OFFSHORE HELICOPTER SAFETY INQUIRY
June 30, 2010
Tara Place, Suite 213, 31 Peet Street
St. John's, NL

June 30, 2010

PRESENT:

John F. Roil, Q.C./
Anne Fagan.....Inquiry Counsel

Amy Crosbie/. ..... Canada-Newfoundland and Labrador Offshore
John Andrews ..... Petroleum Board (C-NLOPB)

Ian Wallace/ ..... Hibernia Management and
Cecily Strickland..... Development Company (HMDC)

D. Blair Pritchett .....Suncor (Petro-Canada)

Stephanie Hickman.. .....Husky Oil Operations Ltd.

Nick Schultz .....Canadian Association of Peetroleum Producers (CAPP)

Geoffrey Spencer..... Helly Hansen Canada Ltd.

Rolf Pritchard/.....Government of Newfoundland and Labrador
Laura Brown Laengle

Jack Harris, Q.C., Member of Parliament..... (Self-Represented)

Kevin Stamp, Q.C. .....Cougar Helicopters Inc.

Jamie Martin.....Families of Deceased Passengers

Kate O'Brien.. .....Davis Estate (Pilot) and
.....Agent on behalf of Douglas A. Latto for Lanouette Estate (Co-pilot)

V. Randell J. Earle, Q.C. .....Communications, Energy and Paperworkers Union
..... Local 2121

David F. Hurley, Q.C. ..... Offshore Safety and Survival Centre, Marine Institute

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COMMISSIONER:
Q. Good morning, ladies and gentlemen. Good morning, Mr. Power. So are we ready, Ms. Fagan?
MS. FAGAN:
Q. Yes, Commissioner.
COMMISSIONER:
Q. Thank you.
MS. FAGAN:
Q. Today's witness is Jonathan Power and he is a Research Council officer with the National Research Council Institute for Ocean Technology. This is a Federal Crown Corporation that supports science and technology for Canada and Canadian businesses. The NRC, which is how I will refer to the National Research Council, is divided into 20 institutions, with over 4,000 professionals. They cover a wide variety of topics.
In St. John's, since 1985, we have had the Ocean -- it's the Institute for Ocean Technology, the IOT. I'm starting to feel like I'm getting into the Transport Canada stuff with all those acronyms again, but

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anyway, the IOT is the nation's centre for ocean technology and research and we have that right here in St. John's, just down on the Parkway. So it's nice and close if those want to go and see what they're doing, and the Institute is capable of a number of things that you can't get anywhere else and that is because they have a 200-metre towing tank, a 75-metre by 32-metre engineering basin and they have the largest ice tank in the world, being 90 metres.
What may not be known, and I will have Mr. Power discuss this in more detail, is that they do tests on human subjects as to how they perform in these tanks, the same as they do tests on the hulls of vessels. So quite often, especially for the local Newfoundland audience and those in Labrador, we've seen various programs and various shows on TV that show, whether it's students from Memorial University or engineering students or, you know, hulls of sailing ships being tested at the Institute. What doesn't seem to have the same prominence is the human subjects that are being tested in these wave tanks, and that's

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what Mr. Power is here to talk about.
So I would ask to have Mr. Power affirmed, and then we will have his exhibits entered.
COMMISSIONER:
Q. Okay then.
MR. JONATHAN POWER (AFFIRMED) EXAMINATION BY MS. ANNE FAGAN
REGISTRAR:
Q. State your name, please.
MR. POWER:
A. Jonathan Thomas Power.
REGISTRAR:
Q. Thank you.
MS. FAGAN:
Q. Mr. Power, you were the author of a paper, research paper that was prepared for Commissioner Wells and I believe that was co-authored by one of the other researchers with you at the Institute, and that's Antonio Simoes Re, and can you please provide: your CV, which we're going to have entered as Exhibit 218; Antonio Simoes Re's CV, which is going to go in as 219. We have the report which is 220, and a PowerPoint presentation,

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which is 221, and we'd have those marked as exhibits. They're public exhibits and they're all 00220, 00221.
COMMISSIONER:
Q. All right then.
MS. FAGAN:
Q. Mr. Power, can you turn to your CV, which is Exhibit 218, and provide a brief summary of your background, and in particular, your current research, which I understand is part of your Ph.D. study, and which is what is why we have you here today is your study. It's very interesting with respect to the performance of humans in cold water. So can you go through your CV for the group?
MR. POWER:
A. Yes. I graduated from Memorial in 2002 with my Bachelor of Science in Biology and I then completed my Masters of Science in Kinesiology in 2005 and I'm now pursuing my doctorate with Professor Michael Tipton in the University of Portsmouth in England. The work composing my doctorate is also the work that I'm currently managing at NRC and that's examining human performance in varying weather conditions in

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the tank facilities that you mentioned earlier.

MS. FAGAN:

Q. Okay. Now we have heard from Dr. Susan Coleshaw and from Mr. Michael Taber. They both, in their reports, refer to a Michael Tipton, Professor Tipton, and we've also heard it's a pretty small group. So is the Professor Tipton that's overseeing your doctorate the same Professor Tipton that's in -- referred to by many of these other experts?

MR. POWER:

A. Yes, he is.

MS. FAGAN:

Q. Okay. So he is your supervisor on this project?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Okay. I briefly just described the three facilities. Could you give just a little more detail on the facilities at the Institute? Because that will be relevant when we then start speaking about the study that's currently underway.

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MR. POWER:

A. Well, we have three main facilities at IOT. We have our ice tank, which is the world's longest tank. We can grow ice sheets of varying sizes and thickness and we can drop the temperature down to as low as minus 20 degrees Celsius and maintain it. We also have our clear water towing tank, which is a 200-metre long tank that has a dual flap wave maker located at one end and this tank is used for assessing the performance of model hulls under tow in both calm conditions and in wave conditions. We also have the offshore engineering basin, which is where the majority of the tests that I've conducted took place. This facility has dual -- has wave makers on two sides of the tank allowing for waves coming in a variety of directions.

MS. FAGAN:

Q. We have heard about pools where there's wave or turbulence created. Is there a difference between the basin, which I hear is referred to as the wave maker -- is there a difference between the wave maker and a pool or turbulent water?

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MR. POWER:

A. Yes. Our wave makers, we're capable of generating a wide spectrum of waves and we can program our wave makers to produce these waves to a high degree of accuracy and make sure they're repeatable as well.

MS. FAGAN:

Q. What's the difference between a wave and turbulent water?

MR. POWER:

A. With a wave, when we dial in a wave into the wave maker and we send it down the tank, we program in a set wave and we know the kind of wave we're going to get. We can measure it to a high degree of accuracy and it's repeatable. With other tanks, it's more turbulent, it's chaos. You may not know exactly what you're getting at certain points in that tank.

MS. FAGAN:

Q. Okay. Are you a member of any boards?

MR. POWER:

A. Yes. I currently sit on two boards.

MS. FAGAN:

Q. And what are the two boards?

MR. POWER:

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A. The boards I sit on are the National Research Council's Research Ethics Board and the Canadian General Standards Board for Immersion Suit Systems.

MS. FAGAN:

Q. On the Ethics Board, what would you -- what's that Board responsible for?

MR. POWER:

A. That Board is responsible for granting ethics approval for all applications across NRC, which is across Canada, for all studies involving human participants. It's our job every month to review the applicants that come in and to determine do they meet ethical approval or not.

MS. FAGAN:

Q. So what would be -- for example, in your study and others, these are studies where you're going to use human subjects or participants. What would be some of the considerations of the Board and how would your background, especially your kinesiology, help in making those decisions or, I guess, guidelines for tests?

MR. POWER:

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A. One of the primary purposes of an ethics board is to weigh the risk versus reward for any kind of research project. So what is the risk to the participant versus the reward that can come out of the research? We examine the applications, determine the risk versus reward balance. We also make sure that in the consent forms supplied to the participants that they're giving full informed consent, so they get the complete details of the project, they know exactly what's going to be happening, and as well, we also take a look at the methodology. Are they approaching it the correct way? Are they doing anything that could be potentially harmful to the participants, to their privacy, to their anonymity.

MS. FAGAN:

Q. Okay. Ethically, would you make any sort of determinations or decisions as to the sex, say male or female or whether or not you're going to put certain age restrictions or health restrictions on tests?

MR. POWER:

A. We wouldn't normally do that. If we see an

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age range or limit to a gender in a specific application, we may ask the researcher why they've included this age range and we would like to see a justification for limiting or narrowing the scope of the participants they could recruit.

MS. FAGAN:

Q. Okay. On the Canadian General Standards Board, what is your role on that Board? And I'm going to -- you're going to have to explain a little bit about the Board, but first, what's your role?

MR. POWER:

A. Well, I represent NRC-IOT on the Board and I'm a general interest member, but also a voting member as well.

MS. FAGAN:

Q. Okay. We understand that that Board is currently studying or examining the standard that is now in place for the helicopter transportation suit. Is that correct?

MR. POWER:

A. That is correct. The standard is now open.

MS. FAGAN:

Q. Okay. You're on the Board. How many people

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are on the board?

MR. POWER:

A. A large number of individuals representing a wide range of groups.

MS. FAGAN:

Q. Okay. Can you tell us who's on the Board, like -

MR. POWER:

A. There's -

MS. FAGAN:

Q. - not people really, who they represent.

MR. POWER:

A. Well, they represent general interest members, such as ourselves. We also have manufacturers and regulators on the Board, as well as end users.

MS. FAGAN:

Q. Okay. Do you have a list -- because I'm interested in knowing who is now going to be making the decision with respect to the standard for the suit that the workers are currently wearing, because it's -- the suit right now has been built to a standard that was set by the Board. Is that correct?

MR. POWER:

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A. Yes.

MS. FAGAN:

Q. And that same Board, that group, is now deciding whether the standard should change?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Or what the standard should be. So do you have a list of who's on the Standards Board?

MR. POWER:

A. Yes, I do.

MS. FAGAN:

Q. Okay. Can you tell us who's on it? Do you have that list there?

MR. POWER:

A. Yes, I do.

COMMISSIONER:

Q. Are you asking for the names or the institutions?

MS. FAGAN:

Q. No, I'd like the organization of who's on the Board.

COMMISSIONER:

Q. The organizations, yes.

MS. FAGAN:

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Q. Because the names can switch. They're there not in a personal capacity. They're there representing an organization. So you say there's voting members and various institutions are represented. So who is represented on the Board?

MR. POWER:

A. The Government of Newfoundland and Labrador, the National Research Council, the Marine Institute, Survival Systems Training Limited, National Resources Canada, a wide variety of suit manufacturers, the National Energy Board, Transport Canada, the United Food and Commercial Workers Union, Exxon Mobil, Communication Energy and Paperworkers Union.

MS. FAGAN:

Q. Are the petroleum regulator -

MR. POWER:

A. Yes.

MS. FAGAN:

Q. - the C-NLOPB, are they on the Board?

MR. POWER:

A. Yes, they are.

MS. FAGAN:

Q. And the Nova Scotia Petroleum is on the Board

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as well?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. What about CAPP?

MR. POWER:

A. CAPP is represented on the Board as well.

MS. FAGAN:

Q. Department of National Defence?

MR. POWER:

A. Yes, they are.

MS. FAGAN:

Q. Okay. Manufacturers, I understand a number of manufacturers, would the manufacturers include Helly Hansen?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Okay. We heard that there's a CORD group. A number of times we'd heard a reference to CORD group. Are they also on that Standards Board?

MR. POWER:

A. Yes, they are.

MS. FAGAN:

Q. Okay. I believe some oil producers are also

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either on the Board or receive information from the Board, and we're going to ask questions about the standard later on. Commissioner, perhaps it would be worthwhile, because the composite of the Board changes and it may be worthwhile to have the list of who's on the Standards Board, because I don't know -- we've had this information before when Helly Hansen gave it, but I don't know if we have the current list.

COMMISSIONER:

Q. I don't think we have a full list. I would like to see it go in evidence.

MS. FAGAN:

Q. Okay. I know we're still in the process of discussing Mr. Power's credentials. However, I don't think there's anything to stop us from having this marked as an exhibit.

