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Judy Bradley - Member
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No Undertakings given

Thursday, November 28, 2013

Upon commencing at 9:30 a.m.

THE CHAIRMAN: Good morning. We'll reconvene. A very empty room, I'm not sure that everybody is tied up in traffic, but Ms. Whelan Enns is, which is no surprise given the conditions this morning. Even though it stopped snowing, it took me just as long to get in from Charleswood this morning as was yesterday, which is quite a bit longer than normal. And Ms. Whelan Enns comes from out of town.

However, her witnesses are here. They are prepared to make their presentation. So we will proceed. I don't know, and her assistants don't know if she intended to use any questioning as part of the direct evidence. If she did, we will give her that opportunity, because I presume, assume that she will get here before the completion of these witnesses. We will give her that opportunity at that time if she had intended that.

I will ask the witnesses to introduce themselves, and then just state your names at this point, and the Commission secretary will swear you in.

MR. SALAZAR: My names is James Salazar, J-A-M-E-S, S-A-L-A-Z-A-R.

MR. BOWICK: I'm Matt Bowick. M-A-T-T, B-O-W-I-C-K.

James Salazar: Sworn.

Matt Bowick: Sworn.

THE CHAIRMAN: Now, Ms. Whelan Enns has provided us with brief resumés for both of you. Could you each very briefly give us an overview of your credentials and your areas of expertise?

MR. SALAZAR: Yes, we can do that.

My name is James Salazar, I am a partner in Coldstream Consulting. Coldstream Consulting has been around since about -- we founded it in 2011. Myself and Matt Bowick have both been doing LCA for a bit longer than that.

My background is as an industrial engineer. So, as a result of that, I am very much interested in manufacturing and the production of products. In fact, that's my specialty is kind of product LCA, lifecycle assessment, also LCA, and some of the methodology issues. I've done a number of LCAs on various building products. It's been my specialty. Senior research associate with

the Athena Institute based out of Ottawa.

Briefly on Athena, Matt also works with Athena as well. Athena Institute has been around since the late '90s, well, mid '90s, about as long as LCA has been going on in Canada. Really kind of pioneers in the field.

CV elements, published several journal articles, peer reviewed, written a few, a book chapter this year. Most of my work is contract based for clients, so very much an industrial focus.

MR. BOWICK: So my background is in structural engineering, I was a structural engineer for five years. I worked primarily on low rise and residential buildings. Always wondering about the environmental implications of my designs got me into lifecycle assessment, because it seemed like the most objective way of analysing the impacts of construction.

As James mentioned, I got connected with the Athena Institute as well. And so my focus, whereas James's focus is perhaps at the product level and looking at manufacturing and producing data, my focus would be more on how to use the data in real world situations like a

building, so adding products together, figuring out perhaps the lowest impact design of the building and strategy. So working through the design process.

So I'm very interested in what parameters kind of influence the impacts of buildings. And I'm also very interested in standardization of assessments, and in terms of that, you know, issues related to LEED and how LEED -- I'm sure you are aware of what LEED is, but how LCA can be incorporated into LEED.

THE CHAIRMAN: Thank you. You may proceed with your presentation.

MR. SALAZAR: Just as a preface to our talk today, we were originally contracted by Manitoba Wildlands to actually do a lifecycle assessment of the Keeyask Generating Station. To that end we completed information requests, data collection, templates, very similar to how we work with most of our clients. We submitted those through the information requests.

At that point we were provided with a previously completed LCA of the project. And at that point we decided that it would be more informative, I think to the Commission, to

actually take a step back as opposed to trying to reverse engineer some of the inputs and their modeling, and/or do a critical review, to actually present a protocol for how we think that LCA can best be used to inform the Environmental Impact Statement, what are the best practices in our industry, based on our experience, for completing an LCA.

So we really appreciate the Commission for letting us come in here and letting us present our idea on what we think a suitable protocol would be for doing LCA for these sorts of things.

MR. SHAW: If I can just interject?

MR. SALAZAR: Yes.

MR. SHAW: You say that you have a previously unpublished LCA?

MR. SALAZAR: Well, we don't.

MR. SHAW: Provided to Manitoba Hydro?

MR. SALAZAR: No, that was referring to the lifecycle assessment that they provided to us when we submitted our information request. We are not aware of that LCA that had been completed on the Keeyask project.

MR. SHAW: So you have never seen it?

MR. SALAZAR: It was previously

unpublished prior to our information request. It was presented to us in response to our information request. So we made information requests for data and they presented us an already completed LCA.

MR. SHAW: So you have a copy of that in your possession?

MR. SALAZAR: Yes.

THE CHAIRMAN: Ms. Mayor?

MS. MAYOR: Perhaps I can just clarify. So the LCA that is being referenced is the one done by the Pembina Institute. When the EIS was filed in 2012, in July of 2012, attached to the EIS, or the response, was an appendix which listed out all of the technical memos, one of which was the Pembina Institute Report. It wasn't filed with the EIS, but it was indicated that it was available upon request in July of 2002.

THE CHAIRMAN: 2002?

MS. MAYOR: 2012, sorry.

MR. SALAZAR: When I say previously published, it was new to us at that point.

MR. SHAW: Thank you.

MR. SALAZAR: So just a brief outline of the presentation we're going to give today. We're going to start with a brief primer on

lifecycle assessment, because I think it's probably fairly new to a lot of people in the room. And I think it would be pretty helpful to discuss some of the kind of key issues in lifecycle assessment, some of the methodology that goes into lifecycle assessment.

LCA is a fairly flexible tool, so I think it's important to kind of discuss some of those key issues so that the protocol that we describe makes a little more sense.

Then we're going to discuss how we think the LCA can be used in the Environmental Impact Statement, and follow that with some of the standards for best practices for lifecycle assessments, for civil engineering projects in particular, and how those have guided our protocol that we have developed.

And then finally, the actual protocol, which is somewhat procedural. We're going to hit some of the high points.

Our document that we produced that accompanies this is somewhat prescriptive, very technical, it's really designed for the LCA practitioner, the protocol part of it, the second part. But the first part I think is more general,

and I think we'll all get something out of the first part of the presentation anyway.

So very briefly, what is lifecycle assessment? Well, as the name implies, lifecycle assessment is really a suite of modeling techniques to address the lifecycle impacts of a product. When we say the lifecycle, we mean from cradle to grave, so from the extraction of raw materials from the earth, through the manufacturing processes, all the transportation, delivery, in the case of buildings or civil engineering project, the construction and the aggregation of all of those different materials, and their service life, and their eventual end of life processes, whether that be demolition, then disposal in a landfill, recycling, et cetera.

And we say product, product is a very generic term and product can be anything from a piece of paper or a stick of lumber to something as complex as a large scale hydroelectric project.

So the first question is, why would one go through this process of doing lifecycle assessment? There's a few reasons. First and foremost, just to gain a better understanding of where the environmental impacts are occurring in

the lifecycle. This is useful, you know, we often think about mitigation strategies as being costly and an additional burden to a project. But in many cases we can identify win-win situations where we are able to identify energy savings, for instance, that lowers the environmental impacts of a project that also saves money.

Lifecycle assessment is also, it really benefits by the amount of data and the amount of analysis that it has to undergo. It's really an improvement from anecdotal kind of claims, recycle content, locally sourced, because it is transparent and it is quantitative. You are able to weigh, you know, different environmental attributes in a unified framework. And to that end, there are a number of standards that we'll get into in a little bit that really define the practice.

In addition to, you know, some of these internal goals of, you know, improving a project, stewardship, it's also increasingly being used in certification standards. I know Matt addressed the U.S. Green Building Council's LEED standard. The new version of LEED, they have actually gone through a significant revision on

some of their methodologies to incorporate lifecycle assessment, based on some of the criticism they were getting, by being able to demonstrate that buildings that were LEED certified weren't necessarily more or less green from a non-certified building. So from our perspective, that's really an improvement to that standard to address lifecycle impacts of products and materials.

So I mentioned briefly that there are some standards to lifecycle assessment. The two universal standards to LCA were developed by the international organization for standardization, commonly known as ISO. The two primary standards are ISO 14040. That defines the principles and framework for conducting an LCA. And ISO 14044, which is an accompanying standard to the framework that details the requirements for conducting an ISO 14000 series compliant LCA.

So the ISO 14040 standard, 14040, defines lifecycle assessment as involving, as including four basic parts. And these are really the basis of the protocol that we have prescribed in our document. The first and foremost is the goal and scope definition. This is where the

study is really defined at this point. It's identified what the goals for conducting the study are, how it's going to be, what data is going to be used, how it's going to be modeled, what's in and out of the system boundaries.

And once that's completed, lifecycle inventory is the next step, in which data is gathered for the amounts of different materials, energy used, transportation distances, where things are coming from, where materials are coming from, how they are used, what kind of waste is produced, what emissions are produced by different processes.

And based on that lifecycle -- and don't worry, we're going to get into each of these in a bit more detail in a second.

Based on the lifecycle inventory, which is really just an accounting of the material and energy flows, the next step is lifecycle impact assessment. At this point we actually, what we call characterize the inventory, to calculate the environmental impacts that are associated with each of the different flows that are caused by the system.

And perhaps the most important element

of a lifecycle assessment is the interruption that goes on throughout. ISO made a point of identifying that as a key, you know, as a stand-alone phase in lifecycle assessment. And you'll notice the arrows are bidirectional and they point to all phases, and this indicates that -- LCA should be an iterative process. So if you are getting into the lifecycle inventory and data is not available, or is incomplete, perhaps you need to revisit the goal and scope definition. Similarly, with the impact assessment, if you recognize that there's a portion of the lifecycle that has quite a bit of impacts, a surprising amount of impacts relative to other components, then perhaps you want to go back to the lifecycle inventory phase and gather more complete or more precise data.

So I always like to describe lifecycle. The goal and scope portion of one of the great philosophers of the 20th Century, Yogi Berra, he said it best, that if you don't know where you're going, you might end up some place else. This is key to the goal and scope definition, because a lot of times people take it for granted when you go into a study that

everybody is on the same page with what the goals are, and what the scope and what it is that we're looking at. But a lot of times -- it's very hard once you get into the data collection to go back and redefine how you're going to conduct the study.

So the goal and scope definition specified in ISO is a separate, distinct step that really deserves significant focus. And really the document we have presented, it can be considered as a goal and scope document, really for conducting a lifecycle assessment of a hydroelectric project.

So ISO requires -- when I say ISO, I mean ISO 14040 and 14044, defines that there's four aspects of the goal that -- the difference is somewhat subtle, but they need to be defined in the lifecycle assessment with some certainty.

The first is the reasons for conducting the study, why has the study been commissioned? What is the information that you are trying to get out of the study? And then how that data and how the information is going to be applied in decision-making. What are the intended audiences? Is it a group of other LCA

practitioners? Is it the general public? Is it engineers? Each of these audiences requires different formats to communicate the information from an LCA.

And then finally, whether or not the LCA is intended to conclude in a comparative assertion that is going to be disclosed to the public? ISO is very, very strict on the requirements for conducting comparative assertion. And this goes back to some of the history of LCA where it's been misused to really kind of pick and choose different elements in competing products to gain a market advantage, so purposely leaving out portions of the lifecycle. So ISO is very clear that in cases of comparative assertion, that a peer review panel be convened based on -- that includes interested parties to the results, and that they sign off essentially that they reviewed the study.

Based on the goals of the study, at this point you can -- in the goal and scope definition, one would identify the standards that are appicable, what are the requirements for the different data elements? What impacts should be calculated, what is -- particularly with regard to

the stakeholders? What limitations are there on the data and what uncertainty is inherent in the data quality, and whether or not there is a critical review warranted if there is a comparative assertion.

So once the goal and scope has been formally defined, then we begin the data collection itself. Lifecycle inventory is almost certainly the most time and resource intensive part of conducting an LCA. This is where typically we deal with engineers, accountants that have the data that we need to complete our models. This is inputs and materials, emissions, purchasing records on electricity, natural gas, energy use. And the goal of all this is to relate essentially the four ground processes to all the way back to nature and all the way to nature. So when I say that, I mean, for instance, in the production of a product, we model the input of electricity, but we know that electricity is generated by burning fuels, by nuclear power plants, by hydroelectric stations. And we want to track all of those inputs, for instance -- say for instance coal electricity plants, we want to trace all of those materials back to nature. So the

coal, back to the point, all of the processes back to the point where the coal or the natural gas is coming out of the ground.

Similarly, with the outputs of a process, we like to model, or ISO requires that all processing of waste, all co-products, if there is a product that's not used directly, is traced all the way back to where it's eventual fate in nature, so it ends up in a landfill and what are the emissions to the soil and the water from the landfill?

So don't try and read this. This is just to show how complex the process flows are for something as simple as a kilogram of Portland cement. Portland cement, you know -- so as you can imagine, you know, building up from all these different elements into the lifecycle assessment of a building or a major civil engineering project builds on all of this data in the background. As a result, the only way to really feasibly complete a lifecycle assessment is to use lifecycle assessment specific software. And this is actually a screen shot from one software that we use called SimaPro. SimaPro is really nice, it's database driven and it retains all of this data

structure running in the background, and you can manipulate the different data sets at a high level to aggregate them into a lifecycle inventory model.

So based on the lifecycle inventory and all of the different flows that are calculated within an LCA software like SimaPro, the next step is to actually characterize these and calculate environmental impacts. So a very common example is the calculation of the global warming potential of a set of emissions.

So, for instance, this is just -- this isn't real data, this is just an example that a Portland cement manufacturer may produce a hundred kilograms of carbon dioxide, one kilogram of methane, and one-tenth of a kilogram of dinitrogen monoxide. But we know that each of these cause global warming differently and they have different potencies as a greenhouse gas. So carbon dioxide, in relating all of these back to a common unit of CO2 equivalence, so carbon dioxide has a factor of one, methane has a factor of 25, dinitrogen monoxide has a characterization factor of 298.

So as we can see, even though the emissions of the methane and the dinitrogen

monoxide are quite a bit lower in terms of mass than the carbon monoxide, the actual global warming impact, they are significant in terms of the overall global warming impact.

So beyond global warming, global warming is obviously on everybody's mind. It's a very -- global warming is obviously a widely identified environmental impact, but there are others that are calculated in lifecycle assessment. Smog, the emission of nitrous oxides; VOCs, volatile organic compounds; eutrophication, which is associated with phosphate and nitrate emissions, ammonia emissions; acidification, sulpher oxides, essentially changing the pH of the natural environment; the emission of CFCs and HCFCs -- I'm not going to try and go for that one -- less of a problem. We find these are generally in LCAs now essentially in trace amounts due to some of the CFC bans have actually been quite effective. And also the consumption of scarce resources like fossil fuels, so natural gas, coal, crude oil.

So, again, this is just, based on the impacts, we do calculate a number of different impacts in a lifecycle assessment. This shows

results from a building study that we have completed. And this is a very common way to interpret multiple impacts in a single chart, to consider the relative impacts of the various components of a building. So each of the columns there is a different environmental impact, and each of the shaded colours represents a different element in the building. So as you can see, it's not, they are not all the same, different materials and different components of something that is complex like a building cause impacts in different ratios.

So at this point, you are probably wondering how we can use all this in an Environmental Impact Statement? Well, we did review some of the guidelines requirements for conducting the EIS. The CEAA Environmental Impact Statement Guidelines, the scoping document for the Keeyask generation project. And we have pulled a few quotes from there. So that we wouldn't misinterpret them, we'd like to represent them verbatim, so that essentially we can present how we interpreted it and why we interpreted it how we did.

The Keeyask scoping document does

include the following passage, that the EIS will include:

> "...a description of atmospheric emissions, liquid emissions and solid wastes, and plans to manage them."

And also a description of fuel and hazardous products. The description is a bit vague. To me, the primary descriptor of an emission would be the quantity, so we interpret that to mean an actual inventory or quantification of the different emissions. Others can presumably arrive at different conclusions to that.

The CEAA EIS guidelines are a little bit more explicit. The EIS must include:

> "...an inventory of all potential sources of air contaminants and emissions from the proposed project."

They list them, the criteria, air contaminants, air pollutants that are on the toxic substances in schedule one. Schedule one toxic substances list is fairly broad, there's over a hundred substances on it, I believe, and include all sorts of different things. Toxic is a fairly broad definition.

Moving beyond that, the CEAA

guidelines do say that the proponent shall identify the likely adverse environmental effects during construction, operation, maintenance, decommissioning and reclamation using appropriate criteria.

So this to me is, it's a really strong case for lifecycle assessment to actually, it includes the various life stages and it defines that the EIS should be calculating environmental impacts using appropriate criteria. It doesn't say what appropriate is, but presumably that is specific to whatever type of -- I mean, this is just one part of an EIS, so whatever part of the EIS that it is trying to inform.

The CEAA guidelines also, it's a little more vague in this regard, but it does mention that the EIS should discuss the mechanisms it would use to require the contractors and subcontractors to comply with -- this is in the mitigation section -- the mitigation commitments and the policies auditing and enforcement programs.

We're interpreting this to mean that, generally speaking, that the EIS should go beyond defining what the impacts are of the proposed

project, to actually have some strategies to try and mitigate some of those impacts. Lifecycle assessment is a perfect tool for that.

Also there's a section on the analysis of the alternatives. The EIS must include an analysis of the alternatives to the project which describe functionally different ways to meet the project need and to achieve the project purpose where analyzed from the perspective of the proponent. The analysis should also identify the requirements of the proposed purchaser of the power to be produced by the project.

We interpret that to mean, essentially, what are the impacts of producing electricity from different means at the point of the consumer? So if the consumer essentially isn't purchasing project that's generated, you know, at the Keeyask Generation Station, then what other types of sources of electricity are they using?

So, to conclude, based on these sequences of passages, we concluded -- and this is our conclusions -- that there are two kinds of key deliverables that have LCA components to them. The first is a fairly detailed lifecycle

assessment that accounts for the air, land and water emissions, and then calculates those impacts, calculates appropriate impacts. And presumably it's left up to the practitioner to decide what those are.

The second part about considering alternative technologies we feel best be met with a literature review. That's simply based on the very, very strict requirements that ISO 14044 puts on doing a comparative LCA, peer review panel with interested parties that will presumably ensure that the goal and scope, the scope essentially of all of the different impact -- all of the different generation technologies were modeled comparably.

So what that means is, essentially, to do a comparative LCA of coal, natural gas, et cetera, that a lifecycle assessment would have to be undertaken of those products with equal scrutiny, with equal data quality requirements, cut-off boundaries, as the LCA of the hydro station itself.

We don't really think that's reasonable. The EIS guidelines do note in there that the comparison of alternative technology

should reflect the fact that it's at a conceptual level. So we don't think that a comparative LCA is -- to be very resource intensive to conduct a study like that.

So based on that, there is quite a bit of room for interpretation, particularly appropriate impacts, the description of appropriate impacts.

So based on our experience, we have identified a series of different standards that we think can help define this a little bit more, and we're going to present them. I am going to get into each of these in more detail, so don't try and spend too much time. This essentially -- there are a number of different standards that can inform this practice. First and foremost -- yes?

MS. WHALEN ENNS: Excuse me. Gail Whelan Enns here. Just a quick technical question. Did the staff give you the laser, the pointer?

MR. SALAZAR: I don't think --

MS. WHELAN ENNS: Please, in case you need it, Mr. Salazar.

MR. SALAZAR: Thank you.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: So we'll get into each of these in a little bit more detail and describe what they are, what they cover.

First and foremost, just the very basic lifecycle assessment standards that we discussed previously, the 14040 series that includes 14040, which just describes the general principles for doing a lifecycle assessment, and then 14044, which describes in more detail the requirement for doing an LCA that's compliant with that framework. And again, this is the framework that's essentially described and outlined in 14040.

ISO recognizes that in each industrial sector that there is the universal rules, the universal standards should be spelled out in a bit more detail. So to do that, they actually have technical committees and sub committees within the technical committees. And this one, SC17 of technical committee 59, is tasked with completing standards for sustainability in buildings and civil engineering works.

The primary basis of this working group thus far has been building standards, the Green Building movement in North America and

Europe has really driven a lot of this. And I can -- in all honesty, in lifecycle assessment, the building industry has really driven a lot of the standardization, a lot of the practice, the generation of databases, et cetera. LEED is a really prominent standard that's incorporating it.

So this is the suite of standards that they have completed to date. ISO 15392, which is really just high level sustainability principles that apply to buildings and civil engineering works.

21929-2, that just came out this summer, and that is a -- it defines the sustainability goals and some of the indicators for sustainability for conducting -- this is actually civil engineering specific, 21929-2 is essentially a partner document to 21929-1 which is on buildings, but this is actually more specific to civil engineering projects.

ISO 21929-2 draws on 21930, that essentially describes the standard for conducting LCA at a product level. 21930, it's mentioned in 21929-2 that this is actually going to be a common standard that applies both to buildings and civil engineering works. So between 21929-2 and 21930,

we can get a pretty good idea of what ISO's intentions are for conducting an LCA of a civil engineering project.

The last one on there is 21931-1, and this is actually the framework for conducting an LCA of a building. Presumably, there is going to be a new standard coming out shortly called 21931-2 that's more specific to civil engineering work. But, again, we can get a pretty good idea of where 21931-2 is going to go by looking at the other two standards, the whole suite of standards in its entirety.

And the big takeaway from that is, what are the impact categories that are relevant to an LCA of a civil engineering project? The columns on the left and the right come directly from 21929-2, and they describe, the column on the left is the lifecycle inventory elements, what should be accounted for in defining the lifecycle inventory of civil engineering project. On the far right are the higher level objectives, sustainability objectives for LCA of civil engineering works. And the middle column is how those link together. And those are based on the impact categories that are defined in 21930 for

LCA of building products.

