the typical rate. And then there is some sort of a borrowing that you would like to put some sort of a cutoff on -- on how much borrowing, you know, you would allow.

I mean, you want to work all these four (4) things in combinations. And we left these alphas which are the weights that should be put. Like I'm going to depend 50 percent on retained earnings above a minimum, and then 10 percent, 30 percent, I mean, until I exhaust this.

You have infinite number of choices for the alpha 1, alpha 2, alpha 3. But this should really be worked out not by us, but by the Board representing the people of Manitoba that can gauge the sensitivity. I mean, I'm sure ratepayers or people who represent them are going to be jumping up, What do you mean, raise it more than we already have.

But on -- on the other hand, we're saying, Look, there is no gain without pain, and -- and you're going to gain by protecting yourself and avoiding these big shocks that could come in -- in the event we don't prepare ourselves. So these are weights that should reflect the tradeoffs that you would -- how much would

you want this multiple stakeholders, all right, because we're bringing things from Manitoba Hydro.

The water is also Manitoba Hydro. The rate -- the -- the rider is the ratepayers. The borrowing is ratepayers and the government. So you're trying to say, Look, this is an issue that involves everybody, and we want to act as partners, preparing ourselves as partners into creating a mechanism that would allow you -- and a capacity that would allow you to avoid difficulties if and when they arrive.

We all know that there's going to be drought problems. We all know that there may be risks in long-term contracts. The issue here is what do we do about it and how and how much should we be prepared. I mean, should we be a hundred percent prepared maybe? maybe a hundred ten (110)?

I mean, the issue here, you could bring actuarial. You could get into amounts and tradeoffs that would bring all these multiple stakeholders into a consensus in a way in which they all participate in the protection of themselves and this important economic node from any financial stress or difficulties in the future.

MS. ANITA SOUTHALL: In the equation, water storage is water level in storage above the minimum determined by dependable -- dependable energy targets,

correct?

DR. ATIF KUBURSI: And these are the kind of things that we saw from the rule curve and other things in -- in SPLASH.

MS. ANITA SOUTHALL: So did I capture though what WS means in the equation?

DR. ATIF KUBURSI: This is exactly what we're saying, is that there is in the SPLASH calculations of what is the amount of water that you keep in storage in such a way that you have sufficient water all the way through the critical period to deliver what your commitments are to load and to firm exports, minus firm imports I hope.

MS. ANITA SOUTHALL: And so in terms of water storage in this calculation as a storage reserve measure, you're talking about some amount above that or in addition to that minimum, I take it?

DR. ATIF KUBURSI: Yeah, addition to the minimum. I know -- I mean, here we're talking -- I mean, the general calculation that I've seen is that 1 foot in Lake Winnipeg -- you only have two (2) places to where you could store things, right: Cedar Lake and Lake Winnipeg. And 1 foot in Lake Winnipeg is around 2,000 gigawatt hours, of -- of that sort. Depending on the price, it translates into a monetary value. So if you

keep -- if you keep 2 feet, maybe that's too much, you have -- at fifty dollars ($50), you have 2 -- you know, you have 200 million. So it -- it has to be worked out with the hydrological engineers, with the people who run the -- the operation.

But I would like to see, you know, some sort, and -- and this has -- in our view it plays a deus ex machina, you know, this is two (2) -- okay, I use English, two (2) purposes here: 1) is that it forces Manitoba Hydro to become more conservative, all right, which is always good in the face of impending drought or things, and 2) that you have, in some sense, a -- a value to this that you could always say it's available in case we need it.

MS. ANITA SOUTHALL: Doctors Kubursi and Magee, you're no doubt aware of the Manitoba Hydro rebuttal position.

Manitoba Hydro disagrees that it should change its current practice of managing minimum reservoir storage to keep additional storage as a drought buffer, or as an additional hedge, correct?

DR. ATIF KUBURSI: Yeah, correct.

MS. ANITA SOUTHALL: And Manitoba Hydro has suggested that the use of reservoir storage would not be an efficient way to mitigate against drought impact,

preferring targeted level of retained earnings, rather than targeted level of reservoirs, if I can summarize.

DR. ATIF KUBURSI: Yeah.

MS. ANITA SOUTHALL: You're aware -- you're aware that they take that position?

DR. ATIF KUBURSI: No, no. Yeah, we are aware.