COMMISSIONER:

Q. Well, the important thing -

MS. FAGAN:

Q. And perhaps the other, you know, parties would like to know who is on the Board and who will be setting the standard for the suits.

COMMISSIONER:

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Q. Yes. The names of the people aren't important, but the institutions and entities, they're important.

MS. FAGAN:

Q. I believe this is available -- is this publicly available? Like can you just Google this information and -

MR. POWER:

A. Via the Canadian General Standards Board website.

MS. FAGAN:

Q. Okay. So you can just go into the Standards Board and pull this out. So is there any issue with having the names?

MR. POWER:

A. I don't think so.

MS. FAGAN:

Q. If it's available on the -

COMMISSIONER:

Q. If it's available on a website, then it's -

REGISTRAR:

Q. A public exhibit?

MS. FAGAN:

Q. It would be a public exhibit.

COMMISSIONER:

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Q. Yes.
REGISTRAR:
Q. 00226.
MS. FAGAN:
Q. Okay. I'll continue on with Mr. Power.
REGISTRAR:
Q. Can we make copies now?
MS. FAGAN:
Q. And perhaps the Registrar could organize getting some copies made for the -- so we're just going to mark it 00226 and then later on, if there's any other questions come up, we can -- we'll have that. And I'll ask you more questions about the Board when we get further into your presentation.
Now on the topic of your Masters, what was the subject matter that you studied?
MR. POWER:
A. We examined whether or not colder water temperatures would influence breath hold time with the idea being is if people were trapped in an inverted helicopter and had to make an escape underwater, would they be able to hold their breath long enough to reach the surface.
MS. FAGAN:

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Q. And we've heard evidence from Dr. Susan Coleshaw on breath hold times, because she indicated she did have some experience with that. What was the results, just generally? We don't need to go into it in detail, but just to give the group an indication that you do have experience in this area.
MR. POWER:
A. What we found is when people immerse their faces in zero degrees Celsius water, it significantly decreased their breath hold time, compared to warmer water temperatures. We saw a range of breath hold temperatures at zero degrees Celsius, but the average value was approximately 30 seconds.
MS. FAGAN:
Q. I believe Dr. Coleshaw had said it could be as low as 10 to 20 seconds. Would that be inconsistent with what you found?
MR. POWER:
A. Yes. Again, we saw a range of breath hold values at that temperature and 30 seconds was the average.
MS. FAGAN:
Q. Okay. So her statement would be consistent

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with your research?
MR. POWER:
A. Yes, it would be.
MS. FAGAN:
Q. Thank you. Mr. Power is here to speak to his report, which is based upon his study. The other thing that Mr. Power will speak to is a literature review of what information is out there so far on how humans react, and the other topic will be on the Canadian General Standards Boards. So they are the areas on which I would like to have Mr. Power speak, and I don't know if any of the group, any other of the lawyers here wish to question Mr. Power. The area is a fairly narrow, I would -- the topics. We're not going to speak generally on the other -- many of the other issues that were discussed today, we're not -- and that would be all the evidence, I would have on his credentials.
COMMISSIONER:
Q. Okay. Would anyone like to ask a question about Mr. Power's credentials? Yes, Mr. Earle?
EARLE, Q.C.:

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Q. Mr. Commissioner, perhaps counsel could clarify because Mr. Power does discuss in his paper, or Mr. Power and Dr. Simoes Re, do discuss in their paper extensively the merits, demerits of a prescriptive regulatory system versus a old test or aspirational regulatory system. We would have a problem if someone is suggesting he is an expert in that area, and I'd like it clarified whether it is intended to qualify him as an expert in that area?
MS. FAGAN:
Q. Mr. Power is going to speak to that topic. His background and basis for speaking to that topic is based upon his research. His research deals with the human reaction in cold water and realistic -- you know, how a human will react in a more realistic environment than a pool environment and that ties into how the standard has now been set and therefore his prescriptive versus performance based is tied to his position which is that a more realistic goal based approach would offer better protection. So I'm not putting him forward as an expert on that topic. However, he does have a view as to why that approach

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would be different. As well, Mr. Power is presenting his report based on the -- it's an NRC report. So I can have Mr. Power go through the process to have the report issued by NRC and Antonio Simoes Re's CV, as well as the review process at NRC, because he is here to explain the report, which is the NRC report.

COMMISSIONER:

Q. I think, Mr. Earle, if it's any help, my understanding -- now, of course, I've been to the National Research Council. I've talked at length with all the people involved. When we normally have heard about prescriptive as against goal setting, we're talking about the regulator and the oil operators and that sort of thing. Mr. Power has nothing to do with that aspect of prescriptive versus goal-related. His is actual hands-on research. Am I correct?

MR. POWER:

A. Yes.

COMMISSIONER:

Q. And he will describe his research, and I should say also that this is the work of the

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National Research Council. Everything he has prepared has been vetted from top to bottom by his colleagues and supervisors, if you like, and this is the work of the National Research Council.

EARLE, Q.C.:

Q. It may well be, Mr. Commissioner, but we would probably equally challenge the role of this particular division of the National Research Council to give expert evidence in what we would submit, and quite frankly, we're a bit disappointed that actually the Inquiry has not been able to get an expert opinion in this area. It really is an area of organizational dynamics and social psychology and we want it to be clear, because this appears to be, outside of the comments of Ms. Turner, the most significant amount of comment we've had on the merits or demerits of a prescriptive versus goal-oriented -

REGISTRAR:

Q. Excuse me, would the solicitor please come to a mic? Thank you.

EARLE, Q.C.:

Q. This appears to be the most extensive

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commentary we've had, other than some comments by Ms. Turner, on the merits or demerits of a prescriptive versus goal-based system of regulation and you will know, of course, that this was a matter raised as a concern by the Federation of Labour, in terms of the report they submitted to you earlier, and it is, in our view, not a matter of the type of research that is done at the Centre here. I'm quite sure that there are probably other parts of the National Research Council that do extensive research in the area of organizational behaviour and social psychology. It is, in our view, an important matter for this Inquiry and with the greatest respect to the authors, we're very interested in their work on human performance in cold water conditions, but that is a different matter than advising or offering expert opinion to the Inquiry on the manner in which we should proceed in the governance really of the industry, and as the paper touches on that extensively, there's about -

COMMISSIONER:

Q. I hear what you're saying.

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EARLE, Q.C.:

Q. - 20 percent of the paper is in that area, we want to be very clear as to the field of expertise that it is sought to qualify this witness for.

COMMISSIONER:

Q. As I understand, and we've talked about prescriptive and goal setting, Ms. Turner has talked about it, that's in the governance of the industry, the oil producing offshore industry. Mr. Power, you're not involved in that in any way, are you?

MR. POWER:

A. In the what?

COMMISSIONER:

Q. The governance of the offshore industry.

MR. POWER:

A. No.

COMMISSIONER:

Q. When you talk about prescriptive and goals, I think you're talking about scientific research.

MR. POWER:

A. Yes.

COMMISSIONER:

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Q. Which is a different thing altogether.
MR. POWER:
A. Well -
COMMISSIONER:
Q. But you can make, you know -
EARLE, Q.C.:
Q. As long as nobody is -
COMMISSIONER:
Q. I'm very clear.
EARLE, Q.C.:
Q. - seeing this as a situation where we're hearing from somebody on the methodology of governance of the industry, we're quite comfortable with it.
COMMISSIONER:
Q. Yes. It's scientific research and the approach to that. That's what we're talking about. Okay then.
MS. FAGAN:
Q. Anybody else?
COMMISSIONER:
Q. Anybody else any questions or like to ask any questions? All right then, I am admitting Mr. Power as an expert in the fields in which he is working that involve scientific research as

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he has described. Okay then.
MS. FAGAN:
Q. Thank you, Commissioner. Now before we actually begin your PowerPoint presentation, which is an outline of the report, I would ask you to describe how the NRC became involved with the Offshore Helicopter Safety Inquiry.
MR. POWER:
A. The Offshore Helicopter Safety Inquiry approached IOT, as an institute, with a list of items for us to consider. We took this list of items. We met internally and we went through the list and determined where our expertise could best fit with those items. We replied to the Inquiry outlining the items that we felt we could contribute to and the Inquiry drafted a terms of reference for us and outlined five areas for us to provide comments on.
MS. FAGAN:
Q. Okay. The list that you're referring to, would that be the issues list that has been referred to by many of the other witnesses so far?
MR. POWER:

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A. Yes.
MS. FAGAN:
Q. Okay, and the terms of reference, they were signed on May 4th, 2010?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Prior to all of this being finalized, the Commissioner had mentioned that he had been to the Institute. Can you -- I was there as well, and Mr. Roil, my colleague. Can you describe what was going on? Because I can't give evidence, so can you describe what was going on at the time we toured the Institute, what was the purpose of us being there?
MR. POWER:
A. The day the Inquiry came to the Institute, we were in the middle of a test program that was examining human performance in varying weather conditions. When the Inquiry came, they were able to see some of the testing where we had somebody in our wave tanks performing a three-hour immersion. I'll touch on this later on to the presentation, but you guys did come to see some of our tests.

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MS. FAGAN:
Q. Okay, thank you. Can you please, for the record, read the terms of reference, not the entire thing, just the topics that you were asked to cover in your report?
MR. POWER:
A. Yes. Item one was summarize existing knowledge of human thermal responses in varying environmental conditions. Item two was to summarize current IOT-led research that has examined human performance in laboratory controlled environments with immersion suits in varying conditions. Item three was identify knowledge gaps in immersion suit standard and expected performance, compare a prescriptive versus performance-based methodology for standards setting for immersion suits. Four, provide comments on suggested safety approaches and best practices specific to immersion suits, as well as part of a holistic safety approach. And the last item was to provide insight into emerging technology areas for further research to support an enhanced Newfoundland and Labrador offshore safety system.

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MS. FAGAN:
Q. Okay, thank you. The report was co-authored with you and Antonio Simoes Re. Can you tell us something about your co-author?
MR. POWER:
A. Antonio is a senior research officer with the Institute for Ocean Technology and has been there for over 20 years. He has been very active in leading the marine safety group area of research at IOT.
MS. FAGAN:
Q. And I believe Mr. Simoes Re's CV is at 219, in the event anyone wishes to review it, but it's on the record. He was the co-author. I'd just have you highlight a couple of other points beyond his work at the Institute. I understand he's a member of the Society of Naval Architects and Marine Engineers and he's also a member of the Association of Professional Engineers in Nova Scotia. Is that correct?
MR. POWER:
A. Yes, he is.
MS. FAGAN:
Q. And he's been with the Institute since 1986?

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MR. POWER:
A. Yes.
MS. FAGAN:
Q. And his two degrees are Masters of Science and Naval Architect and a Bachelor of Engineering in Shipbuilding?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Now this was a study on human immersion, so what was Mr. Simoes Re's sort of relationship in the report writing?
MR. POWER:
A. Mr. Simoes Re's relationship was that he was able to go and provide a great degree of depth, insight and experience on a prescriptive versus performance-based approach.
MS. FAGAN:
Q. Okay.
COMMISSIONER:
Q. Approach to what?
MR. POWER:
A. Pardon?
COMMISSIONER:

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Q. Approach to what?
MR. POWER:
A. Approach to the terms of reference outlined here.
COMMISSIONER:
Q. Okay, not governance?
MR. POWER:
A. No.
COMMISSIONER:
Q. Scientific approach?
MR. POWER:
A. Yes.
COMMISSIONER:
Q. Okay.
MS. FAGAN:
Q. I believe what your -- you have two slides on this and it's standard setting. Is that what you're going to -- it's the performance based and setting a standard?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. A scientific standard, a scientific basis?
MR. POWER:
A. Yes.