So as you can see, the impact categories that are relevant are the completion of resources, mineral and fossil fuels, climate change, ozone depletion, smog, acidification and eutrophication, essentially the impact categories we showed you a few minutes ago.

Now, ISO is a consensus. It's international standardization. I think there's 20 to 30 countries that participate in ISO. The European Centre for Standardization, the French acronym is CEN, also closely mirrors what's happening in ISO. And to that end, they have produced a suite of standards as well that I think are also applicable. A lot of it is the same people that sit on the CEN committees and the ISO committees, so there is quite a bit of overlap between the two. I won't get into these in too much detail because these aren't really -- these are really, I guess, supplementary standards to the ISO standard that really, they kind of define best practice. This is beyond just having an ISO 21900 series compliant study. Yes?

MS. WHELAN ENNS: Excuse me, Mr. Salazar.

Would you give us just a very quick point in time in terms of these European standards that we're looking at on slide 35?

MR. SALAZAR: Yes. They are a bit more recent than the ISO standards, I think we have the dates here but they are for the most part --

MR. BOWICK: 15804 is 2012, and 15978 is 2011.

MS. WHELAN ENNS: And the CEN/TC 350, which also uses a sustainability of construction works, is it recent also?

MR. SALAZAR: CEN/TC 350 is their working group, so these three are the standards that have been produced within that working group.

MS. WHELAN ENNS: Thank you.

MR. BOWICK: And this is kind of the cutting edge of what's going on in the building world. This is the most advanced set of standards in terms of guidelines out. There is nothing comparable in North America, but people are recognizing these standards as, oh, my Lord, finally we have the standard that we have needed for years, you know, somebody like myself that does building LCA.

So, you know, people like myself are big proponents of it, using it in North America until we have something similar here.

MS. WHELAN ENNS: So, Mr. Bowick, are you basically telling us that Europe is ahead but it's coming here?

MR. BOWICK: In LCA, yes.

MS. WHELAN ENNS: Yes, absolutely.

Mr. Salazar, you mentioned that there's between 20 and 30 countries involved in arriving at the ISO standards that you are informing us about this morning.

Quick question then, of the 20 to 30 countries that work steadily on these ISO standards that have to do with LCA, what proportion of them are then also working on these European standards?

MR. SALAZAR: It would be hard to give you a ratio, but it's significant. There is significant communication between the two. Within the LCA community, it's widely understood that as ISO begins to update the 21900 series, they will be leaning very heavily on these CEN standards.

MS. WHELAN ENNS: Thank you.

MR. BOWICK: Kind of a back and forth

that's happening.

MR. SALAZAR: Right.

MS. WHALEN ENNS: Thank you.

This may then be one of those situations where North America, both public sector and industry, is learning from what's going on and being lead by Europe?

MR. SALAZAR: Um-hum.

MR. BOWICK: Absolutely, yeah.

MS. WHELAN ENNS: All right. Head nods, thank you.

MR. SALAZAR: And the key takeaway to our protocol is, in the CEN standards they have a very nice modular structure for organizing lifecycle inventory data collection and modeling of a structure, and this is really useful, because buildings and civil engineering projects are extremely complex in terms of the number of different materials, the processes over the lifecycle. So this is really more, this is actually helpful to have a modular structure like this, the A1 through C4 kind of framework to organize LCA results.

MS. WHELAN ENNS: Mr. Salazar, that's a reference to slide 36?

MR. SALAZAR: This is in slide 36, yes, the modular structure in slide 36 is what I'm referring to.

And specific to civil engineering projects, somewhat differently than a building, there's a potential for significant land use change and some of the greenhouse gas emissions that go with that. We have a couple of standards that can help inform that. That's less in our area of expertise, but these standards are available and we suggest that they be considered.

The first is international panel on climate change, or intergovernmental panel on climate change, IPCC, and their recommendations for calculating emissions from reservoirs.

Also the UNESCO and the International Hydropower Association have produced a very comprehensive format for estimating the emissions from reservoirs. It involves monitoring before and after a project has been completed to estimate greenhouse gas emissions from reservoirs.

MS. WHELAN ENNS: Mr. Salazar, were you showing us then two sets of standards that are relevant to the Keeyask Generation Station project, not to limit them to this project, but do

you see them as relevant to the Keeyask generation project?

MR. SALAZAR: Yes, the IPCC standard is a means of estimating greenhouse gas emissions from a reservoir. The UNESCO and the IHA standard, it's really measurement based, so it's very hard to, you know, it requires measuring after a project has been completed. So it's a standard that, if applied on this project, it could potentially inform future projects, but it doesn't actually provide a mechanism for predicting greenhouse gases of a proposed reservoir. That's more covered in the estimations in the IPCC standard.

And finally, and somewhat beyond the scope of this protocol, but I think it's interesting to recognize, and perhaps provides a business case for conducting LCA and investing the significant resources in it, is the production of an environmental product declaration. Environmental product declarations are -- they have been used in Europe for some time, they are increasingly being used in North America as a standardized format for communicating LCA results on products. The basis behind that is product

category rules. Product category rules essentially define the goal and scope for different product types, so that if a product declaration has been completed based on a PCR, a product category rule, that you can be assured that you are comparing apples to apples. Essentially, it's a unifying scoping document for completing LCA of different products within a category.

There is European product category rules for electricity. They could be adapted to North American market. It's pretty basic process, a lot of people are doing that right now with building products, to essentially change the references from European data sets and impact assessment methods to North American data sources and impact assessment methods. I think it's really a great opportunity for Manitoba Hydro, personally, to be able to produce environmental product declarations.

MR. BOWICK: James, if I can just quickly add?

We came across about five environmental product declarations for hydro projects in Europe, just for some context. So

this is, all of this stuff is cutting edge, but it's definitely taking hold in Europe as we speak.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: So, we're finally getting to the lifecycle assessment protocol that we had proposed based on all of this background information. Kind of took a long way to get here, but I think it's important to identify some of these key elements before we get into the protocol itself, so it makes a bit more sense.

And again, the protocol in the document really is -- it is designed for an LCA practitioner to conduct lifecycle assessment, so it is somewhat prescriptive, somewhat detail oriented. But there are a few kind of key takeaways from the protocol that we have put together.

MS. WHALEN ENNS: Mr. Salazar, I am just going to stop you for a second, if I may?

MR. SALAZAR: Sure.

MS. WHELAN ENNS: You were referring then to your report, the submission to the CEC, as being aimed at practitioners and for potential future decisions in terms of use of LCA. Am I getting you correctly?

MR. SALAZAR: The document that we put together, the whole document is called a protocol. Really, the second part of that document is a protocol and geared towards LCA practitioners. The first half of that provides some background information, I think it's more geared towards a general audience.

But, yes, the LCA protocol is geared towards people conducting lifecycle assessments of hydroelectric projects.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: So the protocol was designed again based on the four ISO 14040 elements. So we defined the goal and scope of a study that should be conducted, based on our interpretation of the EIS requirements and LCA in general, that the study should include air, water and land emissions, that it should calculate appropriate impacts, and that it should facilitate impact mitigation by informing procurement strategies, relationships with contractors, et cetera.

The LCA should also comply with, at the very least, the basic ISO standards, 14040 and 14044, as well as the more specific building and

civil engineering standards, 21929-2 and 21930.

The scope of the LCA, to inform the Environmental Impact Statement, it really should align with the project description. Hydroelectric project is highly complex with a number of different elements, and the only way to ensure that the LCA that has been conducted is complete is to actually -- it's very helpful to align it with the listing of elements that are in the project itself and to use a common list of project elements.

We also think it would be really helpful to use the EN 15978 modularity, because it just helps organize the study. I think a big challenge of doing a study like this is going to be organization and data management. It's always the case with lifecycle assessments of products, but for a building, and particularly in this case, a project of this scale can get very unwieldy, and I think there would be quite a bit of benefit in using a structure like this.

MS. WHELAN ENNS: Mr. Salazar, we are on slide 41, would you let us know then whether I'm understanding you correctly? And I have been working on learning this. Are the columns in your

chart the modularity, the modules, or is each item within this chart a module?

MR. SALAZAR: When I'm saying modularity, I'm referring to each individual box. Each column represents a life stage, and this lines up with the, you know, the basic stages in the lifecycle of a project like this. But each individual box represents a different alphanumeric code that can be used to help organize the data.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: So once the goal and scope has been formally defined, the next step is data collection. This is actually a cut-out of a lifecycle inventory data spreadsheet that we provided in our initial information request.

You can see the first column there, it's indexed to the actual project description itself. So 2.3.1 refers to the section in the EIS project description and the different elements that are contained that way. Again, that's really key for data management because, as you can see in each of these different elements, there's quite a different number of components and there's quite a different pieces of data that are needed to effectively model each component. So a

spreadsheet base like this, again, it's the most time and resource part of doing an LCA, so organization is just critical here.

MS. WHELAN ENNS: Mr. Salazar, could we take a couple of examples then from your chart? I'm looking at a column that has the project description sections, and then the scope, which is, if I'm understanding correctly, the examples of elements in the project where the data is needed. Are each of the items then in scope identified, listed here in your chart specific to, for instance, a generation station project? Turbines, generators?

MR. SALAZAR: Yes, these are elements of the higher level project description elements in the first column, correct.

MS. WHELAN ENNS: And this is a spreadsheet or worksheet that you identified was needed, and provided when a request for information and data were being made?

MR. SALAZAR: Correct.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: And we realized that the Environmental Impact Statement is typically conducted, you know, prior to the completion of a

project. So it is okay, you know, if all of these things, if contracts haven't been granted out, if not all of this data is available at this time, that's fine.

A lifecycle assessment model, one of the key things of organizing it this way is that it allows it to be updated as the project unfolds, as contracts come in, as material take-offs become finalized, and presumably after construction has begun, it can even involve some measurement and refinement that's done on site to the design itself.

MS. WHELAN ENNS: Mr. Salazar, slide 43, a couple of questions then. The estimation information here in front of us in terms of the early conceptual design stage, and then the lifecycle inventory information in front of us, how do they fit with the goals, the stages of an LCA, starting with the goals in scoping?

MR. BOWICK: Well, this would be the lifecycle inventory stage of the project.

MS. WHELAN ENNS: Thank you.

MR. BOWICK: But if you look at the framework diagram, you see the arrow, the bidirectional arrows. So this is -- what we're

kind of implying here is the iterative process where, ideally, you know, you might get an estimation at first, but as the project progresses, by the end of it you have a pretty good number for material quantity or an energy use quantity.

MS. WHALEN ENNS: Then it's a living and ongoing process, LCA for a project such as the Keeyask Generation Station?

MR. BOWICK: Ideally.

MR. SALAZAR: Ideally, yes.

MR. BOWICK: But we live in a world of resource constraints in terms of time and money, and that certainly plays into it.

MR. SALAZAR: Our goal for lifecycle assessment as a practice is to inform decisions, is to improve sustainability, not simply to measure sustainability. So from our perspective, ideally, a lifecycle assessment model is continually refined and continually informs decisions. And, you know, it is actually integrated into the decision process. It's not just a stand-alone report that there's a total number and then it goes and sits on a shelf and nobody ever looks at it again. You know, I think

that's really just scratching the surface of what LCA is capable of.

MS. WHALEN ENNS: And would you then, in for instance a life span of a project such as this being over a hundred years, would you anticipate, or up to a hundred years rather, would you anticipate then, for instance, repairs, changes in materials used, changes in the engineering ability and/or knowledge base in terms of operation --

MR. SALAZAR: Absolutely.

MS. WHELAN ENNS: -- that would apply to the ongoing LCA?

MR. BOWICK: Yeah. So when you're doing your inventory, you need something called scenario information, which are assumptions. If you're modeling something that's a hundred years, you have to make assumptions. And the best assumptions are generally based on current technology. So, you know, speculating on a future technology, you know, change, repair and whatnot, can be a little misleading in results. And it's typically best to, in terms of your scenarios, just assume kind of a status quo repair schedule based on, you know, current practice. But

certainly, you know, modeling a hundred year lifecycle is -- there's quite a few assumptions that have to be made.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: The key takeaway is that, again, the lifecycle inventory, it may be pretty crude, you know, early stages of development, but it should be structured so that, you know, each element is discrete and can be refined with better data, more improved take-offs as these decisions are made, as the designs become finalized.

And based on the, you know, after the lifecycle inventory has been completed, as it continues to be updated, the next step is then to actually calculate the impacts themselves. We recommend a full range of lifecycle impacts for a few reasons.

First and foremost, there is quite a wide range of perspectives of various stakeholders of a large project like this. So picking and choosing a particular impact isn't ideal in that situation because, by exclusion, you are introducing a value judgment.

Second, calculating impacts, once you

have committed to doing a lifecycle inventory, again, that's the time and resource intensive part of a project like this. Actually calculating the impacts themselves is largely automated in lifecycle assessment software. It takes me no more time to calculate seven, eight, 10, even 20, 30 impacts, than it does just to calculate one, as long as the, you know, we use published impact assessment methods. So the characterization factors are there and ready to use.

So based on that we actually recommend calculating a whole wide range of impacts. And we recommend using the most comprehensive lists of different environmental indicators as specified in the European standards, EN 15978. So, again, that includes global warming, ozone depletion, acidification, potentially eutrophication, but also use of different scarce resources like energy, minerals, different wastes that are produced. Developing, you know, the first step in conducting a lifecycle impact assessment would be essentially to set up this calculation in LCA software, and that's not a very -- a lot of this is already ready to go.

So based on, you know, based on the

different impact assessment that is conducted, I think first and foremost, interpreting the results is determining which parts of the lifecycle are actually causing the impacts and the greatest percentages. So to do that, we conduct contribution analysis, simply to estimate, you know, where are the environmental hot spots over the lifecycle and, you know, if one were to pursue mitigation strategies, where would those resources be best spent?

We also recommend benchmarking based on the initial LCA to decide, or to understand, you know, once these become more finalized, whether the impacts that were calculated are underestimating, overestimating, essentially using this as a tool to manage the procurement process, to conduct interviews with contractors to actually influence the result lower, to drive down the impacts.

And the last note on there has to do with carbon footprinting. Because we do recognize that global warming is a key impact for a lot of stakeholder groups, it causes a wide range of different impacts, that the most advanced modeling should be conducted possible on the global warming

impact. The way greenhouse gases work is essentially a greenhouse gas goes up into the atmosphere. It resides there for a period of time and then it decays. And as we noted, you know, different greenhouse gases have different intensities relative to carbon dioxide. Well, typically, those are equated to carbon dioxide strictly based on a one hundred year perspective. But we know that greenhouse gases like methane, for instance, decay much more rapidly than carbon dioxide in the atmosphere. So, for instance, the global warming potential of methane, which is 25, is actually quite a bit lower than what it is in the first 20 years. The first 20 years, I believe, it's in the '70s or '80s even now with the most current provisions of the IPCC assessment report.

So I think that to understand, because it is widely recognized that global warming, the key to managing against global warming is the recognition of a tipping point to manage things, that there is a priority to mitigate impacts in the short-term. I think it's important to understand that a project that has a lifecycle that's this long, to understand where the warming

actually occurs in the lifecycle, whether it's front loaded, whether the emissions are very intense over the first 10, 15, 20 years, and then they taper off drastically, or whether the impacts are more back-loaded. So I think that's just an additional piece of information that can be used to interpret that particular impact.

And with that, I'd like to just conclude, and I'm sure there will be plenty of questions.

MS. WHELAN ENNS: Good morning, Mr. Chair.

Manitoba Wildlands has some questions for these two witnesses. They are what's called high level, because I'm not up to the detail in the software and the analysis.

Mr. Salazar, Mr. Bowick, I'm going to use slide numbers, and correct me if I use any terminology where I am not clear or I've got the acronym wrong.

So you told us this morning, Mr. Salazar, that ISO does a fair bit of interpretation. You were talking about the interpretation that goes on in arriving at a standard, and then specifically for these

standards that are being applied to LCA assessment and analysis.

Would you please describe -- and it's up to the two of you to decide here in terms of answering who is best, and what combination, so please help us there. Would you describe the ISO process to arrive at one of these standards a little bit more? And what I think is of interest is the role industry and developers play, the role that experts, consultants, academics play, and then whether or not there is government involvement? Would you describe the process a bit more, please?

MR. SALAZAR: I do believe that it is -- honestly, I'm not all that familiar with the process itself. I have never been on an ISO committee. But that said, it is a consensus standard based on, it does involve, you know, sector specific experts that come together and reach consensus. That's essentially -- it moves so slow, and potentially doesn't fully define a practice, because it does have the requirement of reaching a consensus in the draft process. But I don't believe that governments are involved -- perhaps governments and representatives and things

like that. But for the most part it's sector specific experts, eggheads like us that kind of get together and hash out the methodological issues.

MS. WHELAN ENNS: Thank you.

When you were explaining slide seven to us, you mentioned that all of the steps in both arriving at a standard and applying a standard and doing all of the technical stages in an LCA are and need to be -- correct me if I'm wrong -- iterative. Would you tell us what that means?

MR. SALAZAR: Just simply that at the lifecycle and, you know, for instance, if your goal is to assess something to a certain level of precision that, you know, if one gets to the lifecycle inventory phase and realizes that level of precision is not there, perhaps the goals need to be readdressed to, you know, simply that the LCA results aren't going to be able to inform a decision the way that it was intended to. Similar with impact assessment, that if it's determined that a particular element of a project is really you know, based on the contribution analysis, is causing a significant portion of the impacts, perhaps more precise data should be gathered.

Perhaps the goal and scope should be revised so that that impact potentially -- for instance, global warming, you know, if one gets to the impact assessment and a particular emission, for instance, methane is really driving the impacts, then perhaps the goal and scope should be revisited to address how that methane is modeled, how it's determined, how it's determined that the impacts are caused through the lifecycle.

MS. WHALEN ENNS: Thank you. Example is a great help.

You also made a comment, and this would be just before slide 10, I think, when you were discussing slide nine, you were talking about peer review. Okay. And that the ISO standards also involve peer review; is that correct? Was I hearing correctly? And you were basically saying that this kind of peer review is absolutely critical to finalizing a standard, using an ISO standard for LCA. Is that --

MR. SALAZAR: Yes, there is a whole procedure they go through where they put a draft out for public comment, and then they take in those -- there's varying stages in the development of an ISO protocol.

MS. WHALEN ENNS: Thank you. On slide 11, which is the lifecycle inventory chart, you were being quite clear in terms of starting with materials in nature and guiding their use and/or return to nature, right through the lifecycle inventory and the stages of an LCA.

Again, either of you or both of you, could you give us a couple of examples then that would be pertinent to the Keeyask Generation Station project in terms of the material from nature going through the lifecycle assessment and the inventory steps?

MR. BOWICK: Well, obviously there's a lot of concrete in a dam, so you need to extract Limestone to produce cement out of the ground. So that's a primary resource. That would be an input from nature. And then in producing the cement, there's calcination, so there's a direct submission of carbon dioxide. So that would be an emission to nature or an output. That's a very specific example.

MS. WHALEN ENNS: How about the steel as a main, assumed main component in the turbines?

MR. BOWICK: So in this case, you are extracting iron ore, you're extracting coal to

produce steel. So those are again primary resources, inputs from nature. Steel is a little more complicated because there's an end of life scenario, it's going to either be reused or recycled. Now, if at the end of life it's simply put into a waste disposal facility, then that is an emission to nature. But typically you are recovering the material, and then rather than going, becoming an output to nature, it enters another product system as a recycled material or reused material. So a little different.

MS. WHALEN ENNS: Thank you.

When we were at slide 12, Mr. Salazar, you were opening up the door on the fact that there are very specific software tools and products used in doing a lifecycle assessment, presumably for wide ranges of materials and in different manufacturing and industrial uses.

Would you tell us a bit more about the software tools?

MR. SALAZAR: Yes, there's two primary tools that we can use, one is called SimaPro, the other is called GaBI. They both do essentially the same thing. They manage lifecycle inventory data. They allow user interface that allows one

to assemble essentially a process that draws on these inputs and automates all of the different background flows. So, for instance, if one kilogram of coal or one kilogram of oil goes into one kilogram of steel, and you're using .1 kilograms of steel, it automates that calculation, it cascades the calculation backwards and forwards through the value chain to calculate the right emissions that are associated with the amount of what's called the reference flow, the use of that material.

MS. WHALEN ENNS: Thank you.

Now, are these products, these two main sets of software that you have mentioned, are they European products? Have they been developed in the States? Have they been developed in Japan? Where are they from?

MR. SALAZAR: They are both European, but there's North American distributors that we --

MS. WHELAN ENNS: Is it fair enough then to say that the fact that these automated systems exist, and that these software products have been developed, is it fair enough to say that that's an indication that there's users, that is correct there's LCA services and inventories being

used a fair bit?

MR. SALAZAR: Certainly. I mean, there's entire databases that are North American that can really only be used in a software like this. The Department of Energy has published the United States lifecycle inventory database, which is, you know, kind of a key, it includes all the primary energy processes, transportation, a lot of the key materials. It has an interface so that practitioners can actually upload data from completed studies into it, into their format so that it can be used in these types of software.

MS. WHALEN ENNS: Thank you.

You have also just mentioned databases. So would you describe, or just let us in on why these databases exist, where they come from in terms of how they are used with the LCA software?

MR. SALAZAR: There's several published databases. The U.S. LCA United States lifecycle inventory is kind of the first and foremost that we use in North America. There's a handful of European databases that we use, but when we use those we typically substitute in, you know, North American electricity grids, primary

energy delivery, you know, the supply chain of different energy, of combustion processes specific to North America. So we actually modify those processes.

But there's a handful of published databases and some are not published, some are, you know, completed, if someone has completed a study in an LCA software, if you have a relationship and nowhere to go to hunt for data, then sometimes you can get pieces of data, databases, data sets that are outside of the databases. But the U.S. lifecyle inventory database is really the primary database that we use in all of our modeling.