MS. ANITA SOUTHALL: Are you able -- I -- you, to some extent, I think, covered this in your direct testimony, but could you just summarize what your position is relative to their rebuttal argument? And here I -- I do want to bring your attention to the excerpt of transcript at page 29 of the reference book of documents. And I'll give you a moment just to review that. It's an exchange between -- sorry, our reference book of documents for this cross-examination of PUB counsel.

Tab 29, yes. It contains excerpts of the transcript from pages 5,613 to 5,617, and is an exchange between Mr. Hacault and Mr. Cormie on this subject matter.

DR. ATIF KUBURSI: Give me a few minutes to look, okay.

MS. ANITA SOUTHALL: Yes, absolutely.

DR. ATIF KUBURSI: I read it before, but

I --

MS. ANITA SOUTHALL: Yeah, absolutely.

DR. ATIF KUBURSI: All right.

(BRIEF PAUSE)

DR. ATIF KUBURSI: I've read it.

MS. ANITA SOUTHALL: My read indicates that in that exchange in the transcript Manitoba Hydro contends that by holding back water in reserve it increases the likelihood of spilling water when high-flow years follow.

Did you notice that, or did you recognize that in the position of Manitoba Hydro?

DR. ATIF KUBURSI: Right, but I mean, basically tendering this for exactly opposite conditions, all right? I mean, the -- the appropriate frame of reference, in our view, would be a time of a period where there is low water flow, and that you have the storage in place. And we're talking about the minimum level, a little bit above a minimum level.

MS. ANITA SOUTHALL: Doctors Kubursi and Magee, Manitoba Hydro contends holding back water reserve is an inefficient way to ensure the financial future of the company as compared to sufficient retained earnings.

DR. ATIF KUBURSI: I mean, no question, I would like to have money instead of water, but, I mean, the issue that we basically and fundamentally came to argue about is that we don't want to depend on retained earnings only.

Retained earnings, for reasons that the Chair had really talked about, includes all these other assets, and besides, I mean, this is something that people take into account when they look at the financial health of the utility, and it has to have a debt, you know, equity ratio, it would have to have ICCs, the investment coverage ratio, ICRs, the interest coverage ratio.

I mean, I don't want to basically leave only this. And then our calculations, too, Madam Counsel, showed that, even with the present and even higher levels of retained earnings, they may not be sufficient if things happen to be incredibly severe and -- and -- and last for a long time.

I'd like to really have the comfort that there are other things that could come to the aid. I -- I recognize that it depends on the storage capacity, it depends on the price at which we can sell, but these things can -- can be managed, and -- and -- and economists, a great economist, Hotelling, H-O-T-E-L-L-I-

N-G, the man argued that, you see, if you have zero storage costs, maybe not exactly zero, but there is a mechanism on how you could optimize your water storage.

You typically would store more if the expected price of electricity in the future minus cost of coverage is larger than the real interest rate, because the story is you can take the money, put it in the -- in the bank and get 2 percent, but if the price is going to rise by more than 2 percent, then why take it now and put it in a bank at 2 percent when you could wait, keep it there, and sell it for more than 3 percent increase in the -- in the price?

So, I mean, there are ways we can do this on an optimal, efficient way, and we're not saying here dispense with all efficiencies, forget about Hotelling. No. We're saying, look, all we really need you here is to recognize and to project to the world, to the rest of the community, the financial or otherwise and to the people of Manitoba, that we are being very conservative and that we are going to basically and fundamentally not exclusively depend on only one (1) variable.

MS. ANITA SOUTHALL: Thank you. Turning to a slightly different issue, Doctors Kubursi and Magee, can you confirm that KPMG recommended that the Utility's long-standing target debt-equity ratio, that being 75:25

as indicated by the Chairman, that the target could be beneficially reviewed, given the pending planned capital expenditures of Manitoba Hydro?

Did you -- did you -- first of all, do you know that KPMG made that recommendation?

DR. ATIF KUBURSI: Yes, ma'am.

MS. ANITA SOUTHALL: Do you have a view on what that target should be, given that Manitoba Hydro plans to borrow an additional $15 billion ahead of profitable results arising from the development?

DR. ATIF KUBURSI: Yes. I mean, we -- we know all too well that rating homes, houses, you know, and different groups that assess the financial viability and prowess of a particular institution, typically use this debt/equity ratio as a sort of an indicator of the financial balance within this.