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MS. FAGAN:
Q. That's where you're going with this prescriptive versus performance, isn't that right?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Okay. As well, we had a list of Mr. Simoes Re's publications. I believe it's a ten-page list attached to his CV. Is that correct?
MR. POWER:
A. Yes, it's an extensive list.
MS. FAGAN:
Q. Now the report itself is a report that was issued by NRC. So you may have been one of the authors, but were you the only person behind the report? Can you please describe the process for the issuance of this report?
MR. POWER:
A. Once the terms of reference were identified by the Inquiry to us, myself and Mr. Simoes Re began working on a draft version of the manuscript. Once we were satisfied with our version of the manuscript, we then submitted it internally to multiple internal reviews at

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IOT. So it went off to our director of research, Dr. Bruce Parsons. It went off to our director general, Dr. Mary Williams, our communications coordinator, Derek Yetman, and our business development officer, Frank Dormady. All these people then provided comments on the manuscript. Myself and Mr. Simoes Re then incorporated the comments into the manuscript. We sent the manuscript out for another round of internal review. More comments were provided. We incorporated the comments and so on and so on until we were all satisfied with the content of the report. Then it was issued to the Inquiry.

MS. FAGAN:

Q. Why is the director of research involved?

MR. POWER:

A. Just to make sure -

MS. FAGAN:

Q. What's each person's role?

MR. POWER:

A. The role of each person is to ensure that the content of the manuscript reflects what NRC-IOT says as a whole. It wasn't just myself and Antonio's views. It was the views of the

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Institute as a whole.

MS. FAGAN:

Q. Okay. Why -- I thought your comment on why you involve your communications officer was interesting. I mean, is it to spin the report? I mean, why do you get a communications officer involved?

MR. POWER:

A. No, oftentimes when we're in this area of research, we keep the terminology at somewhat of a high level. We're used to dealing with acronyms and shorthand notations. So the idea behind the communications coordinator reviewing it is to be able to go and make the language a bit more palatable.

MS. FAGAN:

Q. Okay. I believe your term to me is, while fascinating, it may be very difficult to read.

MR. POWER:

A. Exactly.

MS. FAGAN:

Q. Okay, and this is a fairly technical piece, because what you're going to describe is your research and I'm going to ask you to get into your PowerPoint and I would just like to put

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the statement forward that I asked that it be put in layman's terms and to try and bring it to a place where those who don't have the technical expertise can understand it and I'll tell the group, there was one spot where they said deep body temperature and I thought that was great, and then a revision came back and there was a DT with a little number next to it and I said, you've gone back to those symbols and numbers again. I thought we were going to go with deep body temperature. So these are highly skilled, highly technical people and I've asked them to work hard on bringing it to a level where those without the technical expertise can understand, because it is important to know how the body reacts.

So let's go to your overview, slide two of your PowerPoint presentation which is Exhibit 221. Can you just give a brief overview of the outline? And I believe Mr. Power is going to control the -

MR. POWER:

A. A brief outline would be the first - first we'll talk about the NRC-IOT's Marine Safety Research Program, and what are some of the

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driving goals behind this research program. We'll then have a brief overview of human responses to cold water immersion, a review of literature that's examined human performance in immersion suits. We'll then get into the NRC-IOT research. We'll look at some examples of prescriptive versus performance-based approach to standards. We'll then look at existing knowledge gaps in standards, and then we'll also have observations for ways forward.

MS. FAGAN:

Q. So your first topic, I believe you have one slide on that. Can you just give us the marine safety, because I know IOT has a lot of topics and we've asked you to describe the very narrow aspect?

MR. POWER:

A. IOT has four separate areas of research and marine safety being one of them. It looks at the characterization safety equipment performance in extreme conditions. So how do lifesaving appliances, and this can be immersion suits, lifeboats, life rafts, how do they operate in more realistic conditions. We also look at the assessment of new

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technologies for survival in harsh environments, with the ultimate goal being we want to address the knowledge gap between the performance in calm water testing conditions were lifesaving appliances are often certified, and their performance in real world conditions where they're often used.

MS. FAGAN:

Q. So what you're saying is right now we're moving, or work is being done to do this testing in a more realistic environment because now we have facilities that more closely resemble a more realistic environment? Years ago we just didn't have wave makers and some of the equipment that's now available, would that be fair?

MR. POWER:

A. That's right.

MS. FAGAN:

Q. So let's move right into the human responses to cold water immersion.

MR. POWER:

A. So one of the areas we're looking at now in marine safety is human responses in a variety of extreme conditions. So if a human was to

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become suddenly immersed in cold water, this presents a significant risk to their safety. The most common assumption that when somebody perishes in cold water is that they die due to hypothermia, but oftentimes this isn't the case if they've perished quickly in cold water. There's another phenomenon called the cold shock response that happens upon sudden immersion in cold water, and it's important to understand the physiology between these two in emergency situations for an increased chance of survival.

MS. FAGAN:

Q. Okay, so, you know, we here have a lot of cold water and a lot of water and you hear of, you know, ski-dooers, who go down through the ice and they'll - you know, you'll hear that they died within fifteen or twenty minutes or five minutes, and then people will say, oh, they died of hypothermia. Is that the case? I mean, what's the difference, and I know we've covered cold shock, but we need to understand this because we're going to get into hypothermia because hypothermia is more of an issue once you get out of your helicopter and

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you're on the surface of the water. We've heard experts on those issues, and this issue and what you're going to drill down and deal with is really once you're out there in your survival suit, how is the body going to react? So can you go through cold shock and hypothermia?

MR. POWER:

A. Yes. Hypothermia is defined as a two degree celsius drop in deep body temperature. So for most people deep body - the resting deep body temperature is approximately 37 degrees celsius, and as the body begins to cool over time, you'll start seeing a variety of physiological responses. Within the first two degrees celsius drop, you may have some shivering and impairment of manual dexterity, but as your deep body temperature continues to drop, you'll have increased shivering, you'll find that muscle functions are significantly impaired, you may start to become apathetic and withdrawn. As you start to decrease even further, you'll get a slowing of mental and physical activity, you won't be able to process things as quickly, you'll have

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amnesia. Keep going down even further, it can result in unconsciousness and then erratic beatings of the heart, and finally a slowing of breathing and heart rate and ultimately it can lead to death.

MS. FAGAN:

Q. So you start at 37, and hypothermia, it would be at 35?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. So when the - and this is the core body temperature?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. So when the core body temperature drops to 35, that's hypothermia?

MR. POWER:

A. Exactly, two degree celsius drop.

MS. FAGAN:

Q. How long - cold water, okay, give me an example of our water offshore, let's say, you know, out where these helicopters are flying?

MR. POWER:

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A. Well, since it's salt water the temperature can drop to as low as -1.8 degrees celsius.
MS. FAGAN:
Q. So let's just be optimistic. It's 2 degrees or somewhere in around there, at least be in the positive. From your experience, how long would an unclothed - not unclothed, but -
MR. POWER:
A. A lightly clothed person.
MS. FAGAN:
Q. A lightly clothed person, how long would it take to drop the two degrees, on average?
MR. POWER:
A. Previous research has shown that people in ice water, so around 0 degrees celsius, wearing light clothing can take as long as 30 minutes to develop hypothermia.
MS. FAGAN:
Q. Okay, and that is 35, which is the shivering, that's not the death area which is down around the 28 or the 24. I mean, death you say is between 26 and 24?
MR. POWER:
A. Yes.
MS. FAGAN:

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Q. And you could have some heart problems when you get down around the 28 degrees, is that fair?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. So if it's a half hour to get to 35, how long would it take - maybe you don't do tests that would bring people down to the point of death, that mightn't get past your ethics committee.
MR. POWER:
A. No.
MS. FAGAN:
Q. So -
MR. POWER:
A. They may raise an eyebrow at that one.
MS. FAGAN:
Q. So based on your research to date, and we'll get into that in a little more detail, but this will help explain why this is important, how long would it take for a lightly clothed person to move down this scale?
MR. POWER:
A. That can vary from person to person. There are many factors that can influence that.

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MS. FAGAN:
Q. Well, a range?
MR. POWER:
A. Could be a few hours, could be two hours, I can't say.
MS. FAGAN:
Q. All right, but it's more than 30 - on average, it's more than 30 minutes?
MR. POWER:
A. Yes, the important take home message from this is that hypothermia does take some time to occur even if you're wearing light clothing.
MS. FAGAN:
Q. Okay. So we're back to the cold shock response?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. So somebody who ends up in icy cold water is not likely going to die of hypothermia in that half hour to one hour time span?
MR. POWER:
A. You hear of people becoming suddenly immersed in cold water within three meters of shore or safety and for some reason, they can't make

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it, and this is one of the reasons why, it's the cold shock response. This is what is responsible for the fatalities in a short amount of time after people become suddenly immersed in cold water.
MS. FAGAN:
Q. Okay, and we've heard from the other witnesses on this, so perhaps you can just go through this area, what is the reaction and how does cold shock response work?
MR. POWER:
A. So the cold shock response is four separate responses. First there's a large involuntary gasp that Dr. Coleshaw talked about. Then you have hyperventilation, a massive increase in your breathing rate. You'll also have an increased heart rate, and then you'll have what's called vaso-constriction which is your blood vessels going to your extremities start to close down to make sure that warm blood doesn't get lost - the heat in your blood doesn't get lost to be outside, instead that warm blood is redirected back towards your core. So the large involuntary gasp and the hyperventilation, this can increase your

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chance of inhaling water when you suddenly become immersed. You're not able to hold your breath, you're not able to regulate your breathing upon sudden immersion in cold water, you aspirate water and then you drown.

Part 3 and 4, the increased heart rate and the vaso-constriction, this can actually pose a threat to people who have pre-existing heart conditions because now your heart is beating faster. With vaso-constriction, your blood vessel is closing down, your heart is now trying to push fluid through a smaller opening. This increased cardiac workload may be too much for some people who have pre-existing heart conditions.

MS. FAGAN:

Q. When some of the testing is done, are people screened for heart conditions?

MR. POWER:

A. Yes, we have all our participants, when they perform tests, we have them screened by a medical doctor to make sure they're physically fit and able to perform our tests.

MS. FAGAN:

Q. So if one of the subjects stepped forward and

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they had a pre-existing heart condition, they would be eliminated as a participant, would that be fair?

MR. POWER:

A. Yes. In fact, we did have one participant from a previous study, he was screened out by our medical doctor because he had a pre-existing hypertensive condition.

MS. FAGAN:

Q. So it's the blood in the arms moving to the core. So it's the extra blood that's sort of all moving towards the heart, placing more pressure on the heart that contributes to the potential heart problems from immersion in cold water?

MR. POWER:

A. Well, it's the heart now trying to push fluid through a smaller opening. So your blood vessels are closing down to your extremities and your heart is still trying to push -

MS. FAGAN:

Q. Still trying to get the blood out?

MR. POWER:

A. It's still trying to push the blood out, but your body doesn't want it to go out there

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because it wants to keep it inside, keep it at your core and keep you warm.

MS. FAGAN:

Q. Okay, so it's the opposite of what I just described, but at least I now understand it. Now immersion suits, what are they designed to do?

MR. POWER:

A. Well, immersion suits are designed to help reduce thermal shock, so the cold shock response, delay the onset of hypothermia, provide floatation and minimize the risk of drowning.

MS. FAGAN:

Q. And where does this come from, this statement?

MR. POWER:

A. This comes directly from the Canadian General Standards Board, 65.16-2005 for immersion suit systems.

MS. FAGAN:

Q. Now the two different suit systems that are worn offshore, can you describe those systems?

MR. POWER:

A. There are two different suit systems. Immersion suit systems, which are more

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commonly found on fishing vessels, for example, and helicopter transportation suit systems which is represented by this suit up here.

MS. FAGAN:

Q. Okay, and they are required by regulators, is that correct?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Now the third section of your report was a review of the literature. Why is it important?

MR. POWER:

A. It's important because we know that the performance of immersion suits can help delay the onset of hypothermia, but the question becomes is the environment going to impact the performance of people in immersion suits. So before we began your project at NRC, we needed to see what was done before us to know that we can conduct work that can help address those knowledge gaps.