MS. WHELAN ENNS: Thank you.

Are certain of these databases that are in use here in North America, do they come out of the work of certain industry sectors or industry associations?

MR. SALAZAR: Yes. I mean, you know, the data itself is, you know, compiled and completed by LCA practitioners. They are working with clients in various industries.

MS. WHALEN ENNS: Thank you.

MR. BOWICK: The data is typically

commissioned, though, by industry associations.

MS. WHELAN ENNS: Thank you.

Going to your slide 20, which is examples then in terms of how -- tell me if I'm on track here -- how their interpretation of aspects of the inventory would be arrived at. These -- glasses off so I can read -- the ones that you selected then in this interpretation, just to basically diagram it and give us examples, include global warming, ozone depletion, acidification, eutrophication, smog, fossil fuel use, and health impacts. Is it fair to say that certain of these would be relevant in an LCA for project like the Keeyask Generation Station?

MR. SALAZAR: Certainly. In ISO 21929-2, that outlines the principles for civil engineering project impact categories, as well as 21930, that actually specifies what the impact categories are, lists I think all of these except the human health criteria pollutants, which does have quite a bit more inherent uncertainty about it. But, you know, the kind of key, the big six there are definitely included within the ISO 21900 series of standards as impacts that are relevant to building and civil engineering works.

MS. WHELAN ENNS: Thank you.

MR. BOWICK: I would like to add, just a little more context, that the first six as well are the impacts considered in LEED, when you're doing whole building LCA. So these are definitely the most common impacts calculated in construction.

MS. WHALEN ENNS: In most LCA for construction?

MR. BOWICK: Yeah. It would be odd to conduct a whole building LCA and not include these impacts.

MS. WHELAN ENNS: Thank you.

When you were helping us with slide 24, Mr. Salazar, you made a comment about the toxic substance schedule in the Canadian Environmental Protection Act. I think I heard you say that there's a hundred substances listed?

MR. SALAZAR: There's more than a hundred, I believe. I don't have the list in front of me, but it's -- you know, you see something like toxic and you think, well, there's a handful of substances, but it's actually a fairly broad list of substances.

MS. WHELAN ENNS: Aside from the

content then in the EIS guidelines on this slide, and more specific to LCA, would it be accurate then to say that going through the toxic schedule like this, or in another jurisdiction, in a similar Act or regulation, going through and identifying when you're setting goals for an LCA, which of those may in fact be relevant for the analysis, for the inventory, or is there another way that you'd get at toxics in doing the LCA?

MR. SALAZAR: Well, when we conduct LCA, there's no reason to exclude an inventory element. You know, the software in the databases that we use have complete known lists of emissions associated with different processes, so, you know, and it's no additional work to retain that data, so essentially when we do LCA, it's a complete list of inventory elements.

MS. WHALEN ENNS: Thank you.

Depending on the nature of the project that lifecycle assessment was being done for, and the contents in, for instance, EIS guidelines and/or the regulatory expectations, is it feasible that you might in fact -- thinking about, for instance, a client dealing with a project where they have asked for your LCA services, is it

feasible that there might, in fact, be a very specific pollutants and toxics requirement? Thinking about a client and a theoretical project?

MR. SALAZAR: Yes, certainly. And because we retain all of the background inventory flows through the analysis, through the databases, you know, all the way to the completion of the model, it's not uncommon for us to list the entire list of emissions. It can become somewhat unwieldy, because in any given process there can be hundreds of different emissions. But, yeah, certainly there's -- we can pull kind of key emissions. A lot of what we like to do in explaining the impact categories is listing the emissions that are relevant to that impact category, so kind of going through, and what are the primary drivers in terms of emissions for a given impact category? That's quite common.

MS. WHELAN ENNS: Thank you.

When we were at slide, or just leaving slide 26, and this reference again to the EIS guidelines, you made the statement that an LCA, this assessment, an LCA inventory and the assessment is potentially a perfect tool for this planning stage, which is the EIS.

I wanted to ask each of you to perhaps expand on that a little bit or give us a couple of examples that causes you to say that?

MR. SALAZAR: Well, lifecycle assessment is really the only way to calculate the impacts of material emissions that occur, you know, in different places, in different times and, you know, throughout the supply chain, you know, for the entire lifecycle. So, in that respect it's really an irreplaceable tool to calculate those kind of impacts.

With regards to informing mitigation strategies and things like that, that's really, you know, that's an end goal of LCA. You know, if an LCA is structured properly, I think that's really a result of a well designed LCA, of an application of an LCA that -- you know, a client may or may not -- they may be interested in, for instance, a LEED certification or something like that, where really the only result is to produce a number to get a certification and that's it. But, you know, that's really just -- it's not fulfilling, you know, the full potential of LCA. LCA has the potential to, you know, for instance, dealing with different contractors that are

supplying the material to -- you know, if an LCA is conducted at the EIS phase, to understand what are the primary drivers of impacts that -- what are the key kind of decisions and kind of attributes of a supplier that we should be looking for? I think that's key.

MS. WHALEN ENNS: Thank you.

Mr. Bowick?

MR. BOWICK: I might just give the example of using interpretation to identify hot spots in the lifecycle. So, say theoretically you found out that maintenance activities produced a lot of emissions, well, then, you know, you can set up plans to mitigate emissions by perhaps procuring different materials, perhaps constructing it up-front differently so that it requires less maintenance. If you don't use lifecycle assessment, and you just say based it on the sheer mass of material use over the lifecycle, it wouldn't tell you -- it wouldn't tell you, it wouldn't give you that indication necessarily.

MS. WHALEN ENNS: Thank you.

MR. BOWICK: Lifecycle assessment gives an indication of how different materials perform, not just, you know, well, we're using

more materials by weight here so this must be the hot spot.

MS. WHELAN ENNS: Thank you.

When you were at slide 28, which is about LCA based deliverables, I wanted to ask you whether in terms of comparative analysis in an LCA and energy sources going in, energy sources potentially being developed, such as by a generation station, whether comparisons could, in fact, also be to -- and we largely think about comparing, and this is true practically of all Manitobans, we largely think about comparing hydroelectricity to the carbon fossil fuels.

Okay. So the question then is whether in an LCA comparison, again energy going in, energy used, energy produced, energy wasted, whether an LCA could, in fact, include a comparison to combinations of other energy sources, whether that be, for instance, solar, geothermal, you know, and geothermal heat pumps or earth source, and combinations then of different energy uses?

MR. SALAZAR: Well, lifecycle assessment is highly flexible. I mean, one can do anything they want, you know, in terms of

modeling, you know, which is why there are standards that define, you know, what should be done.

The reason we have not suggested an LCA on a comparative basis is strictly because ISO 14044 is so strict with how that LCA must be conducted. And you know, in order to pass muster with a peer review panel, that an LCA presumably would have to apply a very detailed level of scrutiny to all of the different comparative elements. And we don't think that's really relevant to this study. In all honesty, to compare hydroelectricity against fossil fuels, I don't think it's warranted. I mean, there's plenty of literature that shows, you know, that burning a carbon based fuel causes more carbon emissions than hydroelectricity production. So I don't think there's much to be gained there really.

MS. WHALEN ENNS: Thank you.

On slide 33, and one of my earlier interruptions had a little bit to do with this, so slide 33 has to do with the ISO building and civil engineering standards. I wanted to basically see if we could establish a bit of a time frame or

sequence here, that is how -- is it recent or has there been an ISO standard for sustainability in building and civil engineering works for some time?

MR. BOWICK: I know off the top of my head that the latest version of 21930 is 2007, and 21931-1, I believe, is 2010.

MR. SALAZAR: The draft of 21929-2 just came out, I think in June. And I know that, you know, 21930 is currently being revisited because it is at this point somewhat dated.

MS. WHALEN ENNS: Thank you.

So we have a pattern going back as far as 2005/7, and you are describing this pattern of review and updating, and tell me if I'm right, potentially moving more and more towards sustainability in building and civil engineering works through these ISO standards?

MR. BOWICK: Um-hum.

MS. WHELAN ENNS: Head nodding.

MR. SALAZAR: Yes.

MR. BOWICK: Yes.

MS. WHELAN ENNS: Thank you.

On slide 36, and we're now in the European building and civil engineering standards,

you are describing product and/or construction stages. I wanted to ask you to take a look with us and pick two or three of these, again, between the two of you that your expertise and contribution to LCA varies in terms of what each of you do, so perhaps one or two each, that are relevant again to this project, to a generation station project? So just basically expand and help us understand?

MR. SALAZAR: Well, I mean, for instance, we know that cement has an input into concrete, it is a primary product, it's used, you know, as a construction element. So, for instance, A1 would include the supply and the production of the limestone from the earth. Transporting that in A2 to then the cement kilns and then the actual manufacturing of the cement itself. You know, you can actually trace that all the way through the lifecycle, transporting then in A4 to the construction site, and then the actual installation, you know, the installation, the construction of the dam.

MS. WHELAN ENNS: Mr. Bowick.

MR. SALAZAR: We can keep going, the use of the dam in B1, you know.

MS. WHELAN ENNS: And the cement is, in terms of the Keeyask project, there's also going to be a plant on site, and a lot of acquisition of the materials in a dewatered area. So that is perhaps more complicated in terms of the analysis than cement that's delivered to the site of a building that's built on a site?

Now, the reason why I was asking for examples has to do with just helping us understand. Let's try this then. What is supplementary information, again, on slide 36? This is what you add in, in a specific analysis?

MR. BOWICK: Sorry, are you talking about module D?

MR. SALAZAR: Module D, yes.

MR. BOWICK: So that is a module, kind of an optional module to present information such as the avoided emissions potential of recycling steel or reusing steel, for example, rather than land filling it. So this system works on a polluter pays principle, in terms of the system boundary, what's included are not in the LCA.

And so one of the complaints of some manufacturers is that they don't get to show in the lifecycle the benefit of the reuse of their

product. So the European standard came up with this module D, which is, like I said, optional. It's kind of, if you want to present this information, the avoided emissions or the benefits of reuse or recycling, for example, this is where you would do it. But you don't include it in the lifecycle, because it doesn't belong within the product system itself. So it is a pretty handy module to give kind of additional information, that's actually really important.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: It's essentially impacts that are associated with the project that aren't necessarily attributable to the project.

MS. WHELAN ENNS: Thank you.

On slide 38, you were basically describing the systems for environmental product declarations, international systems, where the -- excuse me, the generation of electricity is in your examples.

Are these declarations common in North America? Are there certain sectors that are using these environmental product declarations more than other sectors?

MR. BOWICK: I can answer that.

MS. WHALEN ENNS: Sure.

MR. BOWICK: So the latest version of LEED has a credit specifically designed to get the market going in terms of environmental product declarations. So it gives credit for just simply having in your building products that have an environmental product declaration.

Right now in the construction industry, let's say there's 30 EPDs, so it's not very many, but I think you will see an explosion, at least in the construction sector during the next couple of years, once this new version of LEED takes hold.

In terms of electricity generation distribution, we haven't found any yet.

MR. SALAZAR: Not in North America?

MR. BOWICK: Sorry, not in North America, but in Europe, yeah.

MS. WHELAN ENNS: Thank you.

Getting close to being done, Mr. Chair.

Let's, if we could, just take a quick look at slide 42 again? You were fairly thorough, and I did ask a question earlier about this spreadsheet that you designed in terms of data

collection for an LCA for the Keeyask Generation Station.

Most of what I'm seeing, and as I asked earlier in the scope, are appicable then to this project. Quick question. If one was undertaking a full LCA for the Keeyask Generation Station in the planning stage, you know, ideally with the expectation in the EIS guidelines, would this set of examples in terms of the scope assessment -- you're going through sort of -- you've got sort of section two, and numbering them where you've got about four examples in terms of the description, and then you've got the scope in the centre. How many more are there? If you, in fact, were doing a full LCA and had access to data for the Keeyask Generation Station, I'm not going to stop and count, but we're looking at about 25, about 25 examples in terms of elements in the scope, would that become 40?

MR. SALAZAR: Quite a bit more than that actually.

MR. BOWICK: Yeah.

MR. SALAZAR: We do understand that, for instance, the parking-lot and estimations for things like that, trash racks and gates, a lot of

these are very detailed, so it's not expected that every single one of these has, you know, a defined amount. But retaining the structures, it's critical to know what has been considered and what hasn't. So if there's a rough estimation, you know, we have quite a bit of experience, you know, as LCA practitioners in the building construction industry to estimate some of these things, to help provide estimates. So it's not -- yeah, we're not naive to think that, you know, at the planning phase that all of these things, and there are a lot of different elements. I mean, just the nature of a project like this, there's hundreds of different, you know, thousands of different components. But I think it's important to at least, you know, provide some estimates, whether they be crude or not, to begin to, you know, to understand that, you know, to be inclusive within the scope, to ensure that it is including all of the different elements. Because, you know, otherwise there's no way to tell whether something has been just completely left out for lack of data, and what are the cut-off rules that were applied that are associated with that? You know, there's no way to really get a picture of that

until you at least try to make some estimates of some of these things.

MR. BOWICK: Sorry, if I could add?

MS. WHELAN ENNS: Yes.

MR. BOWICK: To me what's very important about this is the communication of what's included in the study to the public, to somebody like myself reading a potential LCA study. If it's not clear what's included, it becomes a lot harder to accept what the results are. And so much about LCA is just being transparent. It's okay not to include everything, as long as it's clear what you haven't included and, you know, a reasonable justification for it.

MS. WHELAN ENNS: Thank you.

We are almost exactly four years into the public steps with regard to the Keeyask Generation Station, and that includes arriving at EIS guidelines, the scoping document review, and obviously the steps in review of the EIS, and these proceedings here.

So when you mentioned information for the public, is it reasonable to assume that you are referring to when the EIS becomes public, to actually be able to --

MR. BOWICK: Yeah. Because presumably the LCA is not public until that happens.

MS. WHELAN ENNS: Thank you.

Quick step back then to slide 42, some simple questions. The roads, the dykes, the on-site cement plant, the fairly extensive housing and other facilities for up to 2,000 staff, these are all elements of the footprint, if you will, and the site for the Keeyask Generation Station.

So, in our -- the information you are giving us about an LCA for the Keeyask Generation Station, are each of these elements also then potentially part of an LCA?

MR. SALAZAR: Not just potentially, I mean, they actually are part of the project description, so they are within the scope, within the system boundaries.

MR. BOWICK: Yeah. If the goal is to estimate the impacts, I mean, this is the object of assessment here.

MS. WHALEN ENNS: Thank you.

Mr. Salazar, on slide 44, when you were talking about the full range of lifecycle impacts, you made a comment about the risks, correct me if I've got it wrong, about the risk of

excluding or leaving out an impact. And I believe we heard you say that that's pretty much like an inherent value judgment, that if you exclude something, you have made a value judgment, you have left a value or a series of impacts out. Is that correct?

MR. SALAZAR: Yes.

MS. WHELAN ENNS: Thank you.

MR. SALAZAR: I mean, it's not necessary. There's no reason to exclude an impact.

MS. WHALEN ENNS: Thank you.

Slide 45 is the -- hmm, tough to read on paper and on the screen, but this has got to do with the European environmental indicator standard that you have been talking about and informing us about today.

Are any of the elements in this European standard at play in terms of being practitioners and/or dealing with industry associations here in North America? Is some of this beginning to happen here? And I don't necessarily mean within a standard. We know there isn't an equivalent standard now, but the elements then within this chart, are any of them at play in

terms of being LCA practitioners?

MR. BOWICK: Well, I would certainly like to see a lot more standardization in the EPD world. But it's starting to happen. And so some of the North American program operators that produce the EPDs are starting to adopt this system. It's still kind of the wild west, and they may adopt things that they like about the standard and not other aspects, but the wheel is starting to turn on it.

MS. WHELAN ENNS: Thank you.

The net use of fresh water is one of the elements here in terms of these environmental indicators, and certainly has some relevance in a generation station or hydro generation station project.

Is it an active use in terms of these indicators being applied in Europe? And it's okay to want to pass, that's a tough one.

MR. SALAZAR: In all honesty, water is actually one of the inventory flows that there is -- there is undergoing standardization on how it should be accounted for. Currently fresh water consumption is actually calculated as, you know, the evaporation, the actual loss of water. You

know, within an LCA, you know, LCA isn't perfect at characterizing all different emissions. It is very good at creating a mass balance, an inventory of different emissions. But, you know, something like water, to measure use of water, really the nature of that use is what's important. And there is increasing characterization of water use, classifications of water use. But it's not widely it's not been widely adopted in material databases. Presumably that would be, because it is such a key issue to something like a hydroelectric project, presumably that would be studied by a water expert or, you know, lots of water experts to determine the nature of that water use and the degradation of water supplies and things like that.

MS. WHELAN ENNS: Thank you.

I am finished questions. I wanted to say a couple of things, though.

One is basically to start with thanking both of you and your firm for the steps you have taken since spring in educating Manitoba Wildlands and assisting us in our understanding of lifecycle assessments, and then also thanking you for your investment and time including to be here

in person for the presentation.

One closing question, if I may? And that is, do you consider lifecycle assessment in a wide range of projects, including the one we're all working on here today, to be best practise, and do you look forward to and assume steady increase in the use of LCA tools, software, practitioners in Canada?

MR. SALAZAR: That's our goal, and honestly that was one of the primary reasons we undertook this project from the beginning, is lifecycle assessments really has been driven by the building industry. You know, the ISO committees and CEN committees have begun to introduce civil engineering standards that closely mirror buildings, because the lifecycle of a building closely mirrors that of a civil engineering project. But we really feel that there's a really great potential for projects of this scale, that have this much planning, you know, this defined sustainability goals, to incorporate lifecycle assessments actually as a planning tool, potentially even greater so than the building industry where it's a lot of smaller one-off projects, and it's just not feasible at

that kind of scale.

But a project of this scale, I think it's, you know, with planning phases that are this involved and over this many years, that it really has a great potential to inform infrastructure developments, civil engineering projects.

MS. WHALEN ENNS: Thank you.

Mr. Bowick?

MR. BOWICK: I would basically just concur with what he said. Yeah, again, the scale of these projects insinuates that there might be more resources for LCA practitioners to do a really good job and to actually produce some reduction results for a project. And the scale of the impacts is greater than a building. So I get excited the larger the project it is, because there's just more potential to find interesting ways to reduce impact.

MS. WHALEN ENNS: Again, thank you both. I don't have the time in front of me, Mr. Chair?

THE CHAIRMAN: Thank you, Ms. Whelan Enns. We'll take a break and come back just after 11:35.

MS. WHELAN ENNS: Thank you.

(Proceedings recessed at 11:22 a.m.
and reconvened at 11:35 a.m.)

THE CHAIRMAN: Okay, we'll reconvene the cross-examination of these witnesses. Proponent, Ms. Mayor.

MS. MAYOR: Thank you. We met this morning so I won't re-introduce myself.

Earlier on in the morning, we talked about the report prepared for the Partnership by the Pembina Institute. And you would agree that it's a lifecycle analysis of greenhouse gases and select criteria air contaminants, correct?

MR. SALAZAR: Yes, that's correct.

MS. MAYOR: And would you agree that the Pembina Institute has considerable experience in lifecycle assessments of energy related projects?

MR. SALAZAR: I'm not really familiar with their experience. I'm sure they can speak better to that.

MS. MAYOR: In your report, you indicate that other environmental indicators beyond greenhouse gas emission implications could be taken into consideration using a lifecycle analysis protocol.

MR. SALAZAR: I think we suggest that, yes.

MS. MAYOR: And if we turn to slide 34, thank you, there's a number of elements listed on the left-hand side of the slide. That would be the list of some of the items that you suggested.

MR. SALAZAR: The items on the left side are the actually emissions, the inventory as specified in ISO 21929-2. The centre column, the impact categories are those required by ISO 21930.

MS. MAYOR: In terms of your report, if you turn to page 13 of your report, it says near the top of the page, and it's quoting the ISO standard:

"The following environmental aspects shall be taken into consideration."

And you list a number of the items, many of which, in fact all of which appear on the left-hand column in slide 34. Is that correct?

MR. BOWICK: Sorry, what is the question exactly?

MS. MAYOR: On page 13 of your report, you have listed a number of bullets at the top and those are what are stated to be environmental aspects that should be taken into consideration.

MR. SALAZAR: Yes.

MS. MAYOR: And that's the same list that's included on slide 34. It was more for ease of reference.

MR. BOWICK: Right, yes.

MR. SALAZAR: Yeah.

MS. MAYOR: Thank you. In the environmental impact statement that was filed by the Partnership, the project description supporting volume of the EIS includes discussion on things such as potable water requirements, waste water, solid waste issues for the construction camp as well as potable water and water quality management during operations. You would agree that the assessment of those particular elements is appropriate and in fact is included in some of the elements that you've got listed in your report on page 13.

MR. SALAZAR: We are suggesting an inventory. I think what you said was a description.

MS. MAYOR: There's been a description, there's been an analysis and an assessment contained in the supporting volumes of the environmental impact statements. You would

agree that those are things that should be assessed when looking at a project.

MR. SALAZAR: Yes, those should be assessed. And those would actually form a portion of the lifecycle inventory that would be accounted for in a lifecycle assessment.

MS. MAYOR: You would also want to account for air quality and noise.

MR. SALAZAR: Noise is something, it's not well-addressed in lifecycle assessment. There's no uniform data sets for things like that. Air emissions are certainly one of the key elements of a lifecycle inventory database.

MS. MAYOR: So if that in fact has been assessed again in the physical environment supporting volume, it's a different volume, and the likely effects of the project related to both air quality and noise are assessed, that would be appropriate in your view?

MR. SALAZAR: Can you rephrase that?

MS. MAYOR: In terms of air quality and noise, the Partnership has prepared an assessment, and it's included in its physical environment supporting volume, on the likely effects of the project related to those air

quality and noise. That would be appropriate in your view?