And it -- nothing etched in stone, and you can't really say exactly, but I think there is a general consensus in the financial community that they would prefer companies that have higher equity-to-debt ratios and that there is some magical number of this one (1) to three (3) that's -- that's the 25:75 that seem to have really been etched into the operating performance criteria of -- of many of these homes.

So if you're going to violate this, you

might as well not extend it, and there should really be measures and levels of retained earnings that could balance these things because there is the concern here that if you don't have these retained earnings, you're not going to be able to pay for the debt should the interest rate rise or some problems emerge.

I am willing to say that this debt/equity ratio is extremely important; that you could really tolerate some deviation but only small amounts and for -- for short period of times; and that the Corporation should embark on this investment with very cautious and clear appreciation that long-term deviation and going out of this magical ratio is something to be concerned about.

MS. ANITA SOUTHALL: I -- I would now like to ask you to go to your Direct evidence on page 67. And this is item number 7, or question number 7 perhaps is the way to phrase it, on page 67.

MR. GAVIN WOOD: Just give -- give him a moment, would you?

MS. ANITA SOUTHALL: Yes, for sure.

(BRIEF PAUSE)

MR. GAVIN WOOD: It'S actually Dr. Magee.

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: Dr. Magee, this is the question, I believe. Do you have any opinion as to whether Hydro has identified and considered carefully all available development scenarios? And I take it you're the designate.

DR. LONNIE MAGEE: Well, we -- it -- it's hard to imagine what all the development scenarios could have been.

MS. ANITA SOUTHALL: I'm going to --

DR. LONNIE MAGEE: But --

MS. ANITA SOUTHALL: -- stop you right there if I could.

DR. LONNIE MAGEE: Okay.

MS. ANITA SOUTHALL: And -- and because my question is: Did Manitoba Hydro identify to you other development scenarios beyond the preferred sequence and the no-sale scenario?

DR. ATIF KUBURSI: Maybe -- maybe I'll answer this. We looked at the two (2) -- the two (2) alternatives.

MS. ANITA SOUTHALL: So -- so no other development scenarios?

DR. ATIF KUBURSI: Not that we know of, no.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: Doctors Kubursi and Magee, I'll maybe direct you to -- to now another reference tab in our book of documents, please, for the next series of questions; it's Tab 26.

(BRIEF PAUSE)

MS. ANITA SOUTHALL: And it displays Exhibit -- MH Figure 3.17, Lake Winnipeg Critical Period Trajectory, and is an excerpt and an enlarged version of figure 3.17 from your main report at page 91, correct?

DR. ATIF KUBURSI: Yes, correct.

MS. ANITA SOUTHALL: With reference to this particular figure, I have a number of questions. Could you please confirm if Manitoba Hydro's drought management strategy, specifically Lake Winnipeg operation, calls for minimizing the use of energy and storage in years 1 and 2 of the drought?

MR. GAVIN WOOD: I just -- I -- I wonder, Mr. Chair, if Ms. Southall is going into a series of pre-ask questions that we had been provided with. My point being in part, if -- if -- if they are set out in

writing, it would help the doctor in terms of seeing them.

MS. ANITA SOUTHALL: Yes. So to the extent they're going to be answered in the pre-asks we're -- we're fine with that, and I will come to the introduction of the pre-ask questions on the record in a couple of moments. So I accept that direction, Mr. Wood.

(BRIEF PAUSE)

CONTINUED BY MS. SOUTHALL:

MS. ANITA SOUTHALL: I have a further question on this particular figure 3.17 and in conjunction with your finding, which is on page 222 of your main report, please, and it's in the last paragraph identified as -- as item 8th, E-I-G-H-T-H.

(BRIEF PAUSE)

DR. ATIF KUBURSI: Yeah, I see it, yes.

MS. ANITA SOUTHALL: And I take it, Doctors, you suggest that a statistical process confirms that Manitoba Hydro is correctly using low flow years as the base of -- basis of its dependable energy calculations?

MR. GAVIN WOOD: Sorry, we're at the -- we're at the wrong spot. Could you --

DR. ATIF KUBURSI: Which -- which --

MR. GAVIN WOOD: Page 222.

DR. ATIF KUBURSI: Page -- which -- which --

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: It's -- it's -- in my version it's on the bottom of page 222.

DR. ATIF KUBURSI: Which is the number eighth?

MS. ANITA SOUTHALL: Eighth, yes.

DR. ATIF KUBURSI: Yeah, yeah. Okay.

MS. ANITA SOUTHALL: And it's, I believe, the last sentence of that paragraph on that page.