There has been previous work that looked at the environment impacts on human

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performance. We found - some earlier studies had found that waves can increase cooling. There's also later experiments that used lifeboats and rigid hull inflatable boats to simulate rough sea conditions. So they conducted a study where they looked at the performance of people in calm water, and then they created waves using the wake of boats, and they found that there was some change in the rate of core temperature drop in weather conditions compared to calm, and they concluded that rough seas may result in significantly lower survival times than those estimated in calm water.

MS. FAGAN:

Q. What was - was there any issue with these studies? I mean, you've taken further studies. So why was more study needed?

MR. POWER:

A. Well, some of the earlier studies, and the one I just referred to about testing in calm water and then using the boats to create waves, it lacked a degree of repeatability. When you test outside, you're at the mercy of the weather. So what they tested in the calm

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conditions, whatever the water temperature was that day and whatever the air temperature was, the wind speed, that's what it was. So there may have been a problem with every participant experiencing the same condition as all the others.

MS. FAGAN:

Q. Okay. You the mention Professor Tipton. What was his study?

MR. POWER:

A. Well, Professor Tipton then went and conducted a study in laboratory conditions where he was able to make sure that every participant saw the same conditions as all the rest of them did.

MS. FAGAN:

Q. So he did it in a laboratory?

MR. POWER:

A. In a laboratory setting, yes.

MS. FAGAN:

Q. And what results or what was the takeaway from his study?

MR. POWER:

A. Well, what Tipton concluded from his study was the possibility exists that to overestimate

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survival times based on lab conditions that do not recreate the stresses in a real emergency, and he also suggested that this limitation could be reduced if lab testing could be made more realistic.

MS. FAGAN:

Q. What was Professor Tipton's study, can you describe what this study was, what were the conditions?

MR. POWER:

A. Professor Tipton looked at the performance of suits in both calm water and with 15 centimetre waves, approximately 12 kilometres per hour wind and spray, and 4 degrees celsius water. He found that there was a significant difference compared to the calm conditions and the rough weather conditions that he tested in.

MS. FAGAN:

Q. Your next slide refers to a - I guess we're now down to water leakage. So we've - there's a little bit done on calm versus rough. What is the situation when you have some water leakage?

MR. POWER:

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A. Well, in Tipton's study that I was just referring to, he found that the suits - that one style suit allowed 1.32 litres of water to ingress, and another 2.2 litres of water to leak into the other style of suit. So later work conducted by Tipton and Balmi investigated the effects of water leakage, and he found that as little as two cups of water applied over the torso can result in a 30 percent reduction in clothing insulation.

MS. FAGAN:

Q. So now what do you mean by that?

MR. POWER:

A. Pardon?

MS. FAGAN:

Q. What do you mean by that?

MR. POWER:

A. Well, the level of clothing insulation, how much insulative value, Clo value, I think as we've heard earlier from other witnesses, that was reduced by 30 percent by adding water over the torso.

MS. FAGAN:

Q. So if you're wet, you'll get colder?

MR. POWER:

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A. Yes, but what was interesting as well to come from that study was that the same amount of water applied over the limbs resulted in the same change in deep body temperature as with no water leakage added to the suit. So it's the location of the water leakage that's just as important as how much that comes in.

MS. FAGAN:

Q. So water on the limbs didn't affect the temperature. The takeaway there would be either stay bone dry, but if you have to have some water, have the water on your arms or your limbs?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. The worse place to have water is your torso. If you have water on your torso, that will affect the cooling or the insulation value?

MR. POWER:

A. That would significantly increases your cooling rate compared to water along your extremities.

MS. FAGAN:

Q. Okay. What was the next research?

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MR. POWER:

A. Some later work conducted by Dr. Michel Ducharme and Dr. Chris Brooks investigate the effects of varying wave heights on heat flow. So they had six volunteers perform immersions in waves ranging from 0 to 70 centimetres, and even though they found that there was no change in deep body temperature over these range of waves, they did find that heat flow was affected by wave height. So waves 30 centimetres and higher produced a significantly great amount of heat flow, so heat flowing from the humans to the external environment. They found that waves 30 centimetres and higher produced a significantly greater increase in heat flow compared to calm conditions.

MS. FAGAN:

Q. So what is the difference between - now we've heard core temperature and deep body temperature.

MR. POWER:

A. Sorry, it's -

MS. FAGAN:

Q. Are they different?

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MR. POWER:

A. No, it's the same term.

MS. FAGAN:

Q. So there was no change in the core temperature, which is what you'd be looking at from a hypothermic type scenario.

MR. POWER:

A. Right.

MS. FAGAN:

Q. So what's heat flow?

MR. POWER:

A. Heat flow is measuring how much heat is flowing from the surface of your skin to the external environment.

MS. FAGAN:

Q. And how does that affect a person from, you know, their physical condition? I mean, what's the - I mean, heat flow, how does that change your situation?

MR. POWER:

A. Well, heat flow, obviously with a higher level of heat flow, you're losing more heat to the external environment, and if you're losing more heat, then you're able to compensate for, so referring back to the hypothermia graph and

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we saw some of those physical reactions to cooling. If you're not able to overcome the amount of heat flow that you're losing to the environment, say, by shivering to generate more heat, or vaso-constriction to reduce the amount of heat you're losing to the environment, if you're going to what's referred negative thermal balance, then you're losing more heat than you can produce and you will eventually reach hypothermia.

MS. FAGAN:

Q. So heat flow is what you would expect, it's a precursor -

MR. POWER:

A. Yes.

MS. FAGAN:

Q. To hypothermia?

MR. POWER:

A. Yeah.

MS. FAGAN:

Q. The review of the literature, what would be a summary of all of this information because this is what led you to then start your study?

MR. POWER:

A. What we saw in the summary of literature is

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that varying environments can possibly reduce the performance of humans in immersion suits compared to calm water conditions. The studies that were conducted in lab conditions showed that wind and waves could result in a degradation in this performance, and Tipton recommended that test standards must recreate the tasks which have to be undertaken in the environmental conditions they're to be undertaken in.

MS. FAGAN:

Q. Okay, so this is Tipton's recommendation, you look at the environment when you're setting a standard? Would that be -

MR. POWER:

A. No, take a look at the environment in order to get an accurate assessment of the performance.

MS. FAGAN:

Q. Okay. So you then have a chart, and I think that may explain that idea a little better, and can you go through the chart and who is the author of this chart?

MR. POWER:

A. This is by Professor Michael Tipton. The reference for the chart is at the bottom

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there, and what this chart conveys is that it's important to consider both the human responses and the environmental conditions when we're looking at setting suit standards and designing and getting an accurate idea of suit performance, or people in suit performance, excuse me. As Professor Tipton has outlined here in the diagram, if we ignore either the human responses or the environmental conditions, ultimately we're going to lead to surprisingly poor performance in a real accident. However, if we consider both the human responses and the environmental conditions, it isn't the opposite of surprisingly poor performance and surprisingly good performance. Instead, when we consider both the humans and the environment, we get expected performance in a real accident.

MS. FAGAN:

Q. So you then knowing and having this information, undertook a project with the Institute, and can you please describe the project because this didn't start last week?

MR. POWER:

A. No, this project was originally started in

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2007, and we set out to investigate the effects of weather conditions on human performance, with our objective being measure human thermal responses in wind and wave conditions while in immersion suits. We used our facilities at IOT to create realistic repeatable conditions to address that knowledge gap that exists between calm water testing standards and the real world conditions.

MS. FAGAN:

Q. So as I understand it right now, the standard requires the suits to be tested in a pool or calm water and there is some wave, is that right?

MR. POWER:

A. Depending if you're using suits or manikins, but we'll touch on that a bit later in the presentation.

MS. FAGAN:

Q. And your testing was to have the - see the performance in a more realistic, more realistic than the current means by which they're tested, the suits are tested?

MR. POWER:

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A. For humans, yes.

MS. FAGAN:

Q. And we'll have to deal with the whole manikin/human thing in a minute. So can you describe your tests? The first phase was March of 2008?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Can you just describe the conditions for the test, the first phase of the test?

MR. POWER:

A. For the first phase of the test, we set out to quantify the effects that wind and waves had on human thermal responses. We had 12 people perform one hour immersions in calm water, immersion with only wind, and immersion with only waves, and then immersion in both wind and waves. The waves that we used in this test were actually generated from data collected from a wave buoy deployed on the southwest coast of the Grand Banks. So we logged into the wave buoy, took the wave data that it collected for February of 2008, brought it down to our facility and recreated a wave

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spectrum that was similar to what was out on the Grand Banks in February of 2008.

MS. FAGAN:

Q. Okay, so a spectrum is a pattern?

MR. POWER:

A. A pattern of waves, yes.

MS. FAGAN:

Q. So if in February of 2008 the waves were short, short, long, long, long, short, whatever it happened to be, that is what was recreated in the wave tank?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Now what was in the wave tank?

MR. POWER:

A. Well, we had twelve human participants, as well as we had the CORD Group Limited's thermal manikin tested alongside the humans.

MS. FAGAN:

Q. Okay. Why did you have a manikin in the wave tank when you had the twelve humans in the tank?

MR. POWER:

A. We were looking at adding to the growing

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knowledge base of correlating thermal manikin responses to human responses under a variety of weather conditions.

MS. FAGAN:

Q. Can you describe this manikin?

MR. POWER:

A. The CORD Group thermal manikin is owned by the CORD Group Limited, and it's often used to test immersion suits.

MS. FAGAN:

Q. Is it used to certify suits?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. I know you haven't built the manikin, but could you just give us a little bit more of a - I mean, a manikin that I know is a manikin that's in a window shop. So what's different about a thermal manikin? I assume it has something to do with heat.

MR. POWER:

A. Yes, I'm sorry, I'm no expert on a thermal manikin, the CORD Group's thermal manikin, but the idea behind a thermal manikin is it has several heaters in it, and you set the manikin

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at a set temperature, put it in a suit, and then you put it in an immersion condition, and when it reaches a stable threshold, the amount of power required to maintain that manikin's temperature is equivalent to the power or heat lost to the external environment. So through this balance of how much power does it take to maintain this set temperature at a given water temperature, you're able to determine the clothing insulation value on a suit.

MS. FAGAN:

Q. Okay. Does the vascular restriction in the arms, is that - how does that contribute to a human thermal regulating or a human maintaining their core temperature, how does that work?

MR. POWER:

A. Well, by having vaso-constriction redirecting that warm blood to the core and preventing warm blood going out to the extremities and losing heat to the environment, a human is able to successfully thermal regulate, keep the warm blood into the core, shiver, increase your core body temperature.

MS. FAGAN:

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Q. So does the manikin have a shivering mechanism and does it have an ability to redirect sort of a temperature from the limbs to the core of the manikin?

MR. POWER:

A. No, hence the importance of correlating human responses - correlating the manikin responses to the human responses.

MS. FAGAN:

Q. So is there a knowledge gap as to sort of the manikin - how the manikin is in relationship to a human? You're saying the core relationship - is the knowledge there now, do you know what the correlation is between the limb of the manikin and the limb of a human being?

MR. POWER:

A. That's growing.

MS. FAGAN:

Q. That's growing?

MR. POWER:

A. It's growing, yes.

MS. FAGAN:

Q. But it's not known yet?

MR. POWER:

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A. No.
MS. FAGAN:
Q. Okay. What did you measure?
MR. POWER:
A. Well, on the humans we measured skin temperature, heat flow, and deep body temperature.
MS. FAGAN:
Q. And can you give us the conditions?
MR. POWER:
A. We had four separate conditions; calm, wind only, waves, and then wind and waves, and the chart that's up on the screen here shows the given environmental conditions for each one. We had wind speed of approximately 16 kilometres per hour and the wave spectrum had a maximum wave height of 0.67 metres and the water temperature we tested in ranged from 10.8 to 11.1 degrees, and air temperature was approximately 17.6 to 18.1 degrees.
MS. FAGAN:
Q. So would it be fair to say that is warmer than the Grand Banks?
MR. POWER:
A. Yes.