MR. SALAZAR: It would be appropriate to consider those things? Yes.

MS. WHALEN ENNS: Mr. Salazar -- I may need some direction here, Mr. Chair, because I'm not a lawyer. But I would like to in fact pose a question.

THE CHAIRMAN: You'll get an opportunity for redirect at the end of the cross-examination.

MS. WHALEN ENNS: Thank you very much.

MS. MAYOR: And so if similar analysis has been done on each one of those items listed by the Partnership and by its team of engineers and specialists, again that would be appropriate for this type of project?

MR. SALAZAR: Similar to what? I don't understand the questions. You said similar. Similar to?

MS. MAYOR: Sorry. If analysis has been done by the Partnership through its large team of experts on the environmental effects of each one of those items, that would be appropriate?

MR. SALAZAR: Yes.

MS. MAYOR: Now, in your covering letter that was filed along with your report, you indicate that you prepared a lifecycle assessment protocol to guide future LCA efforts by Manitoba Hydro. That would be a correct description of the report that you filed?

MR. SALAZAR: Yes.

MS. MAYOR: And the purpose of your protocol report and today's presentation was not to critique the lifecycle analysis completed by the Pembina Institute?

MR. SALAZAR: Correct.

MR. BOWICK: Yeah.

MS. MAYOR: And, in fact, a critical review of that lifecycle analysis was done by a senior adviser of Hydro Quebec who was responsible for a lifecycle analysis of their generating stations. You are aware of that?

MR. SALAZAR: Yes.

MR. BOWICK: Yeah.

MS. MAYOR: Your report today was also not intended to assess the environmental impact statement and the various supporting volumes to determine if the requirements under the relevant

legislation and scoping documents were fulfilled for this project. That would be accurate?

MR. SALAZAR: Yes. This is a proposed protocol.

MS. MAYOR: You started out this morning describing for us and you have related throughout the course of your presentation your experience with lifecycle analysis. Is it fair to say that neither of you have direct experience in doing a lifecycle analysis for electricity generation projects, or maybe more specifically, lifecycle analyses for hydroelectric projects?

MR. SALAZAR: We have never conducted a lifecycle assessment of a hydroelectric project, no.

MS. MAYOR: Thank you. I have no further questions.

THE CHAIRMAN: Thank you, Ms. Mayor.

Not at this point, Ms. Whelan Enns, at the conclusion of the cross-examination.

MS. WHALEN ENNS: Thank you.

THE CHAIRMAN: Ms. Craft, do you have any cross-examination? No? There are no other participants in the room at this time. Members of the panel?

MR. SHAW: Mr. Chairman, thank you.

I have a question with respect to the report of the Pembina Institute. Now that document is available to the public? And I guess I'm actually asking Hydro at this point.

MS. MAYOR: Yes, it is.

MR. SHAW: And what about the critical analysis done by, was it by Hydro Quebec, was it?

MS. MAYOR: Yes. Both of them were in fact produced in an information request this summer. We can provide the site for you later this morning.

MR. SHAW: And I have to confess, I haven't read it. Did the critical analysis result in the LCA done by Pembina Institute passing muster so to speak?

MS. MAYOR: I can tell you that the critical review, there is a summary of it in the appendix and, if you want, I can read what the concluding paragraph was. There was a couple of points that they had asked for to be added, and it said:

"Considering that the points mentioned above will be checked and corrected before the report is considered final,

the report is complete and covers all major activities associated with the project. The indicators selected are the best for comparison with the chosen modes of electricity generation. The assumptions used are reasonable in relation to the goal of the study. All specific comments and recommendations of improvement are included in the report."

MR. SHAW: Thank you very much. Now, Mr. Salazar and Mr. Bowick, do you concur with that opinion?

MR. SALAZAR: Can you restate that statement of the opinion? Sorry, I'd like to just hear it verbatim so that I don't agree to something I don't agree to.

MS. MAYOR: I think they had indicated they haven't done an assessment of the report but I can certainly -- it's at page 76, if that helps, or I can provide you with a copy. Did you want me to bring it to you?

MR. SALAZAR: We have a copy. So what is the statement we are being asked whether we agree with? The entire comments?

MS. MAYOR: I just read the last comment in quotations and italicized, starting with "Considering" at the bottom of page 76.

MR. SALAZAR: I don't know if I agree with every part of it. But, you know, again, this wasn't the focus of our research. It wasn't a critical review of this study. You know, typically, we do engage in a critical review. And I had been a part of a few. One of the key things we like to do is to be involved at the goal and scope phase of that project where it's actually defined what impacts are going to be considered. So to say, you know, their comment that it's consistent with the goal is certainly accurate.

MR. SHAW: And you had read the Pembina Institute report?

MR. SALAZAR: Yes, we have.

MR. SHAW: Okay.

MR. SALAZAR: It was provided to us, you know, in reply to our IRs.

MR. SHAW: And you analysed it in detail?

MR. SALAZAR: I wouldn't say analysed in detail. We are certainly aware of what it contains.

MR. SHAW: Did you offer any commentary to Hydro about what you thought of the positives and negatives of it?

MR. SALAZAR: No, we haven't. We haven't offered any comments or critique to Hydro, no.

MR. BOWICK: We asked for some clarifications.

MR. SALAZAR: Right.

MR. BOWICK: But no critique.

MR. SHAW: You say in the letter:

"The LCA study also employed a unique description of the project elements and the alignment of the scope of this document but the project description was not clear."

What does that mean?

MR. SALAZAR: I can scroll through here. The way that they have I guess kind of, their process maps, the way they have identified, you know, different components that make up the lifecycle inventory, they are not the same listing of various components that's in the project description. They are a bit higher level, more general. So that was part of our IR round 2 was

essentially to try and determine if all of the elements that are in the project description were considered within that scope.

MR. SHAW: But just to get down to brass tacks here, there was nothing in that report that you read, I gather, that would prompt you to give it a failing grade?

MR. SALAZAR: It does not comply with all of the standards that we are recommending that should apply to an LCA of this nature. It is certainly -- it certainly follows the ISO 14040 framework which is routinely, you know, repeatedly kind of cited in this as the guiding framework. It is a lifecycle assessment, yes.

MR. SHAW: Just so that I'm clear on this, these standards you refer to, the ISO, the IPCC, UNESCO, IHA, the international EPD system and so on, these are industry-driven standards, are they?

MR. SALAZAR: Yes. The ISO 21900 series is driven by, you know, experts in LCA of building and civil engineering works.

MR. SHAW: Right. You mentioned a while back they were like a consensus standard?

MR. SALAZAR: Correct.

MR. SHAW: And sector specific?

MR. SALAZAR: Correct, yes.

MR. SHAW: And there may be methodological issues that arise from time to time where I guess these folks would meet and try and resolve those?

MR. SALAZAR: Precisely, yes.

MR. SHAW: To your knowledge then, none of these standards have actually been drilled into legislation?

MR. SALAZAR: I'm not aware in North America. I have heard that in Europe, that may be more the case. But I'm not aware of requirements to comply to these standards, no. To be honest, I'm not too familiar with that many requirements for LCA in general.

MR. BOWICK: I could give you an example of the ISO standard site. So in LEED, it says, you know, you are free to use whatever data sets you want in your whole building analysis but they have to comply with ISO 14040 and 14044.

MR. SHAW: But suppose you don't?

MR. BOWICK: That's the issue with green building rating systems and any type of regulation. I mean there will be people that

don't do things that they are supposed to do I suppose.

MR. SHAW: But there's no penalty? Is that what you're saying?

MR. BOWICK: Well, in the LEED circumstance, if you get audited and they find deficiencies, you either have to revise your model or at some point they will deny the credit.

MR. SHAW: What does deny mean?

MR. BOWICK: The whole building LCA credit. So you won't get the point that you need in the system.

MR. SHAW: So I don't get a point. But again, in the real world, what does that mean? I can't go ahead with the next step or --

MR. BOWICK: So LEED, what you're trying to do is accrue a certain amount of points. And if you get say 50 points, you get certified. If you get 75, you get gold. I don't know what exactly the numbers are. But the whole building LCA is an optional credit, it's not a prerequisite credit. So if you somehow fail to comply with the requirements, you could either, you know, get better data or they could deny you the credit. Now that doesn't mean you're not going to get LEED

certified, but it means that you're not going to get one of the credits that you need for certification.

MR. SHAW: And the European building and civil engineering standards at slide 36, to your knowledge, none of those have been adopted in Canada yet?

MR. BOWICK: Well what this is is basically the European interpretation of the ISO 2100 series -- or 21,000 series. So they are very similar. So this draws on the international consensus.

So what the Europeans basically did was they took the modular format, all these boxes, and gave them alpha numeric designations. And rather than the international standard, they actually said what each of these boxes you have to consider. So the ISO standard just says these are the things you have to consider. But it doesn't tell you specifically, you know, for raw materials supply what industrial processes you have to consider. The Europeans took it the next step further and actually started defining the specifics of what's contained in each of these modules. So it's kind of -- it's a consensus from

kind of a higher level consensus.

MR. SHAW: I understand that. But is it actually being applied in Canada now?

MR. BOWICK: What's happening is that there's no North American equivalent to this. And the two European standards that we cite are basically recognized as essential in a system of using EPDs and using building LCA.

So right now in North America, it's the wild west because we don't have these documents. So people are starting to take the ideas from these documents. Some people are actually referencing these documents. But it's certainly not at the scale as it would be in Europe.

So, for example, Underwriters Laboratory Environment produces EPDs. They are starting to understand that they need this document to produce a standardized set of EPDs that people can actually practically use. So they are starting to reference the document, but it is still European standard, right. So they are taking the good out of it because there's nothing that they can draw on in North America.

MR. SHAW: Thank you.

MR. NEPINAK: I just want some clarification, and this actually might be, I'm going to go ahead anyway because you may have already answered the question. But just a moment ago, Ms. Mayor asked if similar assessments had been done, and I'm not quoting correctly probably, would that be appropriate? That was just part of the whole question if I remember right. And you answered yes. Okay? But did you not say -- and from what I got from Ms. Mayor's question, and if you want to clarify it after, that would be great, but didn't you say earlier that ISO criteria had to be met and the whole part of the ISO is -- the whole ISO had to be considered to be complete in order to complete the ISO? Do you understand what I'm saying?

MR. SALAZAR: No, I'm sorry.

MR. BOWICK: I think it needs to be said that nowhere in the guidelines, the CEA guidelines document, does it say that this LCA has to be ISO compliant. Right? So we need to all understand that. What we're suggesting is that moving forward, perhaps it should be explicitly said that, you know, that there's some kind of indication of how to run these things so that, you

know, to keep things on the track.

So in terms of the report, there's nothing wrong with the report, that we should commend them for doing the LCA study. I don't know if that helps.

MR. NEPINAK: I believe you actually answered the question but I thought I'd ask it anyways to see if there was any more clarification. Other than that, I'm okay. Thank you.

THE CHAIRMAN: I have a few questions. This LCA, it's a relatively new process; is that correct?

MR. SALAZAR: Relative to other sciences. But it's been, you know, the earliest LCAs were completed in late '60s, early 70's, primarily on energy use, you know, energy reduction. More and more, it's really caught a lot of wind with the global warming and the recognition of climate change. So yes, it's really accelerated I would say in the last 10 years, 15 years.

THE CHAIRMAN: So --

MR. BOWICK: And there's been a big push in terms of standardization in the last

couple years.

THE CHAIRMAN: Ergo the ISO and EN and stuff like that.

MR. BOWICK: Yeah.

THE CHAIRMAN: What are we assessing? You note in here that the EIS guidelines ask for a description of atmospheric emissions, liquid emissions, solid wastes. So what is it we're assessing in an LCA?

MR. SALAZAR: LCA, it's really a supplement to the site level impacts by, you know, essentially because it doesn't -- it isn't focused on one particular area and one point in time, it allows you to model the entire supply chain of all the different materials, which in a project like this, are quite significant. You know, the production of materials that happens in China. That can actually be incorporated into an LCA. Also the production of, you know, all materials in the entire lifecycle. So what it does is it adds kind of a lifecycle perspective to considering the impacts of a project like this of the materials themselves, the embodied impacts of the materials.

THE CHAIRMAN: But we are assessing sort of emissions that are related to the

lifecycle of those materials?

MR. SALAZAR: Correct, yes.

THE CHAIRMAN: It's emissions that we're assessing?

MR. SALAZAR: Well, we're inventorying the emissions and then we're using those emissions based on essentially climate models and toxicology models and, you know, ecological damage models, then calculate the impacts that are caused by those emissions.

THE CHAIRMAN: So this would be a supplemental to an environmental assessment rather than a replacement?

MR. SALAZAR: Absolutely, yes. It is not intended to be an all-encompassing sustainability, you know, one-off result.

MR. BOWICK: LCA does a particularly good job with things that relate to energy and mass flows. So use of resources and emissions to land, physical flows. But a lot of the site specific stuff and some of the human health stuff, it doesn't do as well on that stuff. So we always say it's one tool in a tool box, but it's a very powerful one.

THE CHAIRMAN: Thank you. In your

cover letter, and this was noted a few moments ago, it talks about a guide to future LCA efforts by Manitoba Hydro. Are you proposing or recommending that an LCA be done for the Keeyask Generating Station?

MR. BOWICK: As in?

THE CHAIRMAN: I mean at this point in the environmental assessment review process, are you recommending that an LCA be done?

MR. BOWICK: Well, in a way I would always recommend that.

THE CHAIRMAN: I mean, we know that one was done by the Pembina Institute.

MR. BOWICK: Right.

THE CHAIRMAN: You have referred to that. But are you recommending that one be done according to your protocol?

MR. SALAZAR: Yes. I mean the LCA we have proposed, because it is more comprehensive in terms of the impacts that are considered, I think that any project and any EIS would benefit from an LCA. That's why we presented this LCA, so that it could inform, you know, processes like this. So certainly this would -- you know, I am under the understanding that this EIS has been completed,

you know, so that's why we kind of framed things in a future tense, you know, future projects. But certainly there's -- if it can be applied to a future project, it can be applied to this one.

THE CHAIRMAN: Now, is this something that can be done at sort of any stage along the process? I think I heard you say that earlier.

MR. SALAZAR: Absolutely. In fact, we had recommended it be continually refined throughout the process.

THE CHAIRMAN: So over the hundred year lifecycle of the project?

MR. SALAZAR: Yes. You know, obviously, you know, the big push is through the construction, you know, of the project and, you know, it coming on line. But certainly, you know, as a tool it can be used to inform, you know, maintenance decisions, you know, replacement materials, things like that.

THE CHAIRMAN: So what would it mean for the proponent to do an LCA following your protocol? How much time is involved? What kind of or how many resources are required?

MR. SALAZAR: It's really hard for us to say at this point. The first part is obviously

the disaggregation of some of these resource material flows, the material take-offs. And, you know, we are very familiar with working with quantity surveyors, quantity -- people that have that data to then, you know, use that to populate our models. So I mean it is -- to be honest, the information request process is not ideal for this because it really is a collaboration between the LCA practitioner and various people, various engineers to have, you know, design specs, drawings. So it really, you know, just depends, you know, the precision of those take-offs currently are in, you know. For all we know, a lot of this data is already, you know, in a tabular format ready to go. But, you know, it could involve, you know, quite a bit of estimation on our part, on Hydro's part, et cetera.

THE CHAIRMAN: And you talked or one of you, maybe both of you, talked about databases, existing databases. Again, I'm just having perhaps a bit of trouble understanding how this process works. Now, are you saying that if you are filling in the dots on this slide 36 or on slide 42, you're filling in these different spaces, does that require original calculations or

do you just pick stuff out of databases? Is there sort of a standard emissions per kilogram of Portland Cement, for example, or per tonne of steel?

MR. BOWICK: So we have to calculate the take-off or we get the take-off. So that's a project specific calculation.

THE CHAIRMAN: What do you mean by take-off?

MR. BOWICK: Material quantity. So quantity of rebar for example. That's the primary calculation that we would have to do. But then just like you suggested, then you would plug it into a secondary database, an LCA database, plug that in on your per kilogram.

THE CHAIRMAN: Yeah.

MR. BOWICK: It's environmental data per kilogram, for example rebar. Just like you suggested.

MR. SALAZAR: Those databases would be, you know, refined to the degree possible. For instance, a North American profile for cement, for instance, may draw on a North American average of electricity; whereas, if we knew the cement would be produced in Alberta or Manitoba, you know, we

would go in and substitute the electricity and put sort of specific to the grid mix. You know, and presumably if you got to the point where you're dealing with contractors, you could then refine those kind of models even further to, you know, continue to hone in on the actual impacts of the project as it unfolds.

THE CHAIRMAN: So for somebody who is schooled and skilled in doing an LCA, it's not a really difficult job.

MR. SALAZAR: We have convinced our clients it is.

THE CHAIRMAN: I take your point. But it's not an impossible task. It's not a task that's going to take years to do.

MR. SALAZAR: No.

MR. BOWICK: Absolutely not.

THE CHAIRMAN: I mean even though you talk about calculating the amount of cement or steel, et cetera, I mean the engineers that have designed the thing have probably done a lot of that already.

MR. BOWICK: Yeah.

THE CHAIRMAN: So it's a matter of just the person who is skilled in this knowing

where to find the input, knowing where to find the database --

MR. BOWICK: It's a lot of data management. And understanding what you're trying to model. So, you know, we haven't done a hydro dam but it's pretty darn close in terms of the components to a building. So we would learn a little more about hydro dams, to make sure that we're properly capturing everything to do with the dam and all the infrastructure components.

THE CHAIRMAN: So I mean in answer to I think my opening question, one of you said it's really come along in the last 10 to 15 years. How widespread is it now? How much is it used? And perhaps a corollary question, how much is its use growing?

MR. BOWICK: Well, if I could say, I keep referencing LEED. The big moment in LCA, North American LCA in particular, is about to happen with this new version of LEED that has come out which has been specifically designed to expand the market use of LCA. They are not perfect credits, it's not a perfect use of LCA, but it's been specifically designed to get people producing, like manufacturers producing data and

even some non-practitioners using LCA to model their buildings.

So we're at a funny point where in two years, I could tell you, you know, we're at a pretty good state. But like right now, we're just about to see what becomes of this.

So it's hard to say. I mean right now, it's not extremely pervasive. There are a lot of people though, a lot of architects that use it. But yeah, talk to me in two years and I can give you a pretty rosey picture of LCA use.

THE CHAIRMAN: So LEED designation comes out of an LCA?

MR. SALAZAR: As a part of it, yes.

THE CHAIRMAN: So then it shouldn't be a foreign concept to Manitoba Hydro which has a very high LEED designation for their building.

MR. BOWICK: But it's a new -- that building was not done to the same version of LEED, so.

MR. SALAZAR: Yeah, the new version -- the version of LEED we are referring to has just come online. So literally in the last few months.

MR. BOWICK: The last two weeks actually. They just had their big conference in

Philadelphia where they released their version 4 of LEED. So it's going to take, you know, a year or two for it to grab hold in the market because they can still use the old version. But I mean this is the moment we had been waiting for in LCA for -- you know, our mentor at the institute, he has been waiting 20 years for this.

THE CHAIRMAN: Thank you. I'll resist. I don't have anymore questions. Ms. Whelan Enns, did you have a some redirect?

MS. WHALEN ENNS: Thank you, Mr. Chair.

Again, at your discretion in terms of whether Mr. Salazar or Mr. Bowick answer questions.

To the best of your knowledge, would you tell us which standard or standards were used in the LCA which Manitoba Hydro commissioned the Pembina Institute to do for the Keeyask Generation Station?

MR. SALAZAR: ISO 14040.

MR. BOWICK: But it doesn't meet the requirements of -- it wouldn't meet the requirements of 14044.

MS. WHALEN ENNS: Thank you. You beat

me to the question. So did we hear you correctly, in your presentation today, that 14040 is a set of principles on how to do an LCA?

MR. SALAZAR: Correct, yes, principles and framework.

MS. WHALEN ENNS: Ms. Mayor asked you, and again I think it's got to do with your slide 34, she asked you some questions and also referred to a page in your report. And her questions were, as I understood them, about elements that are there in the lifecycle inventory information on this slide that are in the EIS. So my question then to you would be, is an assessment of an element that's potentially part of an LCA is an assessment that is, by the EIS guidelines for Keeyask, the same thing as a lifecycle assessment of that element?

MR. BOWICK: We don't -- I personally don't know what those sections describe so it's hard for me to comment.

MS. WHALEN ENNS: Thank you.

Mr. Salazar?

MR. SALAZAR: Yeah, I think she asked if the EIS had similarly accounted for these things if that would be acceptable, and of course,

you know, if it is similarly inventoried these submissions, then yeah, we would agree with that I think is how it's phrased.

MS. WHALEN ENNS: So in your answer to Ms. Mayor, you were indicating then that if the analysis in the EIS of those elements that happened to be on this ISO or ISO chart included the calculation of the admissions and the disclosure of those admissions and the analysis of them, then that would be similar, to use her words, as what an LCA would involve.

MR. SALAZAR: Could you repeat that, please?

MS. WHALEN ENNS: I'll try. Honest. I heard you say, make a clear reference to then needing the emissions from the elements that she was asking you about in terms of how they are assessed in the EIS and that they would also be on the ISO lifecycle inventory requirements. I heard you say that. So I'm basically asking you whether that means that, in your answer to her, you were assuming that. That the greenhouse gas emissions data would have been part of the assessment in the EIS, even if it's not inside the LCA.

MR. SALAZAR: Well, the greenhouse

gases, I mean that was the primary metric in the LCA and in the EIS pertaining to this sort of thing. I don't -- you know, I think she indicated that these other things had been considered. They were not part of the lifecycle assessment so it's really hard for me to tell you how they were estimated. I don't know how one would estimate these things for, you know, all the material manufacturing and all that if they were not part of the LCA. But, you know, that's kind of my understanding.