(BRIEF PAUSE)

DR. ATIF KUBURSI: Okay. I -- I've read it, yeah.

MS. ANITA SOUTHALL: And here I'm also going to -- would you please just look at Tab 28 in our reference book, which is PUB/MH 1-206. And -- and if you require this as an undertaking, please, please let me

know.

Do you have those in front of you, sir?

DR. ATIF KUBURSI: Sorry, yes, I have.

MS. ANITA SOUTHALL: Would you please indicate whether Manitoba Hydro's five (5) year drought portrayal in PUB/MH 1-206(a) is consistent with Manitoba Hydro's drought management strategy in reference to figure 3.17?

DR. ATIF KUBURSI: Yeah. Sorry, counsel, I mean, this is something that I would not be able to do here.

MS. ANITA SOUTHALL: Are -- are you able to undertake to answer that?

DR. ATIF KUBURSI: This is something we really need to discuss because we're not hydrologists, all right? I mean, we're basically trying to use hydrology and see the extent to which we can factor it in and see how it may impinge on generation, and then using the various metrics of revenue and others to make statements. Some of these questions really would assume or presume that we have expertise and knowledge in hydrology far beyond what is really our terms of reference.

MR. GAVIN WOOD: And --

CONTINUED BY MS. ANITA SOUTHALL:

MS. ANITA SOUTHALL: So is your answer that you're not in a position to respond to that?

MR. GAVIN WOOD: If I could just -- just a moment. Just so that the Board understands where the doctors are at, my friend was good enough to provide an extensive set of pre-asks before the hearing last week, and Dr. Kubursi's just pointing out to me that -- why he was able so quickly to respond is it -- it's -- this particular document at Tab 28 is included in the set of materials that he received last week. And -- and his -- his concern is about the -- the request, given their expertise.

The other thing that I think the doctors would need some direction from yourselves on is the utility, particularly if my friends are ultimately going to ask, I think it's about, twenty-six (26) questions, or some -- or some part of them, that my understanding would require them to be going back into ex -- extensive work in terms of the databases they've assembled and things of that nature.

And there's concern on their part as well about frankly the utility of it, given what they've been -- what they've been asked to apply their expertise to up until now, and the questions of costs. My understanding

-- and again, my friends have been good enough to certainly give us a -- them a chance to go through all this stuff. There's a -- there's a concern about the -- the costs.

And the final thing, and I think it -- it -- you should, at least in -- in terms of a sense of it, is I've had extensive conversations with Ms. Ramage. She's certainly, and her people are certainly aware of these questions. I know ultimately -- and she can speak for herself, but as of yesterday, she advised me that, for whatever reason, it sounded as if she wasn't going to get into this issue about whether or not the doctors should be giving undertakings on this -- these matters.

My understanding, though, is that Manitoba Hydro is concerned that there's underlying assumptions and other concerns in the set of questions, that they're concerned as well about Doctors Kubursi and Magee getting into the middle of what, I think, if my friend Ms. Ramage, I understood her correctly yesterday, are really matters that should be asked of Manitoba Hydro rather than -- than these -- these persons.

Having said that, sirs, you appreciate that the doctors' whole approach to this matter, particularly with you gentlemen, is to be as helpful as they can be. They -- they appreciated the retainer that

they've been given, the work that they've done, and if you ultimately conclude that these matters should be undertaken by them, they're -- they're -- they are prepared to -- to undertake to do what they can.

THE CHAIRPERSON: We'll -- we're -- we're not aware of all of these questions, so we'll have to have a look at them and -- but it's not going to happen today, I wouldn't think.

MS. ANITA SOUTHALL: No, Mr. Chairman. In fact, I -- I intended to enter them on the record as my last step today. They were circulated on April 25th to all counsel.

Our position would be that we would be asking Doctors Kubursi and Magee to answer the questions to the best of their ability. If they don't believe they -- they can answer certain of them, either it's beyond what they believe to be -- be beyond their scope or beyond their expertise, they're certainly able to answer it that way.

If they require additional information or resources to answer the questions, those that they believe they can, they certainly can ask -- access those resources. If there is a question of additional costs, certainly it would be appropriate, I believe, for them to submit what they believe that cost estimate would be for

the Board's consideration.