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MS. FAGAN:
Q. The Grand Banks would be closer to 0, 3,4 degrees, and the air can be cooler than 17 degrees celsius?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. I don't even know if we're going to reach that today and it's June 30th. Let's have a look at the setup, which I believe you have a photograph for that. Can you describe what's in the photograph for us?
MR. POWER:
A. Yes. The person in the red suit you see over on the right is one of our participants performing the immersion. This bank of machinery right here is our wind fan, so generating the wind that's blowing over the participants, and this over here, the object situated between the two yellow rectangles is the thermal manikin tested right alongside the humans.
MS. FAGAN:
Q. Okay, so what are the yellow - what are the yellow objects?

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MR. POWER:
A. They're floatation bags. They're designed - they're filled with air and they allow the manikin to float in a similar position to the human.
MS. FAGAN:
Q. Okay. So why wouldn't the manikin just use the life jacket, the preserver that's around the human?
MR. POWER:
A. The thermal manikin is much heavier than the human and needs these floatation bags in order to stay in a floating position similar to the human.
MS. FAGAN:
Q. Okay. We can see, but many of those who can't see the photograph, the suit in the photograph is red. What type of suit were you using for the test?
MR. POWER:
A. This is a marine abandonment suit that we're using.
MS. FAGAN:
Q. How does the marine abandonment suit relate to, or are there any similarities between the

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marine abandonment suit and the helicopter passenger transportation suit, because you weren't using the helicopter suit in the test?
MR. POWER:
A. No.
MS. FAGAN:
Q. So is there any relationship between them?
MR. POWER:
A. The standards between both suits, the immersion suit or marine abandonment suit and the helicopter transportation suit are very similar.
MS. FAGAN:
Q. What about the insulation value?
MR. POWER:
A. The insulation - well, they both have the same thermal protective test required for both.
MS. FAGAN:
Q. Okay. So the Clo?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. We've heard a lot about Clo, so they're required to have the same Clo?
MR. POWER:

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A. Same Clo, yes.
MS. FAGAN:
Q. Buoyancy - we understand that the helicopter transportation suit can only reach a certain maximum buoyancy. That wouldn't apply to the marine abandonment suit?
MR. POWER:
A. No.
MS. FAGAN:
Q. So where they're similar is the insulation value? The two suits are similar from a thermal insulation standard?
MR. POWER:
A. Well, they have to meet the same standard.
MS. FAGAN:
Q. Okay. Just because you have to meet the same standard, can you exceed the standard?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Now that might affect buoyancy when it comes to the passengers?
MR. POWER:
A. Yes.
MS. FAGAN:

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Q. Can you go through the next couple of slides? What are in this - this is the human that we're seeing here, is that right?
MR. POWER:
A. Yes, these are our willing human participants that we had. The photo on the left shows a participant performing an immersion in wind and waves, so you can see the effect of the wind on the water, the blurring of the water, and then it's hard to tell, but there are waves coming down towards the participants feet in the picture on the left. The picture on the right is our calm water testing condition. So if we were to be testing humans in suits, we would be testing them in set conditions similar to what you see in the photo on the right.
MS. FAGAN:
Q. So the current standard, if you want to test a human under the current standard, that's -
MR. POWER:
A. It's a calm circulating water that has a temperature of 2 degrees celsius.
MS. FAGAN:
Q. Now these participants were in 11 degrees celsius?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Okay. The next section is a very, very short video. I don't know if we'll have any sound, so can you describe - there is no sound on the video?
MR. POWER:
A. No.
MS. FAGAN:
Q. So could you just describe before the video plays what is demonstrated by this video?
MR. POWER:
A. This video is a short clip of a participant performing immersion in our wave conditions. So this clip will give you an idea of the kinds of waves that people were experiencing while they were doing this test.
MS. FAGAN:
Q. Okay, and there's no sound, so you can go ahead and play. I can see the waves are a little irregular, there's some big ones and then bigger ones. So how long did this last? An hour?

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MR. POWER:
A. These tests were for one hour in duration.
MS. FAGAN:
Q. Okay, all right, what were the results?
MR. POWER:
A. Some of the results we found was that there was no significant change in deep body or core temperature across all the immersion conditions, but this was not surprising given the fact that the water was only approximately 11 degrees celsius and the immersions were only for one hour.
MS. FAGAN:
Q. Okay. Did you find anything that was surprising? I mean, this wasn't a surprise.
MR. POWER:
A. No.
MS. FAGAN:
Q. I mean, it's 11 degrees and you're in an immersion suit. These suits are supposed to keep your core temperature from dropping for how long?
MR. POWER:
A. For six hours.
MS. FAGAN:

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Q. So they should have been good for at least six hours in these suits, especially at 11 degrees, would it be fair?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Okay.
MR. POWER:
A. But what we did find was--a surprising finding--was the fact that just be adding wind and waves, we increased the heat flow from the humans to the external environment by 37 percent. There was no significant change in water temperature or air temperature just be adding wind and waves, we brought the heat flow up 37 percent.
MS. FAGAN:
Q. Okay, and heat flow is the precursor to hypothermia?
MR. POWER:
A. How much head you are losing to the environment.
MS. FAGAN:
Q. Okay. What else can you tell us from your results? I believe slide 23.

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MR. POWER:
A. Okay, so this slide 23 shows the clothing insulation value or Clo value of the suit that we tested as measured by the CORD Group Limited's thermal manikin. The dashed black line you see going across the slide is the 0.75 Clo value that suits have to meet. So what is surprising here is that we can see the Clo value of the suit start dropping as we move from calm to wind and then waves and then over to wind and waves, with wind and waves producing the greatest drop in Clo value.
MS. FAGAN:
Q. Okay. The human subjects, were they dry or wet?
MR. POWER:
A. Both the manikin and the participants were dry in this test.
MS. FAGAN:
Q. Okay, can the manikin be wet?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Okay, so -
MR. POWER:

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A. But it wasn't wet for these tests.
MS. FAGAN:
Q. Okay, so everything was dry?
MR. POWER:
A. Everything was dry.
MS. FAGAN:
Q. Okay. But I believe later on people are wet?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. So we'll move to the conclusions from Phase 1 and then into Phase 2.
MR. POWER:
A. Briefly the conclusions, we didn't see any significant differences in water or air temperature and this is important because when we go to wind and waves, there's this 37 percent increase in heat flow. So it wasn't a significant change in temperature, it was just by adding these environmental conditions we saw the increase in heat flow.
MS. FAGAN:
Q. Okay, so it's wind, wind and wave is what made the difference?
MR. POWER:

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A. Yes.
MS. FAGAN:
Q. Okay. Phase 2, so the next year, March of 2009, you do another test.
MR. POWER:
A. Yes.
MS. FAGAN:
Q. And you change things up a little bit.
MR. POWER:
A. Now that we've established that wind and waves will cause the greatest amount of heat flow from the humans to the environment, we investigated if varying weather conditions or varying wind and waves will cause a significantly greater increase in heat flow in a linear fashion, so as we increase the weather conditions, will heat flow increase in a similar fashion.
MS. FAGAN:
Q. Okay. So what were the conditions, you can go through--describe this test for us.
MR. POWER:
A. Okay, we did three-hour immersions this time in three separate conditions: a calm water immersion; an immersion condition termed

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weather 1; and an immersion condition termed weather 2. Weather 2 had the same environmental conditions, so same wind speed, same wave pattern as we did in the wind and waves condition from the previous test.

MS. FAGAN:

Q. Okay.

MR. POWER:

A. Weather 1 was half of the wave height of weather 2 with wind speeds matched accordingly.

MS. FAGAN:

Q. What do you mean by "wind speeds matched according"?

MR. POWER:

A. Well, for every sea state, so seas with a certain wave height, that there's an associated wind speed, so we didn't half the wind speed when we halved the wave height because it would not be a wind speed representative of those wave conditions that we had in the tank.

MS. FAGAN:

Q. Okay. So if you have a certain wave, you can expect a certain wind?

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MR. POWER:

A. Yes.

MS. FAGAN:

Q. And in the real world, a certain wave will likely have a certain wind associated with it.

MR. POWER:

A. Yes.

MS. FAGAN:

Q. So once you had your wave, you put in the corresponding real wind, not just some arbitrary, let's just pull the fan back to half.

MR. POWER:

A. Exactly.

MS. FAGAN:

Q. Okay. Now there was a--besides 3 hours, there's another bullet down here. What does this last bullet -

MR. POWER:

A. So we also measured the participant's metabolic rate during this experiment, so as I referred to earlier with hypothermia, one of the body's natural responses is to shiver, increase heat production and shivering you use energy, so by measuring their metabolic rate,

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we can determine how hard they are working to try to maintain this deep body temperature.

MS. FAGAN:

Q. Why is that relevant?

MR. POWER:

A. Well, you could say for example if we had two participants in two separate styles of suits and in both suits the participants performed an immersion and neither participant experienced a significant drop in deep water temperature, neither one of them became hypothermic, but one participant has to shiver like a paint shaker to maintain his deep body temperature, while the other participant is perfectly fine. We get both participants out of the water, the question is who had to work harder to maintain their deep body temperature, who had to work harder to try and, you know, shiver, bring up that deep body temperature.

MS. FAGAN:

Q. And if you're in the water for a long time trying to survive, how does working harder affect your ability to survive?

MR. POWER:

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A. It can lead to fatigue.

MS. FAGAN:

Q. Okay. What were the Phase 2 conditions? I believe the temperature of the water is about the same, 11 degrees?

MR. POWER:

A. So the temperature of the water was the same and air temperature was slightly warmer than what it was the previous year, so again we can see that the maximum wave height is approximately half in weather 1, compared to weather 2, but the wind speed isn't half because as I mentioned earlier, we matched wind speed according to the wave height.

MS. FAGAN:

Q. Okay. Now, your next slide has photographs and what are the white tubes because they're different from the last -

MR. POWER:

A. The white tube is--we have the participants wearing a mask that allows us to capture and measure the amount of oxygen and carbon dioxide in their exhaled breath. So by measuring the amount of oxygen they consume, we have an idea of their metabolic rate, so

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that white tube is leading from the participant to our metabolic measuring unit located on the shore.

MS. FAGAN:

Q. And the one on the left is with the fans, I guess, and the one on the right is the calm, is that correct?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Those photographs.

MR. POWER:

A. Yes, yes.

MS. FAGAN:

Q. And I believe you have another video, a very short clip to show what this experiment looked like.

MR. POWER:

A. So this video shows a participant performing a three hour immersion in the weather 2 conditions, so the highest wind and the highest waves.

MS. FAGAN:

Q. And this time it's three hours.

MR. POWER:

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A. And this time it's three hours.

MS. FAGAN:

Q. Okay, so perhaps we can play the clip so everybody can have an idea what it was like for three hours. Now there's something interesting in the background and perhaps you could explain--I don't know if they'll see it here, but the screen that's now coming up with Lord of the Rings.

MR. POWER:

A. Yes, in order to help prevent boredom and keep our participants entertained in the water for three hours, we constructed a movie screen, so the participants were able to watch movies on the screen and they had a portable FM Walkman with earphones in and we had the audio for the movie playing over a FM frequency.

MS. FAGAN:

Q. Were the participants paid?

MR. POWER:

A. Yes, they were

MS. FAGAN:

Q. Okay, is it a big money maker?

MR. POWER:

A. Fifty dollars per immersion is what we paid

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the participants.

MS. FAGAN:

Q. So if things are slow when the Inquiry is over -

MR. POWER:

A. Yes, please see me.

MS. FAGAN:

Q. If you meet the age requirements. So, now the Phase 2 results.

MR. POWER:

A. Similar to Phase 1, we didn't see significant change in deep body temperature across all the immersion conditions, so weather 2, the highest wind and wave conditions, did not produce a significantly greater decrease in deep body temperature compared to the calm conditions.

MS. FAGAN:

Q. And this graph is a point of a degree, is that correct? So -

MR. POWER:

A. Point one, yes.

MS. FAGAN:

Q. Point one or point two, which isn't a full degree, it's one-tenth of a degree.

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MR. POWER:

A. I think so, yes,

MS. FAGAN:

Q. So there wasn't an appreciable shift.

MR. POWER:

A. No.

MS. FAGAN:

Q. What about the next slide which is the heat flow?

MR. POWER:

A. So the next graph here shows the amount of heat loss from the humans to the external environment and similar to our previous study, we saw that the weather 2 conditions, so the highest wind and wave speed produced a significantly greater increase in heat flow compared to the calm conditions. But what was also surprising was that the weather 1 conditions, so half of the wave height and appropriately matched wind speed, also produced significantly greater increase in heat flow compared to the calm conditions.