MR. BOWICK: At which point I would ask, was there another LCA consultant brought in to calculate these things.

MS. WHELAN ENNS: Thank you.

MR. BOWICK: Hard to say without knowing exactly what's being referred to.

MS. WHELAN ENNS: The next question goes to the different stages of request for information to Manitoba Hydro including the point at which in July that the inventory chart was provided to them.

Did you have access to the work of the senior Quebec Hydro, I believe, executive staff person inside the utility, did you have access

to -- did we receive her work in terms of her review of the Pembina Institute LCA?

MR. SALAZAR: Yes. Her critical review was an appendix to that published report.

MS. WHELAN ENNS: Thank you. Would you tell us what you would have required or needed to in fact undertake an LCA by the standards you are recommending of the Keeyask Generation Station? What data would you have needed?

MR. SALAZAR: All of the data that we requested in the first round of the information request, the data collection spreadsheet. There was some other scenario information. But yeah, generally speaking, the bulk of the round 1 IR request.

MS. WHALEN ENNS: Did you receive any of it, of the data?

MR. SALAZAR: No, we received the Pembina LCA study.

MS. WHELAN ENNS: Thank you.

MR. BOWICK: It should be noted that what we are proposing is a single assessment of the dam, meaning it's not a comparative assertion. Which means that they wouldn't actually be obligated to have a critical review.

MS. WHALEN ENNS: Thank you. Are LCA analysis and products, and I'm thinking about, again, larger structures, lots of cement and so on, do the developers of the proponents make those public or is it a function of whether a public process requires it? Does it vary?

MR. SALAZAR: Can you repeat that one?

MS. WHALEN ENNS: So the LCA results for a large project, not necessarily then on a hydro dam, but it includes a lot of materials, is the outcome, as in the results of the LCA and all the number crunching, is it made public and shared or is that less common unless there's a requirement for it to be shared?

MR. SALAZAR: Well, it really depends on the client. I mean if the client chooses to make the details of the LCA study, I mean, presumably, if they are going for a certification, then maybe they don't. Maybe they, you know, provide that in their submission for, you know, LEED credits or something like that. But, you know, maybe it's for internal use. It really just depends on the goals of the -- the client owns the models, so.

MR. BOWICK: Certainly LCA gets used a

lot for marketing.

MS. WHELAN ENNS: Pardon me?

MR. BOWICK: LCA gets used a lot for marketing. So in the case of a hydro dam, they could start with a baseline, you know, business as usual, concrete mixes. And throughout the design process, attempt to reduce their design and, you know, maybe over the course of the design, they can show a 20 percent reduction in global warming potential and they want to be able to inform the public that they have gone through this process. And that's a use for LCA.

MS. WHELAN ENNS: Thank you. Mr. Shaw asked a series of questions that he beat me to in terms of LCA requirements and whether there's regulatory or legislative requirements at this point, and there are not. Can you point us to any examples, and this is a wide question. So let's see how we do. Can you think of any examples then where the need for an LCA has in fact been quite specific for a client in standards in a regulatory process which is different than a specific regulation or law demanding it. Have you dealt with any clients where they have had a public review process or an EIS process or an industry

association or public requirement for an LCA?

MR. BOWICK: I ran into this recently. But having said that, it's the only case I can think of. UBC, in their request for proposal, and it's their kind of internal regulation, that they have, as part of any new construction project, a lifecycle assessment undertaken.

MS. WHALEN ENNS: So they are perhaps first?

MR. BOWICK: Yeah, yeah, Coldstream has done quite a bit of work with UBC in promoting the use of LCA. And I'm not quite sure if it's a direct consequence of that. But they are definitely trying to make the use of LCA kind of one of their initiatives at the university. So they are ahead of the game.

MS. WHELAN ENNS: Thank you. Mr. Bowick, you made a reference to, and I need to -- I wasn't fast enough in terms of what you were referring to. Again, a question from perhaps Mr. Shaw again about the referencing and the use of the EU series of standards here in Canada or in North America. You said that the underwriters --

MR. BOWICK: Laboratory.

MS. WHELAN ENNS: In the U.S.

MR. BOWICK: Environment. What we would call ULE.

MS. WHELAN ENNS: Yes. And there are standards association for a whole range of things?

MR. BOWICK: Yeah.

MS. WHELAN ENNS: Okay, thank you. Did we -- were you saying that the underwriters laboratory is now requiring LCA or they started to build in --

MR. BOWICK: No, they are what's called a program operator, so they are an administrator of an EPD program. Sorry, environmental product declaration. We get so, you know, insular in our little abbreviations.

If you want an environmental product declaration, you are a manufacturer, you go to ULE and they administer the process of getting an environmental product declaration made for you.

MR. SALAZAR: And there are others, ASTM, International Codes Council.

MR. BOWICK: CSA in Canada. I don't know the degree to how many EPDs. I think very few EPDs, but they are making a play as a program operator.

MS. WHALEN ENNS: Thank you.

Finished, Mr. Chair.

THE CHAIRMAN: Thank you, Ms. Whelan Enns. That concludes this panel. So thank you very much, Mr. Salazar, Mr. Bowick. Thank you for your work in preparing these reports and your presentation today. Thank you.

MR. BOWICK: Thanks for having us.

MR. SALAZAR: Thank you for having us, yeah.

THE CHAIRMAN: Again, we're a few minutes ahead of schedule, but we'll break now for lunch. We won't start a new presentation at this time and we will reconvene at 1:30.

(Proceedings recessed at 12:30 and reconvened at 1:30 p.m.)

THE CHAIRMAN: We will reconvene.

Mr. Soprovich, would you introduce yourself for the record, please?

MR. SOPROVICH: My name is Dan, I'm a wildlife ecologist, self-employed, from Swan River, Manitoba.

THE CHAIRMAN: Thank you. Madam secretary?

Dan Soprovich: Sworn

THE CHAIRMAN: Before we proceed, just

for the record, I would like to note that Mr. Soprovich happens to be my brother-in-law. As in past hearings we have not and we will not have any discussions related to these hearings.

Ms. Whelan Enns, are you leading anything or --

MS. WHELAN ENNS: Thank you, Mr. Chair.

Mr. Soprovich, will you introduce yourself in terms of the reason you are here, but also in terms of your background and your qualifications? Just give us a short introduction?

MR. SOPROVICH: Dan Soprovich, I have a masters degree in Zoology from the University of Manitoba in science. I have worked for the Province of Manitoba for some 14 years early in my career, self-employed for about the last 20. I worked at times for Canadian Wildlife Services, Ducks Unlimited, University of Manitoba, presently working half time as a lands manager for Wuskwi Siphk First Nation, which is a nation around my home community of Swan River. I'm involved primarily in Treaty Land Entitlement issues, and other land issues as a lands manager.

MS. WHELAN ENNS: And your volunteer and community activity is in the CV, so if people need to know that, I think it is there.

Would you add to your introduction and background just a little bit about projects out of Manitoba that you have worked on in the last few years that involved EIS and licensing standards?

MR. SOPROVICH: Probably the most recent projects I have been working on, I have done various wind projects, some inside Manitoba, I have done one in Saskatchewan, several in Alberta. I have been involved in a small 50-megawatt hydroelectric development in B.C., as coordinating the environmental assessment. I have done some work on two streams that were flooded in Southern Alberta where reservoirs were made. We did some work on long-tailed weasel there. My partner and myself just published a paper in Canadian Field Naturalist on that work.

MS. WHELAN ENNS: Are you mostly commissioned or contracted to do inventory field work, or assessment, or are parts of those kinds of activities in different projects?

MR. SOPROVICH: I would say most of my recent work has been more in the way of looking at

information. Early in my career I was involved working for the Province of Manitoba, something called a population ecology biologist. And for the most part what that meant was looking at long term data sets trying to see what that information was telling us, so critical analysis of data.

More recently I have been doing a fair bit of work for First Nations, including my First Nation, looking at, involved in consultation exercises, looking at information. So, for example, one of the ones I'm working on right now is tested with moose consultation in the area. So I'm trying to get data out of the province with respect to things like survey reports, questionnaire data, and trying to look at that type of information.

I also just finished up here about a week and a half ago, I did some modeling of the population for game hunting area 12, which is an area north of the Porcupine Mountains where consultations are ongoing because of very, very low population.

So I have done some inventory work, absolutely, in various species. I wouldn't say a terrible amount of it, but where my sort of

expertise has come in has been in looking at some of the problems with inventories, with inventories in terms of the methodologies, be it aerial surveys for moose, for example, and these kinds of things.

MS. WHELAN ENNS: Thank you very much.

THE CHAIRMAN: Thank you, Ms. Whelan Enns.

If you wish to proceed with your presentation, Mr. Soprovich.

MR. SOPROVICH: Thank you. So this is called habitat quality models, species at risk and wildlife VECs. I won't focus too much in this presentation on the VECs, but we will get to that.

So in terms of -- as a starting point I thought it would be good to think about what does the scientific literature tell us about habitat and habitat related terms? So I turned to a book, it is called Birds and Habitat, Relationships and Changing Landscapes. This is a 2012 book by Robert Fuller, so this is where I'm drawing my definitions for habitat.

One of the first things that Fuller says is clarity about the meanings of these and other habitat related terms is essential. So as

with any other endeavor, I think if we want to be able to communicate effectively, we need to have clarity about our terms so we can communicate.

The definition that he uses in the book and provides in the book for habitat is the environment of the individual bird, including all biotic and abiotic elements. So this is a book about birds, this is habitat for birds.

When he talks about habitat quality, the definition he uses is the fitness potential or value of a defined habitat. What does fitness mean? Essentially what fitness means is, in evolutionary terms, the whole idea is to get as many genes in the gene pool as you can as an individual. So a high fit individual is an individual that can achieve that goal. It is an individual that either because it does well reproductively, or survives colonization thereof, it is able to get lots of its genes into the gene pool. That's called a highly fit animal.

A animal of low fitness would not achieve that. Maybe it wouldn't secure a mate, or maybe the particular habitat it is in would not allow it to have a successful nest, or maybe it would only lay a few eggs or something, or maybe

the survival rate would be low, so it wouldn't get its genes into the gene pool.

Intrinsic habitat quality; the fundamental fitness in the habitat taking no account of conspecific individuals and other species. So this is without the fitness of that habitat, without thinking about how other species, individuals of your species or other species might impact on that fitness.

And realized habitat quality combines intrinsic habitat quality with competition, predation risk, et cetera. So this is where we bring in how other species might affect that species and that individual's ability to use that habitat.

And this is a diagram from this book. And so what you can see, it is just, it is a conceptual diagram. On this access we have a resource availability.

THE CHAIRMAN: If you are going to use the laser printer, only you can see that screen, so point up here.

MR. SOPROVICH: Okay. So what we have on this axis is we have got source availability from high to low. And we have got what we call

the realized habitat quality from low to high. And when we look at intrinsic, so this is the intrinsic, just a schematic to show a concept, this is intrinsic. Then we have got these four different realized ones, A, B, C and D. So in this particular case you can see that A goes like this. And there is different relationships between realized habitat quality and intrinsic. But the main point here is that you can see that realized habitat quality is always lower than intrinsic. Because when we are looking at realized habitat quality, now we are bringing in the impact of other species and individuals of your own species on your ability to use that habitat.

Well, how might we measure fitness for habitat? One means to do that that has been used in various studies is something called Lambda. Lambda is really a population statistic, and it is the rate of increase in a population from one time to another. So that incorporates both your ability to reproduce successfully, bring lots of individuals into that population, and also survival.

Again, it is a population statistic,

but it can be applied to the way we think about habitat as well. So another way we might think about habitat is sources and sinks. When we think about source, this is a habitat that provides individuals of a species to a population. So it is good habitat, it is good realized habitat, it is providing a net increase to the population. And in that particular case, your Lambda, your rate of increase is positive.

On the other hand we can also talk about a sink. In the case of a sink, that's a habitat that results in a net loss of individuals of a species to a population. In that case Lambda is negative.

So we can envision a habitat, for example, that really doesn't provide -- again, it is not able to provide a net increase of individual population. We might see animals there that are dispersing from the good realized habitat, basically going there to perhaps die, in a sense.

I want to talk briefly about landscape ecology. Landscape ecology has really come into its own in the last, I would say about three or four decades. And this is when we start to look

at habitat from a larger perspective, the perspective of the landscape. What has really been able to fuel looking at this is, you know, the advance of computers that can handle lots of data and geographic, GIS programs. So this allows us to look at habitat in a spatial sense.

And so I'm going to talk now in relation to sources and sinks. And in this particular case, this was the book I used, it is called, "Sources, Sinks and Sustainability," it is a 2011 book.

Some of the key concepts from this book are the following. Habitat is patchy. So it is not homogenous. And patches vary as does their arrangement.

I'm sure you people sitting at the Commission here, the panel here, are quite aware of that, but I just thought I would throw in a little bit of data just to show that. So this actually is from a 2006 paper, this is some data on moose. And what they did in this particular study was they looked at different habitat types, and they recounted the number of available stems of browse. And the idea was that, obviously, if you got more stems, all other things being equal,

if you have a lot more stems of browse, that's more food and that's better for moose.

It doesn't bring in the aspect of quality and that's important, but we won't worry about that.

So you can see that, for example, we have got a deciduous with shade tolerant trees up here, and it has about somewhere over 13,000 stems per hectare, and it is rated as a one. Here we have coniferous without balsam fir. This would be like a black spruce, tamarack type of forest, and you can see it has got very few stems and therefore it is .05.

So, again, these patches occur across the landscape and these patches have different value to moose in terms of food.

Source, sink, so we can think when we have all of these different patches within this landscape that some of these patches will be sources and some of these patches will be sinks. And source, sink dynamics are not static. What I mean by that is sometimes, for example sinks may act in support of sources. We may see a situation, for example, where some weather event comes along and the impact is mainly on those

source patches. And now some of those animals that are being produced in the sinks may be able to basically populate the source patches. So it is not, this is not static.

Spatial scale, there is also this aspect of spatial scale. So we can look at sedentary species that may be restricted to one large patch, whereas wide ranging species that will range over many patches and have large home ranges. And you guys talked about caribou, so we know they range over very large areas and use various resources, and different types of resources within those landscapes.

Another thing that this sort of brings in here is migration patterns, when you start looking at these landscapes. So we know that animals can move, they can emigrate, they can immigrate. And this is important because if animals are to move among patches, they need to be able to get there successfully.

What feeds into this also, this knowledge is something that is used, for example, in designing corridors. If you have an issue where one animal might want, or a species of animal needs to get from one patch to another, and

you build a town or something in there, maybe you need to think about how to design that town so that those animals can get to and fro.

I was actually involved in a study, or a project in Canmore where we were looking at corridors in relation to that general area.

Now, let's put this in a perspective of one of the species that Keeyask took a look at, the threatened olive-sided flycatcher, this was a VEC species, and just look at those concepts. So this is a species that migrates, it winters in the south, spends its summers in the north. So it has a very large landscape. Of course, we can look at landscapes of different scales, but that's one way of looking at it, that's a very large landscape.

We see it in North America, in breeding habitats, it can use natural habitats, but it also used log forests. And the interesting thing and the important thing about this particular species is that when it uses these log forests, the scientific evidence that is available tells us it can occur in high densities, but it has poor nest success. The understanding is that it is probably in relation to nest predators.

So even though it has high densities,

because of this low nest success those areas actually may be sinks for this particular species. And that's the case where when you look, when you first look at the habitat, if you don't think about those other species, those nest predators, that habitat has high intrinsic quality. But when we think about the impact of those predators and recognize that these are actually acting as sinks, that's not the case for realized habitat. In those particular cases, if we looked at that in terms of Lambda, the Lambda would be below one.

So the point here is that a high density does not necessarily mean high habitat quality. In fact, in the COSEWIC status report in 2007 on the species, the same report cited by Hydro or by Keeyask, the forest industry was implicated fairly strongly for the decline in this particular species in terms of numbers, both in the United States and Canada.

Now, most of my work here has related to the draft report by Ecosystem et al called Habitat Relationships and Wildlife Habitat Quality Models for the Keeyask Region, this was is 2013 report. I think it was provided in September or something, towards that time period.

Anyhow, when I looked at this report, one thing I noticed was habitat quality was not defined, in terms of a universal definition. So if I went to the glossary, there is no definition of habitat quality. So I'm left wondering exactly what the meaning is here. Now, it was defined by species in specifics. So for each of the six modelled species -- actually I can only say for the two that I looked at, the olive-sided flycatcher and the beaver, species was defined, or habitat quality was defined. But the way that habitat quality was defined, it was primary and secondary habitat. Again, when I went to the glossaries, there was no definition of what primary or secondary habitat meant in the glossaries, or within the document, except again on a species specific basis.

Now, if you look at Fuller, the book that I cited in terms of the references, the definitions for various things, and you look at Johnson as well, 2007, which was another reviewed document, a paper on Condor on reviewing habitat quality and habitat, you don't see these terms used there as well.

So I'm left wondering what exactly do

these terms mean? When I'm thinking about habitat, I'm thinking from the perspective of what is a source and what is a sink? What is the relative value of these habitats in terms of how they contribute to a population? So I'm wondering, is primary intrinsic, and secondary intrinsic, or are they both realized habitats? Is primary a source, secondary a sink? I really don't know.

Now, let's focus now on the beaver habitat quality model. And these are the key assumptions and approaches used within Keeyask. The focus really was on terrestrial habitat, the shrubs and the trees. This would have been based on literature, scientific literature that assesses the food value of these things based on cuttings. So beaver go up into terrestrial environments and they cut these things down, and you can see that a shrub was cut, and also the contents of winter caches. There is a bit of a problem with that because we don't actually know if those animals eat those things. Beavers use cuttings for various things, including building dams, building lodges and the like. In terms of the winter caches, I think that we can generally accept that

that's food.

Other than what they call the marsh course habitat type, aquatic habitat and aquatic plants were virtually ignored. They rated aquatic plants of low value and woody plants including alder of much higher value, and alder was rated to be an important food.

Another thing that it did in this model is they considered 100 metres from the shoreline to be relevant in thinking about what beaver would use in terms of their habitat.

Now, here is some facts about this. Again, I think I already said this, you know, cuttings are more than food. And the other thing, very important thing here is that beaver, even though they build this winter cache to tide them over the winter, is that they can forage in other places for food under the ice.

When I look at the use of alder, well, alder was the word used in the report, two species of alder were cited as being potential beaver food, speckled and green alder. I would presume that when they are talking about alder, they are pretty well talking about speckled alder because that's the one you see growing near water.

My experience in very different environments is that I don't think that I have seen green alder cut, it is typically in a different environment. However, to be absolutely fair, I haven't seen these ecosystems and they may be very different.

The point here is that speckled alder as a species is very, very difficult for a beaver to digest. Essentially what happens is if speckled alder is fed to a beaver and the beaver has no other food, the speckled alder sits in the gut and does not move through the gut because it is poorly digestible. There is anti-nutritive factors there that impede digestion. The idea behind this is that plants maybe have evolved some of these mechanisms not to get eaten by a herbivore. And I cite Fryxell, 1994, where that particular understanding comes from.

95 per cent of the shrubs and trees cut by beaver are within 50 metres of shoreline. This comes from a study that was done in 2011, Stoffyn-Egli and Martin Wilson. So this was a review study. Essentially they looked at the literature that was out there, and this was their findings, that 95 per cent of food was within 50

metres of shoreline. So that's, I would say, contrary to what, the way -- you know, Keeyask considered 100 metres, this suggests that you should only consider 50 metres. If we want to look at this in another way, of 20 trees or shrubs that could be cut by the beaver, 19 would be in that first 50 metres. So the bottom line is, there is absolutely no way, if you are actually looking at constructing a model, that you should be valuing the first 50 metres -- or the last 50 metres, i.e. from 50 to 100, the same as the first 50.

Now aquatic habitat is also very, very important, including in winter. And what I'm going to do is I'm going to talk briefly about a few studies that have been done in Manitoba, and Keeyask didn't cite any of these studies. In some cases I can understand they are a little bit difficult to get at, but in some cases these are part of the scientific literature and easily available. So Nash in 1951, that was actually a study done on beaver in Northern Manitoba, and he found that caches actually were found within -- or rhizomes, pond lily rhizomes, which are -- how would I describe it -- it can be very long and

skinny, but they would be essentially something that we would expect to be high in starch, high in energy. And he found that they were actually stored quite frequently in caches, and some caches having lots of them.

My supervisor was a guy called Bob MacArthur, out of the University of Manitoba, that is for my masters thesis. And Alvin Dyck and Bob did quite a bit of work in the early '90s. They looked at things like temperature in lodges over the course of the season, oxygen in lodges, a lot of work was focused on bioenergetics. He was looking at putting beaver in water, cold water, and seeing at what temperature of that water they might have to use extra energy to keep warm, in one fashion or another. This is called looking at the thermal neutral zone, and also the lower critical temperatures at which they start to expend energy one way or the another, either if it is too warm or it's too cold. So they did a bunch of work on beaver. They put radio transmitters in beaver, they followed beaver on the lodges.

My particular work I looked at body condition of beaver, essentially how fat changed over the course of the annual cycle. Also looking

at protein and ash, and I also looked at the gut dynamics, because I looked at the cecum in particular, because some of these animals like a beaver, rodents, are what we call hind gut fermenters, they can actually get some of the cellulose out of the diet from their hind gut. So I was looking at just how the gut changed over the course of the winter.