Nonetheless, this is the first of its kind in terms of risk analysis. These independent experts have been retained on the broad terms of reference under Order 30/'10. And to forestall the putting of the series of pre-asks that Board counsel and its advisors have assembled would, in our view, not be the prudent way to approach it. Rather the experts can, as I've indicated, take all those steps and, to the best of their ability, answer the questions that they're capable of answering. That would be our submission.

And I will be putting them on the record as my last step today.

MR. GAVIN WOOD: And -- and...

THE CHAIRPERSON: Yeah, okay.

MS. ANITA SOUTHALL: And sorry, lastly, the last position I had for Manitoba Hydro was that they didn't object to the pre-asks as presented.

MR. GAVIN WOOD: And -- and may --

THE CHAIRPERSON: Please proceed.

MR. GAVIN WOOD: And -- and may I say that, just so the Board and Ms. Southall under -- understand, I believe the doctors can attempt to answer most of those questions. But given the underlying discussions that lead up to this exchange, I -- with all

respect, I -- I think Manitoba Hydro and PUB counsel should be talking between themselves because they'll -- they'll do it if -- if you want them to do it, but -- being -- being within their capacity. But my understanding is we're talking considerable work.

THE CHAIRPERSON: You're saying it's considerable work even under the terms that Ms. Southall's talking about?

MR. GAVIN WOOD: Well, sure. I mean, there -- there's -- we -- we were -- in terms of the back and forth, they've understood what PUB counsel and -- and the internal experts were -- were looking -- were looking for them to do. And I guess it -- ultimately it's a question of utility, but they -- they feel they can -- they can try to answer them if -- if the -- if necessary.

And unless Manitoba Hydro sees fit to step in and explain why they have the concerns that they've talked to us about off the record, and we just don't know. But, again, to be fair, Ms. Ramage had indicated to us yesterday they weren't going to get involved, so.

THE CHAIRPERSON: Well, the one (1) thing --

MR. ROBERT MAYER: Can I -- can I suggest a possibility here. Don't bother reading all the questions into the record. Everybody has a copy of them

I'm told. Assign some numbers to them. We -- we haven't seen them. It's four o'clock Friday afternoon. If there's going to be some issues, I think we want counsel to sort those issues out.

We are not scheduled back here to somewhere near the end of May. I'm thinking that those issues should be resolved by that time. I'm thinking we're going to have to be talking about, gentlemen, September, at some point. I don't know, but we're -- we're losing time here rapidly and I -- I don't know where -- where we're going to end up.

But I really think that -- put numbers on those pre-asks. Counsel get together. Doctors, I understand, you've told us a hundred times, you're not hydrologists. If the diagram of Lake Winnipeg -- and it looks like hydrology to me. And -- and we've had some discussion about at what point you can actually still take water out of that lake, and I don't expect you to have had those discussions. So if some of those things are clearly outside your area of expertise, just say so, and that's the end of it.

MR. GAVIN WOOD: Yeah, but understand, Mr. Mayer, given the extent of the study they've done in the last year, they have developed a base of knowledge that they -- they can attempt to answer them. That's --

it's just, you know --

MR. ROBERT MAYER: We could then -- I'm assuming that you will have your discussions with Hydro as to whether that falls within -- within the terms of the expertise which have been requested and permitted by the Board to this point.

THE CHAIRPERSON: We also prefer some degree of transparency here, so Mr. Mayer's proposed an approach. Ms. Southall, does it sound okay to you?

MS. ANITA SOUTHALL: Yes. In fact, I do have the package of questions in this exact form they were circulated on April 25th. My intention today was simply to mark this as a PUB exhibit for the record. And I'm perfectly happy to follow the recommendations of the panel in terms of process.

THE CHAIRPERSON: Okay. Very good.

MS. ANITA SOUTHALL: So it would be the next PUB exhibit. I believe it's 21.

--- EXHIBIT NO. PUB-21: Set of Questions Posed to KM

MS. ANITA SOUTHALL: And we can circulate that --

THE CHAIRPERSON: Could you distribute it, please.

MS. ANITA SOUTHALL: Yes.

(BRIEF PAUSE)

MS. PATTI RAMAGE: Mr. Chairman, while that's being distributed, I've sat fairly silent, and will try to -- to keep it that way, but just by way of comment in terms of Manitoba Hydro's expect -- expectations with some of these questions, and it may assist, Manitoba Hydro is indicating that it doesn't have any objections, it was on the basis that the doctors may respond to the questions.