MS. FAGAN:

Q. Okay, so the wave was reduced and the wind was reduced not in half, but it was reduced and

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you still had this heat flow loss?
MR. POWER:
A. A significant increase in heat flow, yes.
MS. FAGAN:
Q. And so what were the conclusions?
MR. POWER:
A. What we concluded was that while weather 1 and weather 2 produced significantly greater increases in heat flow compared to the calm conditions, the participants' deep body temperature did not change significantly.
MS. FAGAN:
Q. So three hours, still no change.
MR. POWER:
A. Still no change.
MS. FAGAN:
Q. These are six hour suits.
MR. POWER:
A. Yes. So what we're able to conclude is that the participants were able to successfully thermoregulate in these conditions, so even though there's an increase in heat flow, so even though they were losing more heat to the environment through shivering, through vaso-constriction, they were able to successfully

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overcome this and maintain a stable deep body temperature.
MS. FAGAN:
Q. Okay, so they may have had to work, they may have had to work, but their core temperature remained -
MR. POWER:
A. Yes, they responded to the increased heat loss through their own natural thermoregulatory responses and were able to maintain a stable deep body temperature.
MS. FAGAN:
Q. How were the human participants--can you describe how they were when they got out of the water after their three hours?
MR. POWER:
A. All participants were able to perform three hour immersions and they came out of the water and they reported feeling cold, but overall they were no worse for wear. After a quick 20 minute dip in the hot tub and some warm drinks and snacks they were feeling fine.
MS. FAGAN:
Q. Okay, Phase 3 which was March of 2010, how did you change things for Phase 2, what's

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different from the other two?
MR. POWER:
A. What we looked at with Phase 3 was going back to Tipton and Balmi's earlier work where they saw that 500 millimeters of water can cause a significant change during the immersion. We investigated if the effects of weather conditions are now amplified by adding 500 mils of water to the suit, so that's a cup of water to the front and cup of water to the back.
MS. FAGAN:
Q. All right, so this is on the torso?
MR. POWER:
A. On the torso.
MS. FAGAN:
Q. Not on the limbs.
MR. POWER:
A. No.
MS. FAGAN:
Q. Tipton's earlier work had showed that the limbs, having the limbs wet didn't seem to affect core temperature.
MR. POWER:
A. Correct.

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MS. FAGAN:
Q. But the torso seemed to have more of an impact -
MR. POWER:
A. Yes.
MS. FAGAN:
Q. - on the body. So you aimed for the torso.
MR. POWER:
A. Yes.
MS. FAGAN:
Q. How did you make them wet?
MR. POWER:
A. What we did was we took two separate spray bottles and we measured out 250 millilitres of water in each bottle, so then we had one bottle was sprayed all over the front of the participant, this is before they got into their immersion suit, so they were in their test clothing, and then the second bottle was sprayed on the back of the participant.
MS. FAGAN:
Q. What were they wearing?
MR. POWER:
A. They were wearing the standard CGSB test clothing which includes a long sleeve cotton

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shirt, cotton pants, wool socks, underwear and an undershirt.

MS. FAGAN:

Q. So it wasn't that kind of wick away fabric that we've heard discussed earlier.

MR. POWER:

A. No.

MS. FAGAN:

Q. It's cotton.

MR. POWER:

A. No, and the suit or excuse me, the shirt was completely saturated with just two cups of water.

MS. FAGAN:

Q. What was the temperature of the water that you sprayed?

MR. POWER:

A. Oh, it was room temperature water.

MS. FAGAN:

Q. So it wasn't cold water.

MR. POWER:

A. No.

MS. FAGAN:

Q. Probably felt cold -

MR. POWER:

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A. Yes, it did.

MS. FAGAN:

Q. Can you move on and describe the rest of the test please?

MR. POWER:

A. Yes, so the idea behind this, as I mentioned from the Phase 2 work, the participants were able to successfully thermoregulate in the given conditions we had them in in Phase 2. The purpose of adding the water is will the affects of weather be amplified and now will we push participants past that thermoregulatory boundary? Will they be pushed past their capability of maintaining a stable deep body temperature. So some preliminary results from Phase 3, because the data is still under analysis right now, with the water temperature at 8 degrees celsius and the air temperature approximately 16 degrees celsius, so it's similar to the conditions we've tested in previously. What we saw this time, though, was very different responses from the participants when they were coming out of the water. We saw that some of them had intense shaking and shivering, a lot of

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them had a blue tinge to their lips when they came out. We saw a near hypothermic level drops in deep body temperature and we also saw several participants zoning out or losing cognitive processing. An example of this is when the participants are in the water, we periodically check on them, so we walk over to the side of the beach and we'll wave at them while they're in the water and if they're fine, they'll wave back, they'll give us a "thumbs up". So this one time a participant was performing immersion in weather 2 and I walked over to the side of the rail, I waved at him, he turned his head and he looked at me and for a full five seconds, he did nothing. Then he slowly raised his hand and we waved at me. So when he got out, I asked him why was he so slow to respond and he said, "I remember seeing you come over, I remember seeing you wave at me and I remember thinking there was something I was supposed to do, but I couldn't remember what it was I was supposed to do when you waved at me." We also had some participants report that during the last 30 minutes of the immersion they couldn't even

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watch their movie, they were just zoned out and they had no concept of the passage of time.

MS. FAGAN:

Q. Did you have 12?

MR. POWER:

A. We had 12 participants and some of them had trouble finishing the three hour immersions.

MS. FAGAN:

Q. So some got out early?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Is that what you mean?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Okay. And when you say "weather 2", so you mean the windiest, the same weather 2, the windier condition, the waves, and so the difference here is that the torso was wet.

MR. POWER:

A. Yes.

MS. FAGAN:

Q. And what is the sort of take away or summary

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because you don't have the charts for this particular phase because this particular phase is being--is still being analyzed, is that correct?

MR. POWER:

A. Uh-hm.

MS. FAGAN:

Q. So from your preliminary results, what can you tell us?

MR. POWER:

A. What we can see so far is that adding--initially from these initial observations that adding 500 mils of water will produce a significant affect, compared to being dry.

MS. FAGAN:

Q. Okay. So they didn't drop the full two degrees, but what you could tell was they were starting to get close?

MR. POWER:

A. They were getting close, yes.

MS. FAGAN:

Q. This is three hours in 8 degrees, in the suit that should last six. Now they didn't go below the two but there was a significant change once you put in the water and added the

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wind and waves?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. I am going to end there because it's almost 11. There's a couple of questions on the upcoming tests and what's going on, but I think we'll stop at this stage.

COMMISSIONER:

Q. All right, we'll take the break now then.

MS. FAGAN:

Q. Okay, thank you.

(RECESS)

MS. FAGAN:

Q. Thank you, Mr. Power. Now before we move to Section 5 of your presentation, just a couple of things on the study. The age of the group, you mentioned the subject who had a difficulty waving or responding to the wave. Can you tell us how old - the demographics of the 12?

MR. POWER:

A. For the past two studies, the demographics were 19 to 34 year old healthy males.

MS. FAGAN:

Q. And we've had a survey conducted and the

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workforce, although predominantly male, there are some females and they don't fall in the category of 19 to 35. Our workforce is getting older and older and they may not necessarily be the same shape or age as your participants. Can you have participants that are older? I mean, why did you select this group?

MR. POWER:

A. The age range was recommended by the medical doctor who conducts the assessments of the participants for this experiment. Upon consultation with Atlantic Offshore Medical Services, they recommended to me that the age range between 19 to 34 years of age, because 35 years and older increases your chances of a cardiovascular incident. So in the interest of safety of the participants during our test, we capped the age range at 34.

MS. FAGAN:

Q. Okay, so many of us in the room may have to think about something else versus the -

COMMISSIONER:

Q. The Inquiry is safe.

MS. FAGAN:

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Q. That $50.00 fee for the immersion. Now I understand there's another phase. You're going to do an analysis of the information you have where the real difference was making the torso wet, however, that was in 8 degrees and it was three hours. Do we have another phase that we can all keep our eyes on?

MR. POWER:

A. The previous phases of research have looked at wind and waves, and as everybody has seen here, we've been testing in pretty much warm water and warm air. The next phase of this study is going to investigate the thermal aspect of it. So we will be testing people in 2 degree celsius water and 2 degrees celsius air in our ice tank. We're also looking at - we're investigating if the heat lost in waves can be replicated by increasing water velocity past the participants, with the idea being will the heat loss in waves equal the heat los in increased water flowing past the people.

MS. FAGAN:

Q. So the wave is not just water moving up and down. A wave action has a flow.

MR. POWER:

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A. Yes.
MS. FAGAN:
Q. So do you know if it's the flow of the water or if it's the wind or the combination, right now, what's causing this loss in heat flow?
MR. POWER:
A. Well, there's two ideas that I've discussed with my supervisor about why there's an increase in heat loss compared to water velocity past the object, the person, manikin, and it's either there's what's called a boundary layer. So if I was to be immersed in calm still water, I would be immersed, and then I would start heating up the water directly next to me. So then that water would increase in temperature, the water next to that would start increasing in temperature. So what you would have, in effect, is you would have the warm body with water that's warmer, going to cooler, until you finally get to the temperature of the water over here. The idea is this is a boundary layer. So I'm not going to lose heat in, say, 10 degrees celsius water as fast as I would lose heat in 0 degree celsius water, which could be out here. The

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idea with wave action is if we're pushing water past the participants, we are stripping away that boundary layer. So instead of having water 10 degrees celsius that I've heated up with my own body heat, instead I'll have continuous flushing of 0 degrees celsius water next to me, so it will always be 0 degrees celsius water right alongside of me.
MS. FAGAN:
Q. How does that, or does that replicate the conditions on the Grand Banks?
MR. POWER:
A. Well, this is what we're investigating. We're going to be investigating if a given wave spectrum, if we can reproduce the heat loss in a given wave spectrum with water velocity moving past the participants at the same rate as the wave moves past them.
MS. FAGAN:
Q. So this is a - you're going to try to replicate the flow of water?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Because as I understand it, in the ocean,

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water and the waves - what waves are is not up and down water, waves really represent the flow of water as it moves down a current, is that correct?
MR. POWER:
A. In effect.
MS. FAGAN:
Q. So you're going to try and replicate the flow and you're going to have 2 degrees?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Wind, 2 degrees, wave, and when is this going to happen?
MR. POWER:
A. This is scheduled to take place in the fall of this year.
MS. FAGAN:
Q. Same subjects, human participants?
MR. POWER:
A. Well, same age range. I'll try and get back as many participants as I can from previous studies. If they're still going to talk to me at this point, who knows, but let's hope so.
MS. FAGAN:

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Q. Is the plan for an hour or three hours?
MR. POWER:
A. Three hour immersions.
MS. FAGAN:
Q. And this will be in the ice tank?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. The suit that will be worn, what do you plan on for a suit?
MR. POWER:
A. We plan on keeping as many variables the same as we have in previous tests. So we will use the same suit systems that we've been using in the previous year's tests.
MS. FAGAN:
Q. Now this information that you've gained so far, you have two tests completed. Your third test, the analysis is being done. Is this information being passed on to the Canadian General Standards Board?
MR. POWER:
A. Yes, it has been.
MS. FAGAN:
Q. So all of what you have discussed and told us

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here today has been passed on to the board that's trying to make a decision as to what to do with the standards for this suit, the helicopter suit?

MR. POWER:

A. The reports for the first two phases have been passed on to the board. The third report, which hasn't been completed yet, will be passed on to the board when it is written.

MS. FAGAN:

Q. When do you expect that to happen?

MR. POWER:

A. Probably in the fall of this year.

MS. FAGAN:

Q. And when will be have the results - if your tests go off in the fall of this year for a fourth phase, which really in my mind, and I am, you know, not an expert, I'm a layperson here, but I'm hearing it's 2 degrees out there and I'm hearing the air is much colder, so I'd be very interested in seeing what the results are from a - when we get into a really cold water environment. So when are those - when would you expect those results to be passed on to the board?