Now, in my work and in other people's works -- in my work, one of the things I want to say is that when I looked at the fat dynamics of the beaver over the course of the winter, is they actually seemed to put on fat and maintain fat throughout the winter under the ice. And when I looked at the scientific evidence that was out there in relation to the energy that was available in the caches, and these kind of things, just looking woody vegetation, it became apparent that, and also with McArthur's work looking at the energetic requirements, it became apparent that we wouldn't expect that the energy in the cache to support those animals through the winter. Which, again, leads us to think that they have got to be getting some energy from some place else, food from some place else.

Now, that was 1995, and here we are 2013, 18 years later, and he has applied a new technique that was being used I think when I was around, but it really has taken off I think. Presently being used actually to try and look at wolf diets in the Duck Mountains right now, in relation to the moose issues we have up there. And what they found, looking at using stable isotope analysis, this was a population of beaver in Voyageur Park, I think it's a national park in Minnesota, what they found is that about 55 per cent of the diet was aquatic plants, including in the winter, including in the winter.

So, again, this is telling us that, you know, it looks like these aquatic plants are quite important to the species in the winter. You can understand, I mean, why we wouldn't know it until you get these types of techniques, because it is pretty darn hard to study beaver under the ice in the winter. I mean, when I did my study I thought to myself, geez, I would like to get under there and do some scuba diving under the ice. It is still on my bucket list but -- you know, difficult to study. We can understand that people would look at cuttings and look at the cache and

just focus on that. But now we know, you know, that this is important.

And I also -- the other thing I want to note here, one of the studies by Alvin and Bob where they had transmitters on animals, in one of the cases -- well, they documented a number of cases where the animals would leave the lodge and be there under the ice doing something in cattail patches. So we can only presume that they were feeding there, because why would you do that unless you are getting something out of it? And of course, there had to be oxygen there, because I think the longsest time was 43 minutes or something they spent out there. So that's way past, you know, how long those animals can actually dive for without oxygen.

Okay. So now, you know, that's the situation, we do know that aquatic plants can be very important, including in the winter.

So looking at this now, when we look at the Ecostem et al 2013 ratings for plants, it is completely inconsistent. They bascially rated the aquatic plants very low. Well, at least in Minnesota for sure we know they are more important. And that's assimilated energy, by the

way, that's actual energy that gets into the animal.

We see other sort of various other inconvenient truths relative to the information by Ecostem and the beaver habitat model. For example, they cited a paper, Lancia et al, I think it is 1982. This was a paper where the guy studied two beaver, or they studied two beaver colonies in Massachusetts, and they were looking at over winter lodge temperature, that's Massachusetts, and arrived at the conclusion that the over winter temperature was typically around 0C.

Okay. Bob MacArthur and Alvin Dyck, in the Whiteshell, a much more northern environment, a colder environment, more relevant to Keeyask, studied 14 colonies over the winter, and found that over the course of the winter the average temperature was about 10 degrees C or more.

Now, I believe, I read that Lancia et al paper probably 15, 20 years ago. And I'm almost wondering, I would have to go back to be certain, but I'm almost wondering if there was beaver in that place. I mean, Massachusetts is

pretty warm. I mean, maybe those were unoccupied colonies, who knows? I mean, there is an obvious difference here.

The bottom line is there is this literature here for Manitoba that was completely ignored, and here we have Ecostem itself citing studies from Massachusetts.

Okay. And this is just a quick look at a little bit of my data from my thesis. And so, again, this is total body fat as a percentage on the one axis, Julian date. So Julian date, 365 would be December 31st, and this 450 over there is actually about March 26th. So you can see that these beaver are still pretty fat.

Essentially, what I concluded looking at my sample was that where they really started to utilize their fat was probably almost, probably around breakup. So these animals that I looked at, some were from Netley Marsh, some were from Cooks Creek, around Winnipeg. And so you have spring breakup, particularly in streams where all of a sudden you may get a lot of water going through the system, and it probably is a difficult time for those beaver, certainly in terms of foraging aquatics. The water rises and you have

got some maybe more difficult times. Maybe that's just when they just utilize their fat resource. But that's after the cache is no longer there.

Okay. So there is no explicit definitions in Ecostem et al, the report, except what they do say is that primary habitat are coarse habitat types meeting all food requirements. Again, this is terrestrial food only, other than coarse habitat type marsh. And they defined secondary habitat as providing additional source of less desirable or and potentially less abundant browse, or as a secondary source of lodge building materials.

So, again, it is looking at the secondary, it doesn't even include -- it is not including any aquatics. We would see some of the aquatics in the marsh.

Again, taking the approach of source, sink, intrinsic or realized, and fit, thinking about fitness, what is the meeting of primary and secondary? We have no -- it is certainly not input in those terms. So what does the dichotomy really mean? Again, I look at it from the population perspective, what does that really mean, primary versus secondary? Does secondary

produce 60 per cent of the realized habitat that primary wouldn't? I really don't know what the relationship really is there.

But when I look at some of the plant communities that are cited as secondary habitat, and again I will stress that I haven't sat down and looked at the report and seen exactly what plants are found in those communities, and what abundance levels of those plants are, but I look at them just at face value, and I look at that and I would say that's not even realized habitat. That is if you put an animal into that habitat, it would not make it.

Now, let's look at the validation test of the model. Again, terrestrial, it was only supposed to be looking at terrestrial vegetation, other than marsh, so again ignoring all of the aquatic food. This is what I find quite bizarre, lumping active and abandoned lodges together. So when they did their test, they didn't differentiate between active or abandoned lodges. 53 per cent of the sample was active, that means 47 per cent was abandoned. My immediate question is, why lump? Again, I'm looking at this from the perspective of source, sink.

Maybe, I mean, we can see lodges abandoned for many reasons, but the immediate things that comes to mind is maybe the beaver left those lodges because the resources had run out, maybe the resources were limited to begin with and now those resources are gone, maybe that's why they are gone. I mean, you can certainly envision that.

Even as a scientist, my immediate look at this would be, I wouldn't assume right from the start that we should be looking at active lodges and abandoned lodges collectively. To try and understand what is going on, we should maybe see how the habitat types differ, and that might help us, you know, differentiate between the two, and help us understand if maybe where those abandoned lodges are, are abandoned because the habitat differs.

Again, 100 metres from the shoreline considered habitat. In my view, anything beyond 50 is very low realized habitat or not realized habitat at all. What happens is, of course, you have greater chance of predation as you move further away. And one of the things I want to just bring up here is that, again, the paper that

said 95 per cent of the food was, the trees and shrubs were accessed within 50 metres, that was a collective of studies from all over. So that could include studies where there wasn't big predators. So maybe if we get into the boreal forest where there is wolves and bears, and wolves can take quite a few beaver during the summer and fall, maybe it is way less than 50 metres. I haven't looked at that, you know, I would have to sit down and tease that information apart. But it certainly seems to me that beaver foraging in an environment where there is wolves and bears would have different risks associated with it than a beaver foraging where there is coyotes and raccoons. Of course, there is energetic costs that you have to think about as well.

So how did they test it here? Basically what they did is drew circles around the lodges, and they drew circles of different scales, 100 metres around the lodge, 250 metres, 500 metres, 1,000 metres. One thing I should note here is this is not an uncommon thing to do when you are trying to understand habitat selection. But I have seen it with terrestrial animals, so not uncommon with terrestrial animals.

And what they did was, in terms of determining what was selected, the coarse habitat types representing 80 per cent of the area within circles was treated as selective. In other words, as I understand it, the other 20 per cent was discarded as, I don't know what it was, but it was discarded.

Now, let's take a look at a picture from -- this is actually out of the Keeyask report, of a lodge right here. And I'm not sure how well the picture shows. I used to have a builders thumb and be able to estimate distances somewhat. But when I look at this, if I was to put 100 metre circle around here, well, you can see actually -- just to backtrack -- you can see these spruce along the edges, and you can see what looks like aspen or maybe black poplar or something behind there. When I looked at this I thought, okay, well, you put 100 metre circle around here, well, you are going to get lots of water -- of course, we don't know what is on this side -- but you are going to get lots of water. Maybe you will get the edges of that into the spruce. Maybe you might get a little bit of that high quality, and it is high quality aspen, or

black poplar. But when you start thinking about this as only including 80 per cent, that stuff at the edge is 20 per cent, you are going to discard that. Well, that doesn't make sense.

What really has happened here -- and the other thing that you see here too -- and so the bottom line is when I'm looking at this, looking at this for a semi-aquatic species is that the aquatic -- my view is that aquatic component of the habitat should have been considered completely independently of the terrestrial. What they did was they put a terrestrial model together here, and actually when they did their tests, they have got all of this water that they are considering, which is absurd. They should have just been looking over here if they are going to test the terrestrial model. If they want to only think about marsh and ignore the pond lilies and all of the many other aquatic, then they should have looked for marsh within the water, and treated the two independently.

In fact, what actually happens when you look at their so-called test data is that now, of course, you have a high selected for water, not surprisingly when you are drawing these circles

around the lodges found in water.

This is really an artifact, you know, doing something like this is an artifact. What it does, it attempts to mask or hide real effects.

And I had earlier indicated that, you know, it is not uncommon to draw circles around sites in terrestrial habitats. And I don't think it is appropriate for semi-aquatic species that spends time in water and also on the land. And it is really, in my view, something like trying to pound a square peg into a round hole.

Again, assessed, they assessed that 50 to 100 metres out from the shoreline the same as zero to 50, and again, that can mask real effects. Again, if we are just looking at the 100 metre buffer here in the circle, you know, or if we were just looking at, even ignoring that part, if we were just actually taking this right from the shoreline and we were including everything 100 metres out, let's just take as example, let's say you had aspen 20 metres out, or 30 metres out, and then it was all spruce. Well, that's 70 metres of spruce and 30 metres of aspen. You actually come to the conclusion based on that sort of a test that the spruce is actually of more value than the

aspen. Whereas if you are only looking at 50 metres, it is the aspen that's more important. Again, some problems with the scale in the test.

Okay. Back to Robert Fuller for a second. And this goes to the whole idea of what we really should be thinking about when we are doing these tests. And what he said was the extent to which an individual or a population depends upon, or shows disproportionate use or avoidance of a defined habitat type. So it can be positive, neutral or negative. All that is saying is when we are thinking about whether an animal can associate positively or negatively, or not at all with a habitat, depends on if it uses it more than it is found out there, within the area that it can select from.

Okay. The Ecostem, basically they really didn't test habitat association, which is what you really need to do. Because it didn't relate the habitats that were found in the circles to what habitat was available. So in the absence of doing that, I'm really not quite sure what they are testing, you know, what the value of this validation is.

What they did say was, of the 139

beaver lodges examined, only 28, or 20 per cent, were directly on areas identified as primary habitat. Again, it does not demonstrate association, because you have to have an understanding of how much primary habitat is available from which to select. If there is, if the landscape consists of 80 primary habitat, then that animal is actually avoiding that 20 per cent, or that identified primary habitat.

So, exactly -- the other thing, looking at this thing directly on areas, what does that even mean? I really don't understand that.

This is another thing they said, for a conclusion, tall shrub on riparian peat land was predicted correctly and ranked fifth. Now, this particular one, it is a primary habitat, that tall shrub on riparian peat land. Let's actually look at the data. Okay. Here is tall shrub on riparian peat land right here. So it says it is predicted correctly. Well, in fact, this is primary habitat, according to them, presumably it is better quality than secondary habitat.

What we see is that, in fact, there is four types that were ranked higher, at least just looking at the 100 metre for now, but it is fairly

consistent throughout. One with shallow water, it is not surprising, again, it shouldn't even have been in the test. These two are secondary -- these three are secondary habitats. So in this case you have three secondary habitats ranked higher than your primary. Shouldn't your primary habitat be ranked higher if the model is working?

There was, I believe, three above and four below. So, effectively, it predicted, according to their data the way it has been presented, it was about the same as the secondary habitat, so right in the middle, when the primary should be better.

Two other notes relative to this. There is this Nelson River stuff. If you actually go and look at the details, there is different types of Nelson River, and in fact, some of the Nelson River is designated primary habitat in their initial ratings, and some is non habitat. So I'm sitting here wondering exactly what this stuff is? Yeah.

So anyhow I have trouble seeing how those, how they ever arrive at that conclusion from those data, as presented.

Okay. So after going through this

exercise with all of its limitations and failures and problems, here is the conclusions. No need to change the beaver habitat quality model. But in my view, it failed to demonstrate any positive association. The numbers don't show anything. I conclude failure. And in fact, the validation tests in and of itself is not a valid test, and I would say this because they were considering habitat all the way out to 100 metres. Right there that invalidates that test in my view.

Even if you went through an exercise of numerically doing this and rating this, what you would do is you would rate the first 50 metres as .95. So if you took that habitat, that first 50 metres, and you were rating that habitat, it would, that habitat would constitute 95 per cent of your final score. That last 50 metres would constitute 5 per cent. Essentially it has no impact. So really you should be looking at the first 50 metres.

Okay. I just want to talk a little bit about what model, how it was sort of defined within the report. Model validation is an evaluation of how well the model performs relative to its intended use. This was out of the Ecostem

report.

So intended use -- well, I guess I really don't -- I haven't read the documents. Maybe some place presumably in there it does talk about intended use. But my expectation would be that the intended use would be to accurately predict beaver habitat quality. And I can't believe that we have got that here.

And again, I'm just going to preface this by saying, the whole reason we do these studies in places like this is because maybe these animals might, living in this environment, might act differently or use habitat differently than what we know from the scientific literature. That's the whole point of doing this. So we should be looking at the data on site, not the literature. The literature informs us, but we also -- the whole point of these studies is to look at what this site tells us. So, again, coming up with a model based on literature, et cetera, and then running some data that doesn't support that model and just saying, oh, well, the data didn't support the model, we are not going change anything, it just seems really problematic to me. Why collect and test the data if the

appropriate test is not made, or the data will be ignored? I mean, what is the point? Why do we even go through the point of collecting the data is really what I start to wonder?

Okay. I'm just going to briefly talk a little bit about designing and conducting field surveys of animals. Again, I have had some experience in this, fairly broad experience from waterfowl to big game moose, a little bit on amphibians, some limited bird stuff. So I have had some experience, mostly waterfowl and the birds. So that's my background. But, you know, there is challenges to doing surveys, so I just want to maybe talk a little bit about that. And where I come from, again because I'm the bottom line guy, because I'm looking at what does the data really mean? So if you are really looking at what the data means, you have to understand what the limitations of those data are. I mean, we can collect lots of data. Let's just talk about a recent example, we just went through -- and this has nothing to do with biology -- but if you were tracking what was going on in Brandon/Souris in the Federal election, there was some kind of polling that was being done that was putting that

candidate, the rural candidate way ahead. And also say a guy like, Greg, I think it is Greg, who is a fairly reputed pollster, said that there is some methods being used right now that are terrible methods. Okay. Well, we saw a case there probably where that polling was way off. So you can apply any kind of method, but that doesn't mean that the data that's coming out of there are reliable, it doesn't mean it is truthful.

So, anyhow, when I'm looking at utilizing data and information, I want to understand what the limitations are, how credible that information is, and where the biases are. So, yes, we have -- when we look at doing field surveys, there is various factors that we take into account in terms of trying to design a survey that's appropriate for the animal. We can see with Keeyask that they used different survey methods for different animals. For the rail, they used basically a remote recording device. Seems fine to me, I don't know much about that myself, but that was probably workable for the working conditions and the like. Whereas for the olive-sided flycatcher they used a different method which relied on listening for the bird to

call or sing.

Now, what are just some the challenges? And I'm not going to go through a whole lot here, but when we look at bird surveys where we are trying to determine what is out there by their songs or their calls, there is a number of challenges, and it can be difficult to actually hear those calls sometimes for some people to identify them. So there is those kind of things.

When we can put people into aircraft, and I'm most familiar with waterfowl surveys from aircraft and big game surveys from aircraft, I can tell you there has been all kinds of really bad things that happen in terms of survey methodology with aircraft.

When we look at moose and deer surveys, for example, people -- what you do is you try to control for the problems with your data by setting standards and adhering to those standards. But I have seen situations where the people flew the aircraft too low because the snow was so bad because they couldn't see very good. Well, that's a good time to abort a survey because you are going to get bad data. But they do it. Situations where people are getting sick in

airplanes, there is -- part of the exercise that Manitoba Conservation goes through right in doing their moose surveys is they have a public relations component to it. They like to bring people from First Nations and all kinds of other people up in the aircraft and the helicopters to give them a sense of what is out there and how it works. And that's fine. Last winter there was a survey going and they had to come back four times because three people got too sick in those aircraft. Well, if you don't think that that doesn't impact on your data, you have got another thing coming.

So I have seen, you know, I have been out in an airplane counting ducks with a guy looking for broods, where the glare off the lake was so bad that it was terrible and, you know, I went out the next day on the ground, and the species that he was identifying were completely different.

So there is all of these challenges, and you try to collect good data, but sometimes you know, what schedules are such that people do things they shouldn't do.

So let's look at surveying for

olive-sided flycatcher, and this is -- the first thing I want to cite is the habitat of the species. And this was cited in the Ecostem report. So it is most often associated with open areas containing tall trees or snags for perching. Open areas may be forest openings, forest edges, near natural openings such as rivers, muskegs, bogs or swamps, or human made openings such as log areas, burned forest, or open to semi-open mature forest stands. Generally forest habitat is either coniferous or mixed coniferous. And in the boreal forest, suitable habitat is more likely to occur near wetlands.

So when you filter through all this stuff, certainly edges is important to the species and that was certainly recognized in the Ecostem report. By edge we are typically meaning hard edge here, but not always. But hard edge is where you have a very abrupt change from one habitat type to another.

Okay. Now here is the method that was used for the survey of olive-sided flycatcher, and this is from section six bird's report. Breeding Bird surveys were consistent with standard procedures and included using the point count

method for olive-sided flycatcher. Now, what is critical is stand procedures. We have got a partial definition here within the document, but we didn't get the full story. When we think about estimating distance to bird, for example, in forest cover is very difficult. And it can differ in relation to a number of things. The type of forest can impact how that sound transmits through the forest when the bird makes a call. The height of the bird within the forest is going to have a bearing. The observer, certainly, you can have some observers that -- well, I will give you an example. A fellow by the name of Keith Hobson who is a fairly well renowned bird scientist working for Canadians Wildlife Service, someone who had worked with him, who was quite involved in doing bird work, told me one time he was quite upset because as he got older, he couldn't hear brown creeper. So even a guy, you know, he knew what he was doing, just the impact of the age, I guess the frequency that he could hear bird sounds had changed over time. But observer variability can be a very significant factor.

Weather conditions, the amount of wind, or other weather conditions could impact

whether the birds are calling or whether you are able to hear them. And in fact, when you look at standard bird surveys, methodologies, one of the things you try to constrain is, you don't survey under conditions of certain amount of wind.

Simons et al in 2009, this was a review document looking at various literature on what impacted on data, concluded that measurement error can be substantial. And this is basically how far out is that bird? If you are thinking, say you have a 50 metre plot or 75 feet plot, or whatever it is, your ability to decide if that bird is inside or outside of that plot, there could be a lot of error associated with that.

And this is a schematic that I have pulled from a paper by Hobson and Schieck -- Schieck is a guy that has done tons of work out of Alberta, and Keith Hobson. This is just to illustrate what at least one standard procedure might be, okay, so a 1999 paper. And this is the forest stand, this is the boundary or the edge of the forest stand. Outside of that would be some other type of habitat. And in this particular case they have got 50 metre radius plots. This is their transect. And in this particular case you

can see that they have offset each plot by, in this case it would be 100 metres. And again, that's to try to ensure that when you -- if you had your plot right next to it, good chance you might even be counting birds right next that are in that plot when you are counting over here, because of the problem of being able to estimate the actual distance that bird is calling from.

So they were both offsetting their plots, and they were offsetting their plots from the edge, minimum of 50 metres. Okay. So they would not get closer than 50 metres. The whole idea behind this thinking, and this is sort of first approximation understanding bird habitat, is that birds, when you have these edges you are probably likely to have birds from different types of habitats there, and probably have high biodiversity. And this could confound trying to determine the relationship between this particular type of habitat and the bird associations. So that's the reason these are offset, so you don't get these confounding edge effects.

In their particular case, and this is in reality in doing this kind of work, and obviously it was a reality for Keeyask, is that it

is not always easy to find plots that are large enough to actually meet this. So in this particular study, in 9 of the 18 stands -- this would be called a stand, this area -- in 9 of the 18 stands they were able to meet the criteria. They were shooting for 100 metres, 100 metres from the edge for their plots, not this 50 metres, but they were shooting for 100. So in 9 of 18 they actually were able to achieve that. In the other 9 of 18, I think that was 9 of 18 transects perhaps, I would have to go back and check, but in 9 of 18 other cases some percentage of each, some percentage of the plots were between 50 and 100 metres away.

Okay. So that's one standard procedure, first approximation of bird habitat, where they were trying to control for edge effects by doing this.

Going back to Fuller, what he said was restricting sampling to part of any environmental gradient can give an incomplete representation of habitat association. So I'm just going to go back here for a second to speak to that.

Again, this is something when I started, and I can't say that I have a lot of

experience with this, I have some understanding of this type of survey methodology, but when I started first being exposed to this some time in the '70s, I think it was, what came to my mind was okay, that's good, that's all good, but, you know, now we don't understand what is going on within those 50 metres and that edge. So we only have and incomplete understanding of bird habitat associations. And in fact, when you actually start to think about this, again, from a practical perspective in doing these studies, you have to find stands of a certain size to be able to do this. And in many cases the stands are too small. So, again, those ones we are not learning too much about too. So it is a first start, in my view, but there is a lot more work to be done.

Okay. Let's look at what Keeyask did. So Keeyask had a 75 metre radius for their point counts. Did the proponent -- or did they locate their plots away from edges like Hobson and Schieck? And the document doesn't speak to that so I have no idea. Using my sleuth like capabilities, I was able to determine something, but it doesn't speak, it is silent about this.