That doesn't necessarily mean answers -- answer the question. It's respond to the question. And we -- we would expect -- our expectation is that there's questions in there that they simply won't be able to answer, but it's for them to make that determination whether -- whether they can. And we would deal with that answer after the fact.

MR. GAVIN WOOD: And -- and on that, before Ms. Ramage goes further, would the doctors have access to people at Manitoba Hydro to check on the -- some of the underlying assumptions in those questions? Because --

THE CHAIRPERSON: I think this is part of

the discussion we were talking about --

MR. GAVIN WOOD: Okay. Be -- be --

THE CHAIRPERSON: -- between the counsels.

MR. GAVIN WOOD: -- because Ms. Ramage has told me certain problems with the questions that I've tried to convey in my limited understanding of the complexity of some of them. But it would really help if -- if they -- if the doctors could talk directly to the people with the skills at Manitoba Hydro.

THE CHAIRPERSON: Well, I -- I can't see how we're going to work this out at 4:06 on a Friday afternoon. I think we're going to have to leave it with Ms. Southall, yourself, and Ms. -- Ms. Ramage.

MR. ROBERT MAYER: And in the end result with the doctors. If they don't feel comfortable answering the questions, I think you're entitled to say, Go to hell.

THE CHAIRPERSON: If it's -- if it's outside your -- your expertise you'll -- you'll comment that. You said you picked up a considerable degree of knowledge through your work to date. We recognize the fact that you're attempting to help the hearing in every which way and we greatly appreciate that.

DR. ATIF KUBURSI: Yeah. No, we

appreciate that. I mean, we take this to be something we can live with, yeah.

THE CHAIRPERSON: And Manitoba Hydro has been cooperative with you before, showed you models, you've been appreciative of that. It's PUB-21 then.

MR. GAVIN WOOD: And -- and, Mr. -- Mr. Chair, just for the reporter, I'm going to -- I would ask you then, with your permission, to note that as undertaking 6, with all the parameters that have been set on it, just so that I can approach the assembly of the undertakings for them for next week in -- in that way.

THE CHAIRPERSON: That's fine.

--- UNDERTAKING NO. 146: Doctors Kubursi and Magee to respond to Manitoba Hydro's Pre-asks

MS. PATTI RAMAGE: There was one (1) other point that I -- I wish to make on that, and that was a caveat with respect to Manitoba Hydro's "respond, not answer." There are also questions in there that -- in which the doctors are asked to represent what Manitoba Hydro would do in certain circumstances. And Manitoba Hydro doesn't believe that that's fair to ask those -- the doctors those type of questions.

THE CHAIRPERSON: I would imagine, given their level of expertise, that they'll come to a rational conclusion on such items.

MR. ROBERT MAYER: We did, however, have a brief discussion about psychics earlier today, but I don't think we intended to introduce that into evidence.

MS. ANITA SOUTHALL: And finally, as my last wrap-up matter in my cross-examination, panel, we have three (3) technical undertakings that we'd like to pose to Doctors Kubursi and Magee. I can prepare those in writing though and enter them as a PUB exhibit immediately at the commencement of the next day of hearing. And that way I don't have to take the time today to read them into the record.

THE CHAIRPERSON: And you can --

MS. ANITA SOUTHALL: If that's acceptable.

THE CHAIRPERSON: -- you can provide them with them during the interim?

MS. ANITA SOUTHALL: Absolutely. They would be circulated in the interim.

THE CHAIRPERSON: And in the -- in the same attempt at hearing efficiency, if we pick up a few extra questions from our reflections, we may add them to the list.

MS. ANITA SOUTHALL: Thank you, Mr. Chairman. That concludes -- subject to those -- to those follow-ups, that concludes my cross-examination of this panel.

Thank you very much, Doctors Kubursi and Magee and Mr. Wood.

DR. ATIF KUBURSI: Thank you.

THE CHAIRPERSON: Thank you, Ms. Southall, and thank you, Doctors and Mr. Wood and everyone else that's been present for these three (3) days.

It's been -- I believe the next time we come together is May the 26th, which is a considerable period of time, and Mr. Mayer's concerns undoubtedly are echoed by everyone. So we'll have to try and determine whether we can find additional days, or to try and bring this whole process to a conclusion within normal human time frames.

So with that, we stand adjourned. Thank you.

(INDEPENDENT EXPERT PANEL RETIRES)

--- Upon adjourning at 4:08 p.m.

Certified Correct

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Cheryl Lavigne, Ms.