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MR. POWER:

A. Probably spring, late spring, 2011.

MS. FAGAN:

Q. Okay, and the standard that's now being considered by the board, how long is that process? I mean, what I'd like to think is that information will be available to the board before the board made a decision on the standard for the helicopter passenger suit?

MR. POWER:

A. So how long has the standard been open for review?

MS. FAGAN:

Q. How long does that review process take?

MR. POWER:

A. It approximately would take about 18 months. I'm not completely sure, though, how long it will take.

MS. FAGAN:

Q. Would it be fair to say that most likely this information would be to the board during its deliberations? What I'm getting at is I wouldn't want the information to end up in the board's hands after the board has -

MR. POWER:

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A. I'm not sure.

MS. FAGAN:

Q. You can't say.

MR. POWER:

A. No.

MS. FAGAN:

Q. You're on the board, though?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. So you can keep them abreast of developments as they happen?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Okay. Now the next section is prescriptive versus performance based standards. Exactly what is your position or what are you getting at - Mr. Earle, the counsel for the union for the workers that work offshore, is concerned that you're dealing with the oil regulation itself. When you talk about prescriptive versus performance, exactly what area are you speaking to?

MR. POWER:

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A. What we're looking at is, in the previous research we've done and the research that we've spent the morning discussing, the calm conditions, with the exception of the water temperature, is the conditions that we currently would test humans in. So they are the prescribed standards. So when we're approaching prescriptive versus performance, one of the main goals of the IOT Marine Safety Research Program is to address that knowledge gap between the prescriptive testing standards and the performance of people, suits, whatever, in real world conditions. So we are looking at the data to show that there is this knowledge gap, there is this decrease in performance when we move away from conditions that are not representative or that are prescribed by current prescriptive standards.

MS. FAGAN:

Q. Can you give us an example right now how do the standards read?

MR. POWER:

A. This slide shows two standards for the thermal protection tests for people and manikins in immersion suits. So for the current standard

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for helicopter transportation suits, it says that with humans the suit system shall provide thermal protection such that the average body core as measured via temperature of persons wearing suit system for six hours in calm circulating water that is between 0 to 2 degrees celsius shall not drop more than 2 degrees celsius.

MS. FAGAN:

Q. Okay.

MR. POWER:

A. So what that means is a person should not develop hypothermia in six hours in calm circulating water with a temperature of 2 degrees celsius.

MS. FAGAN:

Q. So right now the standard is calm circulating water?

MR. POWER:

A. For humans.

MS. FAGAN:

Q. For a human. If a suit meets that standard, then the regulation would allow a suit that is good in six hours of calm circulating water to be used in a number of areas?

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MR. POWER:

A. Yes.

MS. FAGAN:

Q. Of the world is what I'm getting at.

MR. POWER:

A. Well, in Canada.

MS. FAGAN:

Q. In Canada, right, sorry, because it's the Canadian Standards Board. Now what about the other standard that you've mentioned here?

MR. POWER:

A. So the other standard is when suits are tested with a thermal manikin, and when tested in accordance with Section 8.1.6.2, the mean level of thermal insulation over the body as provided by the suit system, which includes test clothing, must not be less than 0.75 immersed Clo.

MS. FAGAN:

Q. Okay, so what's the difference between - does this say you can use a human or a manikin to test the suit?

MR. POWER:

A. Yes.

MS. FAGAN:

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Q. Okay, and this would be the standard for testing the helicopter passenger suit?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. What's the difference in the test when you use a human - so you can put a human in that suit and test, or you can put a manikin in the suit and test. What's the difference in the two tests if you're in a manikin or you have a human?

MR. POWER:

A. What is the two differences -

MS. FAGAN:

Q. What's the difference between the manikin test and the human test? I mean, they're both in the suit.

MR. POWER:

A. Well, the humans are tested in calm circulating water at 2 degrees celsius and the manikin is tested in 40 centimetre waves, and if you refer back to what I said earlier about the set point of the manikin - so when we put the manikin in and we tell it to maintain a certain temperature, that temperature has to

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be 3 degrees celsius higher than the water it's being tested in, 3 degrees celsius or more than the water it's being tested in.

MS. FAGAN:

Q. Okay. So if you use a human, which is what's really using the suits, it's this first one of calm water?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. If you use a manikin, you can have a wave type action in the pool?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. Okay, but you said earlier it's not known how the manikin correlates to the human?

MR. POWER:

A. That work is still ongoing.

MS. FAGAN:

Q. That work is still ongoing. Now assuming that the suit has passed the test, and the evidence is that the suit has met the standard, where can it be used?

MR. POWER:

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A. Assuming the suit passes all its tests, including the thermal protective test, be it manikin or human, it's now - the suit can be used off the west coast of BC, a sheltered harbour in PEI, the Arctic Circle, the east coast of Newfoundland, or anywhere in Canada for that matter.

MS. FAGAN:

Q. So if a human will not lose its core temperature by any more than 2 degrees in a pool for six hours, then the standard would allow that human to use that suit in the Arctic Circle?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. And is the assumption the suit is going to last for six hours in the Arctic Circle?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. But there's been nothing - there's been no tests to replicate a human in Arctic Circle real conditions?

MR. POWER:

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A. No.

MS. FAGAN:

Q. Based on what you've studied, and looking at the standard, can you say whether this suit will prevent a 2 degrees drop in core temperature in six hours in the real world conditions?

MR. POWER:

A. I can't say with certainty, but the data that we've collected so far suggests that there would be a change in performance from the conditions it was tested in and the conditions it would be ultimately used in.

MS. FAGAN:

Q. Okay. If you're advocating, you know, I believe, the suit should perform in the areas in which they are used, the standard should require that the suit be shown to perform in conditions that are similar to where they're actually going to be used. So how would you like to see a standard?

MR. POWER:

A. Well, an example, if we switched from a prescriptive based standard to a performance based standard, this would read if there was a

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performance based standard, is that the suit must prevent a 2 degree celsius drop in core body temperature in conditions representative of the area of operation for the amount of time it would take Search and Rescue to respond. As an additional note of guidance for this, the size and distribution of the test subjects should have physical characteristics equal to that of the workforce using the suit. So if we switch - if we move towards performance based standard, we would allow the area of operation, the SAR response assets, and the size of the people to set the testing standards, and this would help reduce the uncertainty and help close that knowledge gap between testing conditions and real world conditions.

MS. FAGAN:

Q. So if you want to use it where it's 2 degrees, and the other sort of conditions, and you know it's - you know, I don't know, however long it's going to take to a rescue, you must prove or establish that the suit will prevent the 2 degree drop in those same conditions?

MR. POWER:

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A. Exactly.

MS. FAGAN:

Q. You have - there are advantages and disadvantages, is that correct?

MR. POWER:

A. Yes. So some advantages of a prescriptive based standard, they're easy to create and implement and they provide certainty for operators and regulators as to compliance. Some of the disadvantages is that compliance may not always provide the best solution; it can reduce the flexibility to the operator to provide the best solution, it does not account for improvements in technology, it can reduce innovative solutions, and there is a possible tendency to become passive in approaches to safety.

MS. FAGAN:

Q. What do you mean by that?

MR. POWER:

A. The check box.

MS. FAGAN:

Q. All right. What do you mean by the check box, meet the minimum or -

MR. POWER:

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A. Yeah, so just tick off the list, meets this, meets this, meets this.

MS. FAGAN:

Q. And not worry about what could be done to improve the situation. You have a second slide.

MR. POWER:

A. Right. So performance based standards, like perspective based standards, there are advantages and disadvantages as well. Some of the advantages of a performance based standard is that it puts responsibilities for solutions on the operators, it provides flexibility in developing solutions, it can foster innovative solutions, it allows for continuous upgrading of the system, and allows for adaptation of new technologies. Some of the disadvantages is that it requires that the regulators, inspectors, and operators be highly qualified, management system must be adaptive and closely monitored in order to change the system if required, and as well the regulators and operators must work together harmoniously to provide the best solutions available.

MS. FAGAN:

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Q. When you have your performance based approach, what's your view on guidance of guidelines? Can guidelines or guidance also be provided?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. So you could - or what about minimums, can there be - just because you have a performance based approach, can you still have minimum requirements that must be met?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. You have some examples here of standards and the knowledge gap that exists between the standards that are now set, and I'll just ask you to move to slide 41. The donning time is not really that appropriate here because the passengers are already in their suits. What about mobility and hand dexterity? We've heard that cold water can affect the hands, and if you're in your passenger suit, you have to get the gloves on after you have escaped from the helicopter. So what does the standard require somebody to prove?

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MR. POWER:

A. Well, the standard requires that mobility and hand dexterity tests to be conducted in water not less than 18 degrees celsius, but earlier work by Vincent and Tipton reported that with only two minutes with your hand in 5 degrees celsius water, you could have a significant reduction in maximum grip strength.

MS. FAGAN:

Q. So the test is 18 degrees. So as long as you can get your hand in the glove in 18 degree water, then according to the standard that will be sufficient. However, the suit is being used in an area where we know the water temperature is far less than 18 degrees?

MR. POWER:

A. Yes.

MS. FAGAN:

Q. What about the stability and floating standard?

MR. POWER:

A. Well, stability, floating, and vertical positioning are all conducted in calm water pools and it's unknown at this time how wave motion can influence the performance during

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these tests.

MS. FAGAN:

Q. So what do you mean by that?

MR. POWER:

A. Well, the stability and floatation characteristics are conducted in calm water pools. Will we still see 120 millimetres of freeboard when we move to wave environment?

MS. FAGAN:

Q. What do you mean by 120 millimetres of freeboard?

MR. POWER:

A. Sorry, 120 millimetres of freeboard is the distance - the minimum distance between your nose and mouth and the surface of the water.

MS. FAGAN:

Q. So you have to be out of the water by that amount of space?

MR. POWER:

A. Yes, from your nose and mouth to the surface of the water.

MS. FAGAN:

Q. To the surface of the water, but the standard right now does not require testing to be done in a wavy condition?

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MR. POWER:
A. No, but work is ongoing that's going to investigate the effects of waves on floatation and stability.
MS. FAGAN:
Q. Where is that work ongoing?
MR. POWER:
A. Right now we're looking like it might be conducted at IOT.
MS. FAGAN:
Q. What about vertical positioning, what do you mean by vertical positioning?
MR. POWER:
A. Vertical positioning is your ability to stand upright in the water.
MS. FAGAN:
Q. And the test right now, I take it from what you're saying is calm pools?
MR. POWER:
A. Yes.
MS. FAGAN:
Q. So we don't know if a suit that works in a calm pool will work in a wavy turbulent environment?
MR. POWER:

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A. We don't know how the performance will change moving from calm to waves.
MS. FAGAN:
Q. What about the ingress?
MR. POWER:
A. The current standards for water ingress or water leakage tests requires that you start the test with a three metre or greater jump and a 60 metre swim in calm water, and then you start adding in - you multiply the water obtained during the 60 metre swim, plus an extra standard deviation, I won't get into the math, to calculate the amount of water that's to be added to the suit before you conduct the thermal protective tests. However, there's been some work conducted by the CORD Group Limited that shows that rougher conditions could result in more water leakage entering the suit than conditions that are prescribed in the current standard.
MS. FAGAN:
Q. So the current standard is conducted or allow the test to be conducted in calm water?
MR. POWER:
A. Yes.