What we do see is TetrES in 2004, and

TetrES 2004 report is on the 2001 sampling program, and I think that was the first sampling program. It states:

"Transects were located within relatively homogenous habitat."

So that suggests to me that they are trying to stay away from edges. In the bird's volume it says:

"Final selections were within habitats that were as homogenous as possible."

So, again, trying to keep things homogenous to the extent possible, suggesting stay away from edges. I am wondering what final selections were; I have no idea. Does that mean they threw out a bunch of data? I don't know. But I kind of wonder what is going on there.

But I can understand why this happened. And without looking at it in detail, you know, I looked at TetrES 2004, but it seems like probably the base habitat types probably changed over the course of the data selection, or the data collection program. They probably started, my recollection from TetrES was they were using forest resource inventory maps, aerial photos, topography maps and so on to come up with

their sampling areas. You know, so now we are going from forest resource inventory maps to base maps as to how you might locate your plots, to a whole other system which is all of these course habitat types and broad habitat types and that type of thing.

So I could envision -- usually what you do is you start with your base map and then you locate your plots. But I can envision they located their plots and now they have this habitat map that they are superimposing on the plots. And I can see that creating some challenges and questions.

And I did get a little bit of a touch of it. I didn't get on the first go through of the reports, but when I went through again, I noticed this footnote in table 7.2, and it said some plots include several broad habitat types. So we do have some understanding here that some of these plots had some edge in them, because they had several, maybe more, two, three, four, I don't know, different habitat types in there. So that indicates that there could be -- that suggests there is edge in there.

We don't know, you know, it is not --

it doesn't tell us why that happened. I mean, I can speculate as I just did. We don't know -- why would you do that? How many cases, is this just a few cases, is it lots of cases? We don't know. This is important.

So the question, I guess when we get to the end of the road the question is, did Keeyask match the sampling design to the biology of the species for olive-sided flycatcher? I really can't answer that, I just can't. Because I don't know -- thinking in retrospect and knowing something about the biology, obviously if the edge is important for the species, you would want to set some plots around edges. But what was the standard procedure? Well, if we looked at standard procedure from Hobson and Schieck, it was to set your plots away from edges. Is that what Keeyask tried to do? I don't know. So I can't really answer that question. But the implications are, the implications to me are that if you would tend to set your plots away from edges, is that maybe you are not going to detect that species out there or have a complete understanding of that species.

The bottom line is that if you were

designing a survey method for olive-sided flycatcher, is you would sample edges, you would sample edges by design. You would want to sample some edges. And we don't know if that happened here. It may not have happened.

Let's talk about the model that was developed. So this is where the primary and secondary habitat types are defined. So what is -- the primary habitat is old and mature needle forest, woodland spruce dominated, or late successional open and semi-open coniferous, and/or mixed wood forest within 50 metres of an edge. It is important, 50 metres. So it could be a burn that is between, also could be a burn that's between five and 15 years, beavers ponds, snags, water, bogs, muskegs, open areas with snags and lakes with standing dead trees, or adjacent to poor wooded fen, rich wooded fen, and wooded swamp. So, again, the edge, that 50 metres is important. It is recognition that edge is important.

Secondary, young needle forest, woodland spruce dominated or late successional open and semi-open coniferous or mixed wood forest within 50 metres of an edge. I think there is

probably an error here, because the late successional open and semi-open coniferous and/or mixed wood forest is in both secondary and primary habitat. Not a big deal, but that should be straightened out.

So, anyway, that's the definition there.

Now let's look at some of their data. This is their test of the olive-sided habitat quality model, table 7-4, and this is provided as evidence of the model working. So, for example, the broad habitats with the highest recorded densities include black spruce dominant on ground ice peat land. Now, this is up here. So we can see some data up here.

Okay. One of the problems with this data as presented is, to really evaluate it, it would help to have the sample sizes here, it really would. So, just the example that I use, okay, so you have this that's supposed to be pretty well the best habitat, highest recorded. And when I look at -- there is one here, trembling aspen, okay, this is supposed to be not habitat. That's not habitat at all according to their model. But if you take a mean of all of these, if

you take these numbers and average them, there is nine of them, and you do the same for this, you actually get an average that's very close, hardly any difference.

So I'm sitting here thinking, well, geez, you know, this is non-habitat, it has got the same -- the same average, the same mean as this stuff. That doesn't make sense if that model is working. It doesn't make sense at all.

Now, just looking at this trembling aspen, I mean, you can see it was only found in one year, you know, maybe some strange artifact, who knows what that is about? Again, that doesn't support the model.

Another thing I just want to point out is this human infrastructure. I am not sure what that is, if that's logged areas or roads, I have no idea what that is because I never looked at these things. But note this, so these have been observed in the area, something called human infrastructure. And given what I know now, after reading the information about this particular species, is we know in logged forests, those are sink habitats, to the best of our understanding. And so this makes me concerned, the fact that we

are putting this kind of infrastructure in there.

Okay. So their conclusion, Ecostem's conclusion was:

"Model performs well because the majority of field observations found within primary or secondary habitat and, therefore, the model was not changed."

Well, again, we go back to the other -- the real need for the model is to, you know, was there a positive association with the primary and secondary habitats as required for predictions to be accurate? It is not addressed. Primary and secondary habitat -- well, I realize that the numbers are obviously low. But one of the things I would be interested in looking at, even with those numbers being low, would be is there separation between the primary and secondary habitats? You are saying the primary is better, but what does your data tell us? Because maybe the secondary habitats had higher numbers, I don't know.

What they did say also is that 41 per cent of observations were non-habitat. Well, to me that seems rather high, almost half their

observations were non-habitat. Why would you not think about -- or why would you at least not provide us with some understanding then as to why you ignored that habitat? Almost half the observations, what was the reason for ignoring those data? They are non-habitat, why did you ignore them? Why does that the habitat not count, and should that model have incorporated those data? Well, at face value you should be thinking about half your data as important, and at least give us a reason as to why you didn't incorporate that information.

So one of the obvious problems with the model as constructed, density, okay, we know that density was based on, what they call density, it is really singing males per plot or something like that. We know that can be misleading for the species, so that can be a real problem with the model.

I looked at this in terms of the model, and they come up with a 50 metre edge, defining habitat as being within 50 metres of an edge. Well, geez, you know, I hate these round numbers, I'm looking for some biological explanation. Why wasn't it 32 or 73, what is the

empirical basis? Where is the data to support this 50 metre width, or the argument, or something?

Similarly, they indicated that forest five to 15 years old after fires were considered to be habitat. Again, where is the basis for selecting five to 15? You know, it is not there.

Again, I look at this thing and I say, where is the evidence to support the model? The model may work, I don't know, but I see no evidence, the evidence is not there.

Okay. I'm going to move over to the wildlife VECs portion of my presentation.

When I started working on this particular project, one of the things that we wanted to accomplish was to look at the whole issue of VECs. And what I did find was that there is not a lot of literature on VECs in terms of peer reviewed type of literature on maybe how these things should be selected. So one of the documents I did come across was this document in 2012, it was done by I think a graduate student of Brown and Noble, so I think you heard from Noble already.

So he reviewed some VEC literature,

principally in the context of cumulative effects assessment, but he also was looking at it in terms of project assessment. So his conclusions were, one of them, were surprisingly little research has been done in past few decades to examine the principles, processes and rationales applied to VEC selection in either assessment modality.

So that's what I was starting out trying to do, but didn't find a whole lot out there.

And secondly he says, there remains a considerable gap in terms of understanding the processes applied in selecting VECs in project EAs and CA.

Okay. Let's look at what Keeyask did here, and this is in their introductory section, section 1 of the terrestrial report.

So my evaluation looking at this, while I looked at this and seen that the criteria for selection were reasonably well communicated, and the specifics were provided in table 1A3, so that's fine, seemed pretty good to me.

And you know, when I looked at what literature was provided, I don't think there was any specific literature directing how one would go

about selecting VECs. However, there is not much out there, so I find that understandable.

There were some issues. And I think it really is principally a matter of the lack of standards and process and like in terms of selecting VECs, that would be my belief, and some matters of transparency, where I think the proponent could exhibit greater transparency.

So when we look at yellow rail as a species, again yellow rail was initially selected as a species to look at, it is a species at risk. There is information within the document to provide direction on the decisions that were made by Keeyask. But yellow rail is not selected as a be VEC, whereas other species at risk were. So my immediate question to myself is, well, why not?

Well, they didn't find any in their surveys, so I will presume that's the reason. I didn't see them saying, well, we didn't select yellow rail because we couldn't find it. But there is a criteria that sort of speaks to that. But at the same time, I never looked at the yellow rail surveys critically, in terms of literature on yellow rail surveys or anything like that, and I would have to start that even from a fairly

uninformed perspective. But I do wonder, okay, so what was the uncertainty in the surveys? So, just -- and what I mean by that, and I do data analysis in the science of statistics, and I'm referring to what we call type two error. And a type two error in that particular case, in this context, is we would conclude a species is not there when it really is. Okay. And there is all kinds of things that one can do to mitigate, to manage for type two error.

So, for example, if you are looking for a species at risk, if you don't sample very often, or if you sample in the wrong places, obviously there is a high probability of not finding that species even if it is there. And there is a high probability of type two error.

You mitigate that by having lots of samples out there. Whether Keeyask did that or not, I can't comment on, but that's what you do. In fact, in some jurisdictions because of this, they don't talk about presence and absence, okay, they talk about presence, not detected. Those are the two options.

I will give you a example from B.C. where I did some work. There is a species at risk

out there called the tailed frog, and it is a species found in, typically in fairly small fast flowing mountain streams. So they have designed a survey methodology -- actually the way they have designed it, they set it up so you have to sample for so much time and do it in a certain way. And what their understanding, given the studies they have done in designing the sampling technique, is their type two error, the probability of that type two error is about .02 per cent, very low, one in 50. Okay. So they have actually designed those surveys to mitigate and manage for that type two error. Because the idea being, when you are dealing with a species at risk, you should be quite concerned about type two error. That's the thing you should be concerned about. In fact, if anybody does EA out there, they have to do their surveys according to that standard. Okay.

So I'm sitting here, you know, wondering about, should level of uncertainty be a consideration when we think about whether a species stays in as a VEC or not? I can just throw that out as a question. I think it should be a consideration, in terms of how you actually apply something like that is something entirely

different. We can see how B.C. applies it with respect to tailed frog. And even if you don't find it, it is still treated as not detected. But it should be a consideration in the decision as to in VEC or out of VEC.

Looking at the northern leopard frog, which again was another species at risk, it was not selected as a VEC. It was looked for. According to Aboriginal traditional knowledge, it was quite common in the area at one time. It is no longer found there. The species did undergo a very broad scale decline in, I believe the '70s, some time ago. And I looked at, I have done a few amphibian surveys. What we see in the Keeyask document is spring surveys were done. Spring -- well, my experience with leopard frog, and that's mostly in southern Manitoba, the Minnedosa country, Reston country, down through there, a few other areas, is that they actually call later than some of the earlier species. Some of the species, boreal chorus frogs call early in the spring, we see that the leopard frog is typically calling later. For that very reason you should not be doing one survey, you should be doing surveys over a longer period of time. So when you design these

surveys, you are typically looking at maybe two or three surveys over the course of the summer, over the course of a sampling year, spring, summer.

So I guess I just look at this without actually having gone into the reports, individual reports, to try to see exactly when they surveyed. But, you know, maybe that could have been a reason why they didn't find some leopard frogs, I don't know.

And again this gets into the whole idea of level of uncertainty. Where did they sample? When I looked at the map and the report, Keeyask terrestrial report, section five, there is some maps at the back showing various samples from various places, but, I mean, a lot of those samples were probably uplands where you would never expect to see leopard frogs there. So, I mean, you really have to go into the data to start to really tease that apart to see what kind of level of uncertainty there is.

And this also goes to the precautionary principle here, okay, being cautious.

So I guess what I concluded after looking at this is that there is probably some

greater transparency needed to explain VEC selection. So I would suggest that it would be appropriate going forward to have a document that actually provides the basis for VEC selection in detail. So, I mean, an argument as to why, for example, the yellow rail weren't selected, explicit. I mean, I can look at sort of what has been presented and speculate, but I would like to see something explicit.

Another thing about VEC selection, one of the criteria for VEC selection was the high importance to local people, including particularly high importance to KCNs.

And I'm quite comfortable with that statement, I believe it is appropriate to over weight local and KCNs. But it does appear to have ignored others and I think it should not be so narrow. So, for example, Metis people, including Metis people I'm sure, in that area, I can't say for certain, but I'm pretty sure there is Metis people in that area that would have some fairly significant resource rights. I think it would be important to include them. And Manitobans in general, I don't think you can just discount people living in Winnipeg. And that seems to be,

from what I have seen with this statement, implicit.

Okay. Here is some of my conclusions and recommendations here, the larger picture.

So, my view is that data on nest success are required for the threatened olive-sided flycatcher. And given that realized habitat quality for the species can be wrongly predicted by density, that's really the key here, an attempt should have been made to collect data on nest success for the species.

Secondly, thinking about this at the landscape level, and recognizing, and I see this in my neck of the woods certainly with all of the logging going on in the Porcupine Mountains and Duck Mountains all around me, and recognizing that logging, as we understand the science right now, is detrimental to the species. That suggests to me that maybe those olive-sided flycatchers in the Keeyask area could be particularly important to the population. Maybe they are a great source, I don't know, but that certainly occurs to me and I think it is important context.

For assessment we should always consider going beyond simply counting, rating

individuals for rating species at risk, to at least attempt to understand realized habitat quality, source and sink, those kind of things. At least think in these terms.

Looking at this particular species again, looking at the biology, looking at the fact that it relates to edge, why would you apply a standard breeding bird survey method to it if that method actually tries to keep your plots away from the edge? You know, but we have to start to go beyond that too with these, once we do these plots and we are there, and maybe we should be starting to think about, you know, source and sink and nest success.

Survey designs for birds must be appropriate to the biology. As I said before, just before, we need to look at perhaps edge in terms of how we design surveys for olive-sided flycatcher. My view, after going through the various data in the document, is that there is a need to audit these data. I mean, there is far too much uncertainty about really what the data mean. I mean, I really think someone needs to look at this, they need to see these plots on maps, and they need to understand, you know, what

type of habitats are in these plots and what type of edges.

Another thing I didn't talk about is what we call pseudo replication in the statistical vernacular. One of the things I picked up in looking at the Keeyask documents and Ecostem documents, somewhere in there they talked about multiple surveys of plots. So what they did was they surveyed plots in consecutive years. So maybe the same plot was surveyed in 2001, 2003, 2004, I don't really know. But as a statistician looking at data and trying to draw correct inferences, correct conclusions from data, pseudo replication, which is what that is, is problem.

Just consider this, for example, if one was trying to understand the bird associations with two species of habitat, jack pine habitat and aspen habitat, and the way one did that was to put one plot in one habitat and one plot in the other habitat. And what one did was over the course of 30 days, went to that plot every day and counted the birds, same plot, you would have 30 data points, okay. If you want to draw an assumption from those 30 data points, it could be really off, right? It is really only one data point counted

30 times, and you really are just sampling what is happening at that plot through time. It is very different from 30 plots distributed in the same kind of habitat around the landscape. Which one is more credible to draw a conclusion from? That first one, 30 plots, the one plot done 30 times, I would be awful scared to draw conclusions from that. That plot could have just been located in a very atypical situation -- place. That's what we are talking about in pseudo replication. Pseudo replication is when you equate 30 plots from 30 different places to have the same value as 30 plots from the same place.

So we see that there has been some pseudo replication done here with the Keeyask data. I have no idea of the extent, I presume it is minimal, but I have no idea.

Again, I'm looking at these various kinds of uncertainty with these data, and I think an audit is in order.

In moving forward in terms of mitigation, I didn't look at what Keeyask had proposed in terms of mitigation for the species. But Robertson, 2012, is one of the guys that was involved in some of the research on this

particular species, actually provided some recommendations on mitigation, as to how one might try to do things on log landscapes to try to keep the species from selecting those places. So that's something that Keeyask should look at.

I'm not sure if they looked at compensation for lost habitat, that's certainly something that is being done in B.C., I'm not sure if Keeyask considered that, but that is something that should be looked at. And I'm not even sure how you would do that.

Effects monitoring, okay. For this species, my view of effects monitoring, given that you are introducing all of this development, it is going to be very important for the species. In fact, we already know from the data that was presented by Ecostem et al, that the species uses human infrastructure, whatever that is, in the Keeyask area.

Again, it was impossible really for me to evaluate the veracity of the olive-sided flycatcher habitat quality model given the information that was provided.

Looking at the beaver habitat quality model, it would be inappropriate for technical and

scientific reasons. Again, this is not considering aquatic separate from terrestrial habitat, they should have been looked at independently. And also using 100 metres versus 50 metres, and various other reasons, really ignoring that aquatic food, it is really -- the test was inappropriate.

Consequence of failure. We can think about that relative to the beaver habitat quality model. We know that beaver are very numerous across Manitoba. So the consequences in terms of biodiversity in number of beaver are pretty limited, but there are some consequences and implications to -- I can think of compensation for resource users. If the model is not properly constructed, you might see -- undervalue the loss, the resource that's been lost.

And just one other note on that, it is worthwhile -- I have no idea how Keeyask calculated what their losses might be to resource users of the beaver resource, I'm not sure if they just sort of looked at what habitat was there now. But one should probably really be looking through time. Because, of course, as you have been told, these ecosystems with fire in particular are quite

dynamic. Just because we see habitat there at this point in time doesn't mean that it could be much, much greater value later, after fires, or less value. So I think in compensation you need to look through time.

I didn't look at the other four habitat quality models, time and scope and all of those kind of things. I mean, based on what I seen of the other two, I would want to look at them critically given the opportunity. We see these problems with the first two. You know, does that mean the other four aren't very good? We don't know for sure, but --

MS. WHELAN ENNS: Mr. Soprovich, it is just me over here. I'm going to check with the Chair in terms of time.

MR. SOPROVICH: I'm done.

THE CHAIRMAN: Thank you. We are getting very tight on time.

Ms. Whelan Enns, if you are going to conduct a questioning of this witness, as you did with the witness earlier in the day, we will not complete today. And that means that we may have to strike all of this from the record, because I don't know when we would complete it. The purpose

of additional questions right now is not to have the witness completely restate the whole thing again, as happened this morning.

So having said that, if you have a couple of questions that you want to ask Mr. Soprovich right now, we will do that before the break. If not, we will return after the break.

MS. WHELAN ENNS: And are you letting us know that Manitoba Hydro does not have questions?

THE CHAIRMAN: I didn't say that at all.

MS. WHELAN ENNS: Just checking in terms of sequence, because this morning you basically suggested that --

THE CHAIRMAN: That was for re-examination. But if you have questions as part of the direct evidence right now, I want to keep that to a minimum. You did it this morning and it went on quite extensively and, in fact, did repeat an awful lot of what the witness had presented. Mr. Soprovich has made a very comprehensive presentation. So if you have more that you wish to put on the record, if he missed anything, I

will entertain that briefly, but otherwise --

MS. WHELAN ENNS: I think that you are correct, Mr. Chair, that it is fairly thorough and that we can stay with rebut.

THE CHAIRMAN: Thank you. We will take a break for 15 minutes, come back at 3:15.

(Proceedings recessed the 3:05 p.m. and reconvened at 3:17 p.m.)

THE CHAIRMAN: Can we reconvene, please? We will turn to cross-examination of this witness, Mr. Bedford.

MR. BEDFORD: Thank you. Good afternoon, Mr. Soprovich. Of course you and I have met on previous occasions.

MR. SOPROVICH: Good afternoon.

MR. BEDFORD: Mr. Soprovich, my understanding is that beavers are abundant in the beaver regional study area for the Keeyask project, is that your understanding?

MR. SOPROVICH: I can't really say I could comment on that. Define abundant?

MR. BEDFORD: I --

MR. SOPROVICH: Okay. I will go back on this. I can't really comment, I didn't look at the data in terms of the -- if you want to look at

in terms of lodges per linear kilometre of the area and relate that to other areas, so I couldn't comment on that.

MR. BEDFORD: Thank you. And my understanding is that the effects on beaver of the proposed Keeyask project are expected to be small. Is that your understanding?

MR. SOPROVICH: I can't comment on that. I didn't look at that.

MR. BEDFORD: Now, I will tell you, Mr. Soprovich, that earlier this week when I read through your paper, you have a copy of that with you, aside from the slide presentation, do you actually --

MR. SOPROVICH: Actually I don't. In terms of the one that got submitted Sunday night?

MR. BEDFORD: Yes.

MR. SOPROVICH: I do not have a copy.

MR. BEDFORD: Perhaps Ms. Whelan Enns could supply one to you.

MS. WHELAN ENNS: Mr. Chair, we found when we came back from lunch that it was not in our box of paper so I -- I think the panel is going to assist. Thank you very much.

MR. SOPROVICH: Thank you.

MR. BEDFORD: Mr. Soprovich, when I -- please finish.

MR. SOPROVICH: That's fine.

MR. BEDFORD: You just wanted to satisfy yourself that it is the one that you remember, so finish doing that, please.

MR. SOPROVICH: Yeah, it looks all right.

MR. BEDFORD: It looks like the right one?

MR. SOPROVICH: I think so.

MR. BEDFORD: Earlier this week when I read through the paper and I read it very slowly, with respect, I concluded that for whatever reasons it was written quickly by you. Is my assumption correct?

MR. SOPROVICH: No, I think your assumption is incorrect. When it was written, the copy you got, was a rough copy. In my view it was not going to be the final copy. So my understanding was that I had a deadline of Monday at noon. So this is an early copy, but I would say there is going to be some issues in there in terms of writing and clarity. And so, for example, including the picture out of the Keeyask,

or out of the Ecostem et al report, you can see here I have a reference to putting it in, in my final document that I finalized that was in there, and that is the photograph that I used up here. So I would say this is a rough copy. But it would have all of the concepts I would expect in there without having a second reading and tightening up the writing. And certainly there could be some errors in there, I wouldn't dispute that, that I might have picked up later on the second read.

MR. BEDFORD: Thank you. I also concluded that you had probably read through those portions of the environmental impact statement that you chose to read, also very quickly?

MR. SOPROVICH: No. I'm assuming that you are including the Ecostem et al 2013 document as part of the environmental impact statement?

MR. BEDFORD: Yes.

MR. SOPROVICH: There are sections that I looked at and I looked at very carefully, and I would have hoped that I would have communicated that during my presentation. Perhaps I didn't. But I can't say that I read the whole document of the birds document, for example, but what I did was I looked for the information

respecting methodology.

MR. BEDFORD: Well --

MR. SOPROVICH: Which was my focus.

MR. BEDFORD: You have correctly anticipated, no doubt because you are coming to know me well, where I'm headed. And I would like now to draw your attention to just a few what I will call oversights in the paper that I do respectfully say to you that I suggest you might have caught with a wee bit more time and attention on your part.

So you do note in the paper, pages 6 and 7, and it was repeated in your presentation this afternoon, that a concern you have with respect to the work done was that there was no definition of primary habitat, and no definition of secondary habitat in the work done by my client, the Keeyask Hydropower Limited Partnership. Have I captured that in summary fashion?

MR. SOPROVICH: No universal definition. So no definition in the glossary, for example, that would help guide, for example, different practitioners trying to deal with the concept.

MR. BEDFORD: Okay. Well, there are definitions in fact in the glossary for primary habitat and secondary habitat. And I'm going to -- I have had a copy made and I would certainly like you to take it home and you can file it with the other materials that you have no doubt accumulated for this particular assignment.

MR. SOPROVICH: Can you tell me what document that's in?

MR. BEDFORD: Of course, while Ms. Cole is circulating it, the document in question, I believe you have been handed pages 12-20 and 12-22, they come from chapter 12 of the glossary. And someone very helpfully for me has yellow highlighted the primary habitat and the secondary habitat definitions.

MR. SOPROVICH: Okay. That's fair. I did look at some of the generation project response to EIS guidelines. I did not look at that glossary, but the glossary is not in the birds report and it is not in Ecostem et al's report either, and those are the documents that I looked at.

MR. BEDFORD: Okay. And your assignment, of course, was a restricted one, and I

think that everyone in this room realizes this is a huge filing of a lot of paper and volumes, and it would be a challenge for any human being in fact to read every word or read perhaps even every pertinent aspect of it, so I will acknowledge that as well.

Would you turn, please, to page 24 of the report that we received Sunday night. And you will see the first bullet point and you will recognize that I'm now touching upon the subject of the olive-sided flycatcher, and one of the criticisms that you advance at some length in your written report are the way that my client went about studying and gathering data about the olive-sided flycatcher. So when I read the report I noticed one of the apparent concerns that's reflected in your bullet point is 39 observations in only two years, 2011 and 2012 plots. And from there you have much discussion about how this data was handled and size of samplings and so forth.

So I want to draw your attention to what I've realized is another oversight on your part. Ms. Cole is going to circulate page 7-21. This particular material relates to the olive-sided flycatcher, and again an anonymous

person has helpfully put yellow highlight here. This comes from the work done by Ms. Wyenberg, who not coincidently is sitting beside me this afternoon.

When I was given this to re-read I detected what I think has happened when you were doing your work. 39 observations, we can all see at the top of the page, within a 75 metre radius between 2001 and 2012. So, in fact there were eleven years of efforts to observe the olive-sided flycatcher in the relevant region. And what I saw happening when I thought of you, and you doing your work, when one reads quickly 2001 on a quick read can sometimes register in one's brain as 2011 and 2012. Now, is my, in effect, guess right, in that in a quick read you concluded there were only two years of observations taken and the 39 observations all occurred in the two years, when in fact there were eleven years and 39 observations over the eleven years?

MR. SOPROVICH: I don't think so. I think I felt that these were over the period, as it reads.

MR. BEDFORD: But as I read your paper, consider that there were 39 observations of

flycatchers in the --

MR. SOPROVICH: Okay, I gotcha. So that's immaterial, that's really immaterial, you could change that to 2000 -- you could change that to 2001 and 2089, it wouldn't make a difference. The important thing here is that 59 per cent were in primary, secondary, and 41 per cent were in non-habitat. That's the important thing. That's really drawing -- that's yeah, okay, so that should have been -- that actually should have been reading as 2001 to 2012 in my document. That's an error. But it is immaterial to the point of the bullet.

MR. BEDFORD: But you made a material conclusion and observation that was repeated in your presentation this afternoon that my client, to be more accurate, Ms. Wyenberg who was hired to apply her expertise with respect to birds to this project, that your words were almost half the data seems to have been, or observations seemed to have been ignored by her. And when I just read this little portion of one page of the EIS filing, it became immediately apparent to me that she has not ignored one half of the observations, she has applied all of them in to her thinking and

analysis, hasn't she?

MR. SOPROVICH: Not in terms of the model, I don't think. There is no evidence to demonstrate that with respect to the model, i.e., why 50 metres? This data here is relevant to this whole distance of edge and how far you go out. It is not relevant to the discussion of other than that, discussion of the model. The data is there, I'm not disputing that the information is there, but in terms of applying that to how you develop that model, there is no evidence in the documents as to how that was applied to develop the 50 metre edge, with that being within 50 metres. As I said during my discussion, that may be true, but the demonstration has not been made within the documents that have been provided by Keeyask.

MR. BEDFORD: Well, if we step back a few paces and look at the olive-sided flycatcher frankly from the perspective that someone like me, very much a non-specialist in the field, looks at these issues; 39 sightings over 11 years of species type of bird called olive-sided flycatcher, I quickly conclude that that's an average of less than four sightings a year. That strikes me that this is indeed a rare species.

MR. SOPROVICH: I'm not disputing that.

MR. BEDFORD: And what I have learned from Ms. Wyenberg and reading the material is that this particular type of bird, unlike some other types of birds, forages over a very large territory. Have I got that correct?

MR. SOPROVICH: I have read 26 hectares, perhaps 40 hectares, so that's a fairly large territory, that's true.

MR. BEDFORD: And when a specialist like Ms. Wyenberg or yourself is given the challenge of studying this particular type of bird with respect to a project like the Keeyask project, I have been told that it is probably, given that it is a rare species, given that it forages over a very wide area, not practical nor positive for the rare species to do what is called a nesting study. Do you agree with that?

MR. SOPROVICH: Well, practical is a matter that's relevant. However, one would presume that if one was looking in the right place it may be more practical. With respect to whether it is the correct thing to do, in my particular situation I have been involved in looking at a --

more within my expertise obviously -- a moose study in the Duck Mountain area. And in the course of doing that, one of the things that we considered was putting collars on calves. The literature will tell you that maybe up to seven per cent of those calves might die almost immediately because of you doing that. On that basis, and it is an ethical decision, when I put the proposal together I decided that was too high for me. I also know that there is some work going on in Minnesota right now which some government representatives reported to us in Swan River recently where they had probably half their calves die. That's unacceptable. I cannot comment with any detail as to why it might be inappropriate to try and study nest success for the species. But I do make the note that others have done it.

Now if there is evidence out there that it is inappropriate to do it for this particular species, I would be quite interested in knowing about that. I'm unsure if you have any, but I would certainly like to see it. Can you provide any evidence, scientific papers or whatever that would state that that would be inappropriate to look at nest success, or is this

a judgment?

MR. BEDFORD: It won't surprise anyone here that Doug Bedford can't do that. But we can ask Ms. Wyenberg. So if you will bear with me for a minute.

Well, Ms. Wyenberg tells me that nesting studies generally are not done for impact assessments. Does that sound familiar to you?

MR. SOPROVICH: Yeah, it does. I'm saying we should maybe be thinking about going beyond that for these species, especially when we know that density is not a good indicator of real life's habitat. That's the point.

MR. BEDFORD: Page 4 of your report, and I draw this to your attention just on the assumption that you might some day want to edit your report and have it appear somewhere else, you reference on page 4, the American warbler. There is no such bird as the American warbler.

MR. SOPROVICH: American Red Star.

MR. BEDFORD: Pardon me?

MR. SOPROVICH: American Red Star. You can find it -- It may be helpful to you to understand that even on my second edit I found some errors. I'm not infallible.

MR. BEDFORD: And that's the kind of error even specialists make in their work when they write quickly. Generally you catch them on slower reads and edits and re-edits, correct?

MR. SOPROVICH: That's fair.

MR. BEDFORD: When we turn to the last part of the paper, right at the end, it is a small document about two pages, and you built upon that in your presentation, it is a short discussion on VEC selection. And you asked some I thought pertinent questions with respect to the yellow rail, as to why was the yellow rail not considered a VEC in this process. And I concluded reading the paper that you must be wholly unaware that that question was asked by someone else last summer and was answered in writing. I'm referring, of course, to an information request. And I would like you to look at the written explanation that was given by the Partnership regarding yellow rail, and why it was not selected as a VEC.

MR. SOPROVICH: Okay, thank you. That doesn't discount the idea that in future filings, the idea of this being explicit within the filing would be appropriate.

MR. BEDFORD: You will see someone has helpfully, although they changed the colour of the pen, outlined in blue felt pen the pertinent portion of this page of this answer to an information request.

MR. SOPROVICH: Okay.

MR. BEDFORD: The explanation to summarize, you have now read it, is that in over ten years of breeding bird surveys not even a single yellow rail apparently was observed. Two years of nocturnal surveys, not a single yellow rail was observed. And the known breeding habitat for yellow rail is very limited in the study area for the Keeyask project. Are those not sound reasons, Mr. Soprovich, for a proponent of a project to conclude that yellow rail ought not to be a VEC, but it can and was a supporting topic?

MR. SOPROVICH: Yes, I think this speaks to my suggestion that this be explicit, and this is good. Ultimately for me to make that decision I would have to look at the methodologies and where they sampled and that type of thing. But at face value, certainly it seems appropriate.

MR. BEDFORD: Okay. And I would like to, one last time, clarify what I will say I

believe to be an oversight on your part in the paper, just in case anyone ultimately relies upon the paper, and that is with respect to the northern leopard frog. You refer to the northern leopard frog in the paper as threatened, and that's incorrect, of course, isn't it?

MR. SOPROVICH: It is a western population.

MR. BEDFORD: My concern is associating the northern leopard frog with threatened, so just for the briefest of efforts to educate those who are not as conversant with the Federal Species at Risk Act, as I know you are, and as I have come modestly to be, if a species is listed under the Species at Risk Act, there are in fact a hierarchy of three choices as to how to list the species once it is listed under the legislation. And to summarize quickly, the lowest category of listing is special concern, a more heightened listing would be threatened, and the most serious listing would be endangered. Have I got that correct?

MR. SOPROVICH: Yep.

MR. BEDFORD: Then to go back to the northern leopard frog, it hasn't arrived at that

second more serious category of threatened, it today continues to be of special concern?

MR. SOPROVICH: That's incorrect, it should be special concern. That's an error on my part.

MR. BEDFORD: Before we leave the northern leopard frog, my understanding is that the western population for northern leopard frog, as it is known today, does not overlap with the regional study area for the Keeyask project. Again, is that your understanding, no overlap?

MR. SOPROVICH: Well, I would have to check. Yes. I would say I assume it was the western population, but I would have to check.

MR. BEDFORD: Now I listened carefully, as I always try to do at these hearings, to the views that you offered us all on how to go about selecting VECs for projects, including projects like Keeyask. And I have slide 32 of your presentation in front of me. And you made a special point of telling us all that you have some concern that the views of pertinent populations of Manitobans, and you singled out the Metis, appear to have been ignored in the VEC selection process for the Keeyask project. It

occurs to me that a good way to try and include a segment of the Manitoba population, specifically Metis people, would be to invite them to come to public meetings, partly for the purpose of soliciting from them their comments and advice as to what are appropriate topics for VEC selection. Now, surely you would agree with me that that would be one way to try and be inclusive of the views of people like the Metis?

MR. SOPROVICH: That's one tool in the tool box, yes.

MR. BEDFORD: And listening to you I quickly concluded that you must not personally be aware that that was, for the Keeyask project, repeatedly done by my client?

MR. SOPROVICH: I can't -- no, I can't say that I'm aware of specifically what you did in terms of engagement. However, this was based on what was in your document, that's where that came from. That's a quote right out of your document.

MR. BEDFORD: And we don't have to confine ourselves to one approach to a segment of the population. Another way to reach out to a known group of Manitobans might be, would it not, to communicate with an official organization that

represents that group? So using the Metis as an example, would you agree with me that an appropriate approach might be to invite the Manitoba Metis Federation to meet and provide the views of its members regarding appropriate VECs to select?

MR. SOPROVICH: Absolutely.

MR. BEDFORD: And once again I quickly conclude that you personally are unaware of the fact that there were in excess of 40 such meetings arranged by my client with the Manitoba Metis Federation with respect to the Keeyask project?

MR. SOPROVICH: I'm not aware of what your engagement was.

MR. BEDFORD: Mr. Sargeant, that concludes the questions that I have this afternoon for Mr. Soprovich.

THE CHAIRMAN: Thank you, Mr. Bedford. Consumers Association, do you have any cross on this witness? Pimicikamak? No. Thank you very much. Any of the panel members? Thank you.

Ms. Whelan Enns, you may conduct some re-direct, but I wanted to note that re-direct really is meant to address any concerns that arose out of Mr. Bedford's cross-examination, not to

revisit the entire presentation.

MS. WHELAN ENNS: Yes. But what I would like to do is also make sure that I understood what you said when we went for our 15 minute break. You were concerned about time and you asked me whether I had priority questions for our witness, and suggested that there was a risk of losing the time, the witness, the evidence.

THE CHAIRMAN: Because I had no idea how long the cross-examination would take. What I'm saying now is that you have an opportunity to conduct re-direct of your witness, to ask him questions that might have, in your view or in his view, the cross-examination may have twisted the meaning you wished to get across. So please address those issues now.

MS. WHELAN ENNS: That means then that the other opportunity for questions of our witness is gone?

THE CHAIRMAN: Well, if you have legitimate issues that were not raised by the witness in his presentation, additional issues that were not raised by the witness, I will allow you to ask them. But if you are going to ask questions that repeat his presentation, I will cut

that off.

MS. WHELAN ENNS: Fair enough. And I have been looking pretty closely on that basis, so thank you. Mr. Soprovich, maybe this is a lack -- maybe it is a lack in terms of not having arrived at this before, but you have been very clear about aquatic and terrestrial and realities for beaver. But I did not hear and would like to ask you if there is specific, in terms of food for beaver, specific aquatic plants that prompted you to make the recommendations in the analysis you did?

MR. SOPROVICH: Well, pond lily tubers in particular are important. That was recognized by Nash in Northern Beaver, 1951. I worked in the Cumberland marshes and I saw it there, in northern Saskatchewan, along the Saskatchewan River, quite different habitat, I have seen that. Pond lily tuber use in the boreal forest near Kenora. So that particular species would be important. Cattails probably quite important. In terms of the Severn study, the 2007 study for Voyageur National Park in Minnesota, what were called floating leafed plants, and that was pond lilies, represented I think it was 30 per cent of the diet or something like that in the winter. And the

plants like cattails about 20 per cent. There could have been some other species in there, maybe some sedges. I can't remember.

MS. WHELAN ENNS: Thank you. Would you recommend then, this maybe goes to monitoring, but would you recommend ongoing studies and then ongoing monitoring in terms of beaver food sources, both terrestrial and aquatic for the project?

THE CHAIRMAN: How is that relevant? I think the point that Mr. Soprovich wanted to make in his paper is that aquatic foods are important to beaver diet in the winter, and that's been clearly made.

MS. WHELAN ENNS: Fine, we will pass.

On your slide number 14, you indicated that you felt there might be masked effects. But we did not hear whether there is risk, specific risk to beaver as a result?

MR. SOPROVICH: Well, the risk is to the model. It means that the model is going to be -- it means that the model may fail.

MS. WHELAN ENNS: All right, thank you.

MR. SOPROVICH: Or the test -- maybe I

should look at that thing. It is on 14 you said? See exactly what we are talking about here. Yeah, see this is the flaw with the testing of the model.

MS. WHELAN ENNS: Thank you.

MR. SOPROVICH: Both of those.

MS. WHELAN ENNS: When you were at slide 19 you were talking about ledger and data sources and on site data collection. But we didn't, I was waiting, and I did not hear anything specifically about needing to ground truth in relation to the model and the data that's being used, this species or any other species?

MR. SOPROVICH: Well, they attempted to do this but they failed miserably in my view. I think, I guess that was the point I was trying to make. They tried to do this. They presented some data, but the tests were inappropriate. So, you know, they tried. There is some data thrown out there, there is something on paper. It is a matter of doing it right.

MS. WHELAN ENNS: Thank you.

MS. WHELAN ENNS: You identified in one case about a 40 per cent portion of data not used or data not explained. I -- as a

non-scientist or non-technical person, I think of these as variances. Is it best practice for the proponent to be clearly, explicitly stating what kinds of variances or margins they are using in handling the data?

MR. SOPROVICH: Well, the practice of science is to be fully transparent in how you handle data. So, for example, when I did my Masters thesis, I encountered some problems with some of my very fat beaver where I had the lab assay that I did ran into some kind of problems and I was getting wrong data, wrong numbers. And I knew that because there is a strong inverse relation between the amount of fat and the amount of water in a sample. So I knew how much water was in the sample. With those particular data, what I did was I actually estimated fat using the relationship between water and fat in the samples. But that was very clearly communicated within my document, what I had done. So this is the crux of things. So when we look at how we handle data, be it in the pseudo replication issue that I brought up, or the samples of how close the edges of the fall is within these documents, you know, it is not communicated. There is nothing there. The

fundamental thing in science is you have to be open and show what you did and you let the chips fall where they may.

MS. WHELAN ENNS: Thank you. I would like to ask you about practice beyond Manitoba in terms of the presence, absence model that this EIS uses in terms of species, whether they be VECs or sub topics, and what you were identifying which is that not detected as being used. Could you give us an instance or examples of where that's being used versus what happens here?

MR. SOPROVICH: Yes, that's standard practice in British Columbia, it is found at some level or not detected.

MS. WHELAN ENNS: Thank you. A couple of questions in relation to the cross, Mr. Chair. This is to do with glossaries, and that they are a bit of a challenge for some us in terms of how extensive the material in the EIS is. Do you know a glossary that's an all in glossary for the volumes of this EIS?

MR. SOPROVICH: No.

MS. WHELAN ENNS: Do you know whether there is a glossary that's all in for all of the species information, that's spread in different

volumes in the EIS?

MR. SOPROVICH: I know of two glossaries, one was in the Ecostem et al, one was in the terrestrial volume, those are the ones that I looked at, I found out about another one.

MS. WHELAN ENNS: Thank you. We have had some identification of some small errors in your report or submission that was filed. Do the -- do these small errors discussed today change any of the definitions, concepts, failures in assessment or recommendations that you are making to the CEC?

MR. SOPROVICH: No.

MS. WHELAN ENNS: Thank you. Quick question then about the northern leopard frog cross-examination. What comes before in terms of this species, what comes before the SARA reviews? Is it COSEWIC? And where is this species in the pattern in terms of COSEWIC reviewing it?

MR. SOPROVICH: COSEWIC would have provided a status paper and provided a recommendation on how it should be designated, special concern, threatened, endangered. SARA can list species I think somewhat independently.

MS. WHELAN ENNS: Thank you very much.

Done.

THE CHAIRMAN: Thank you, Ms. Whelan Enns. I must say that your re-direct was quite appropriate, and on point.

That brings us to the end of the day's proceedings. We have a number of documents to be registered, Madam secretary.

MS. JOHNSON: Yes. First I have a correction from some of the documents from yesterday; for Peguis First Nation, their outline and CV documents from October 7 is actually PFN002, Mr. Flanders report is number 3. And his presentation is number 4. MWL002 is Mr. Salazar Mr. Bowick's report. 003 is their presentation. 004 is thoughts on Keeyask Generation Project Process for the selection and communication of VECs. Number 5 is Mr. Soprovich's paper. And number 6 is his presentation.

THE CHAIRMAN: Thank you.

(EXHIBIT PFN002: Peguis First Nation, outline and CV documents from October 7)

(EXHIBIT PFN003: Mr. Flanders report)

(EXHIBIT PFN004: Mr. Flanders presentation)
(EXHIBIT MWL002: Mr. Salazar and Mr. Bowick's report)
(EXHIBIT MWL003: Mr. Salazar and Mr. Bowick's presentation)
(EXHIBIT MWL004: Thoughts on Keeyask Generation Project Process for the selection and communication of VECs)
(EXHIBIT MWL005: Mr. Soprovich's paper)
(EXHIBIT MWL006: Mr. Soprovich's presentation)

THE CHAIRMAN: I'm so happy it is Thursday. We have a day sort of off tomorrow. For some of us, it will just be doing our regular jobs back in the office. We are back Monday morning at 9:30. Next week we are in the Provencher room on the main floor. Have a good weekend. See you Monday morning.

(Adjourned at 3:54 p.m.)

OFFICIAL EXAMINER'S CERTIFICATE

Cecelia Reid and Debra Kot, duly appointed Official Examiners in the Province of Manitoba, do hereby certify the foregoing pages are a true and correct transcript of my Stenotype notes as taken by us at the time and place hereinbefore stated to the best of our skill and ability.

Cecelia Reid

Official Examiner, Q.B.

Debra Kot

Official Examiner Q.B.