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MS. FAGAN:
Q. And some of the work, and I believe this work may have been referred - is this the same work that was referred to earlier evidence that there was some testing done in Halifax by the CORD Group when the changes were made to the suit. Do you know if that was the same testing?
MR. POWER:
A. I'm not sure for certain.
MS. FAGAN:
Q. Okay. The next slide has been covered, I believe.
MR. POWER:
A. Yes.
MS. FAGAN:
Q. Is that correct?
MR. POWER:
A. Yeah.
MS. FAGAN:
Q. And slide 44, what would you like us to takeaway from this slide?
MR. POWER:
A. The idea is, and this is what has led to or started our research at IOT, is that there's a

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knowledge gap between the calm testing conditions that we often certify lifesaving appliances in and their performance in real world conditions. So when we prescribe testing standards, when we say it has to be calm circulating water at 2 degrees celsius, we create a narrow avenue of criteria that we establish the performance of the lifesaving appliance in, and then we take this - we measure its performance in this narrow avenue and then we assume that this is going to be the same performance at any level.
MS. FAGAN:
Q. Okay. I think you have a diagram that would help demonstrate this idea?
MR. POWER:
A. Yes. So the graph you see before you has two axis. The bottom axis or bottom line is a sea state. So starting at the very left, it's calm water, flat, still, calm water, and moving along to the right we see an increase in sea state until we get something equivalent to a hurricane, and then we see performance along the left hand line. So at the bottom near the calm water, we can assume no performance, and

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the higher up we go in performance, we assume a better level of performance, a higher value. So we can say this red line represents the minimum requirement to preserve life and at this point it's just an abstract idea. This could be an immersion suit, a life raft, a life boat, but the red line represents the minimum requirement or how good the suit has to perform just to preserve life. So when we use a prescriptive standard, we prescribe a very narrow avenue of testing conditions. As you can see here, we oftentimes only test in pools, sheltered harbours, things of that, and it creates a very narrow window at which we can measure the performance of a lifesaving appliance, but as we know, lifesaving appliances are oftentimes used in sea states or weather conditions that are much worse than calm circulating water.

The black dash line represents our assumption. We assume that because this lifesaving appliance reached this level of performance in prescribed testing conditions that it'll have the same level of performance all the way across through higher increasing

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sea states, but we know from past work and the work that IOT is currently conducting that the green line, which represents the performance of lifesaving appliances, can start to decrease as you start increasing your sea state. We know that performance will decrease, but the question remains will you each a certain sea state where the performance of a lifesaving appliance will drop below the minimum requirement to preserve life.

MS. FAGAN:

Q. And this would be - this last section is the knowledge gap, you don't know exactly how far you can push the appliance?

MR. POWER:

A. Exactly. So the difference between the assumed level and the unknown level of performance is this uncertainty, is this knowledge gap in real world conditions, and it's this uncertainty that leads to the surprisingly poor performance in real accidents as mentioned by Tipton in his chart that we had up earlier.

MS. FAGAN:

Q. And what's a way to eliminate or reduce some

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of this uncertainty?

MR. POWER:

A. The best way to reduce this uncertainty is to test people and the equipment in the most realistic conditions, representative conditions possible, with the people who will be using them. So should we be testing with 19 to 34 year old young health fit males.

MS. FAGAN:

Q. Well, you at some point will have to balance that with safety.

MR. POWER:

A. Yes.

MS. FAGAN:

Q. And that's an issue for the Training Institute and many others as to exactly how far you can push the boundary when it comes to realism versus safety, and I guess that'll just have to be up to your medical advisors as to how far you can go. Do you have any suggestions as to how this situation, the uncertainty, can be reduced and the situation improved?

MR. POWER:

A. We do. We do have some observations for the way forward. So one of the first things is to

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examine the cost and feasibility to shift from a prescriptive to performance based regulations. We can also look at a holistic design of the transportation environment and its components, new fabrics and materials for immersion suits that allow for increased performance in realistic conditions. We could also possibly look at redesign of immersion suits for thermal balance. That's been discussed earlier. We could also look at develop of training simulators for helicopter emergency operations, escape, evacuation, and rescue. We can also look at the continuous monitoring and assessment of the offshore workforce's physical characteristics and their physical capabilities. We could also use this ongoing database of these parameters that can be transferred back to suit standards - the standards boards and manufacturers to allow for further refinements of their products.

MS. FAGAN:

Q. Do you know right now if data is being collected on the physical characteristics of the workforce that's using the suits?

MR. POWER:

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A. I'm not sure.
MS. FAGAN:
Q. What's the advantage of having this data? I mean, why is it important that that data go back to the standards boards and the manufacturers?
MR. POWER:
A. Well, just to give an example, for the longest time IMO, the International Maritime Organization, stated whenever you designed a 16 person life raft or a 150 person life raft, they said the average weight of the person using the life raft was 75 kilograms, and 75 kilograms is a very low weight for many of us here in North America, but when you saw a 150 person life raft and a 16 person life raft, it was always under the assumption that they were 75 kilograms. We know for a fact that this is not often the case. So then you could have sixteen 100 kilogram people trying to use this life raft, and all of a sudden it can't fit sixteen 100 kilogram people any more. So it's important to feed this information back to standards boards, to manufacturers, so they know who the people are that will be using

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their products.
MS. FAGAN:
Q. That's all the questions that I have for you, and I don't know if there's anything you want to add before it's turned over to the group for questioning.
MR. POWER:
A. No, nothing further to add.
MS. FAGAN:
Q. Okay, thank you very much.
COMMISSIONER:
Q. Thank you, Ms. Fagan. You know, one thing I want to mention to you, since I've been involved in this work and become aware of the suit issues, I've thought a hundred times or more how come in this part of Canada where conditions are, everybody agrees, quite severe in terms of cold, wind, waves, and all that, how come a suit wasn't purposely designed and built for these conditions? I wondered it a hundred times or more. Any comment on that?
MR. POWER:
A. No, I'm not sure.
COMMISSIONER:
Q. In your view, does a national standard in a

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huge country like Canada meet the requirement of more of the more difficult environments to be immersed in the offshore?
MR. POWER:
A. I think we have to further examine the performance in these kinds of conditions, which is the work that's ongoing.
COMMISSIONER:
Q. So you - yeah, I see what you mean. So that may come out of - the answer to that question may come out of the work that's -
MR. POWER:
A. Ongoing.
COMMISSIONER:
Q. Still ongoing?
MR. POWER:
A. Yes.
COMMISSIONER:
Q. Okay, thank you. Now I will go back to the list of parties. Transport Canada is not present. Counsel for CAPP.
MR. SCHULTZ:
Q. No questions, thank you, sir.
COMMISSIONER:
Q. Thank you. The oil operators.

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MS. STRICKLAND:
Q. No questions from HMDC at this time.
MS. HICKMAN:
Q. No questions for Husky Oil, Commissioner.
MR. PRITCHETT:
Q. No questions for Suncor.
COMMISSIONER:
Q. Okay. Counsel for Cougar.
STAMP, Q.C.:
Q. No questions, Mr. Commissioner.
COMMISSIONER:
Q. Helly Hansen?
MR. SPENCER:
Q. Not at this time, Mr. Commissioner, although we do reserve the right to ask (inaudible).
COMMISSIONER:
Q. Thank you. Counsel for MUN, Mr. Hurley.
HURLEY, Q.C.:
Q. No questions.
COMMISSIONER:
Q. Mr. Pritchard.
MR. PRITCHARD:
Q. No questions, thank you.
COMMISSIONER:
Q. Mr. Harris.

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HARRIS, Q.C.:
Q. Yes, I have a few questions, Commissioner.
MR. JONATHAN POWER - EXAMINATION BY JACK HARRIS, Q.C.:
HARRIS, Q.C.:
Q. Thank you, Mr. Commissioner. Mr. Power, my name is Jack Harris. I'm a Member of Parliament and have standing at this hearing. I was very interested in your research, in particular, your findings that when you started variations from the test standards that are being used by adding increased wind and wave conditions, that you - resulted in different conditions, in fact, more - you found, I guess, that the standard changed as a result of that. Now this is something that most of us would assume just by logic alone. Can you tell us why is it that you had to undertake what appears to be three years of research to come to that conclusion? I know you're quantifying it and that's important, but wouldn't it be accepted that the calm water test conditions would be not as rigorous as the actual conditions in the ocean?
MR. POWER:
A. You are correct, but we sought out to actually

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quantify that. So we - everybody kind of had the idea that wind and waves can increase heat flow, can it be worse than calm water conditions, and we set out to put a hard number to those values.
HARRIS, Q.C.:
Q. And of course, if you started decreasing the temperature, you know, you did your tests in 16/17 degrees of air and 11 degrees of water temperature, started decreasing those, of course, you'd have even more significant, at least in theory, more significant changes?
MR. POWER:
A. In theory, but until we actually do the work, we can't say with certainty.
HARRIS, Q.C.:
Q. Uh-hm. I guess, you know, I'm listening to your argument that there needs to be - you're suggesting, for example, the solution here is a performance based approach, and what I get from your evidence, though, is that the standard that's being used is inadequate because it doesn't test for the right weather conditions, and I'm guessing you're criticizing the fact that the same standard

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applies to calm water in the harbour in PEI to the Arctic, that that is inadequate for the conditions that we're operating in here of Newfoundland, or it may be operating in the Arctic. Doesn't it just argue that the standard is inadequate?
MR. POWER:
A. I would say it's inadequate, but we don't know the level of performance; will performance change, and if so, by how much. Until we actually establish that, it may be a bit premature to call a standard inadequate.
HARRIS, Q.C.:
Q. So you're not saying the performance is inadequate. What you're saying, though, is that the standard doesn't necessarily - obviously doesn't have universal application?
MR. POWER:
A. No, again prescriptive creates a very narrow avenue.
HARRIS, Q.C.:
Q. Well, my problem, though, with a - if you had one standard which - and I don't have a disagreement with the guideline that you would use. For example, your suggestion that the

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suit must prevent a 2 percent drop in deep body temperature in conditions representative of the area of operation for the amount of time it would take Search and Rescue to respond as a general guideline for developing a standard. That seems to me to be a good rationale, but my question, based on the fact that it's taken, and I'm not criticizing this, but it's taken three years to come up with the information that you've given us here today, and even the work that was done in 2009 has not yet been collated to the point that you're able to give us anything definitive, how many years do you think it might take for the industry or for some group to come up with a standard that was adequate for the offshore in Newfoundland, how many years will be have to wait for this research to be done?
MR. POWER:
A. I'm not sure.
HARRIS, Q.C.:
Q. Okay. What you've told us so far, though, and the research based on the 2009 work, you had 8 degrees of temperature and similar wind conditions, that in under three hours a number

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at least of the subjects that you were testing showed a reaction, which I guess you - a reaction, a change in cognitive ability, I think, zoning out, or the - you only talked about one subject here in your evidence, but I'm looking at page five of your presentation, your hypothermia chart, I wonder if you could just turn that up. What I see in the chart here is different categories based on changes, I think, in body temperature. The first category is shivering, impairment of manual dexterity, errors of omission. The second one down includes shivering, plus, plus, and I guess that means more - a high degree of shivering. Muscle function significantly impaired. The next category shows slowing mental and physical activity, amnesia, and muscle spasticity. Would the kind of activity that you described, the zoning out, would that fall into that third category or would it be somewhere else?

MR. POWER:

A. Probably be higher up. I would be more inclined to think it would be under errors of omission and the introversion/apathy. Like,

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the participant was still able to successfully get out of the tank, sit down and talk with me afterwards. So he still had his cognitive faculties in that regard.

HARRIS, Q.C.:

Q. But he wasn't able to respond -

MR. POWER:

A. Not quickly, no.

HARRIS, Q.C.:

Q. Not quickly. So he would be in the second category?

MR. POWER:

A. I would put him near errors of omission.

HARRIS, Q.C.:

Q. So in your view, he would still be within the 2 degree range?

MR. POWER:

A. Yes, he was, because if they actually did experience hypothermia during the test, we had to stop the test and pull them out for safety reasons.

HARRIS, Q.C.:

Q. So nobody did that during your -

MR. POWER:

A. No, that was a safety limit that we have

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during these tests.

HARRIS, Q.C.:

Q. You said that some people couldn't finish the three hours. Was that just an individual choice or was there any objective measurement that you had?

MR. POWER:

A. No, it was individual choice. As always in any of our experiments all participants have the right to voluntarily withdraw at any time with no penalty. So again this periodic waving that we would do, that was to make sure they are all right, and there were a lot of times when we came over and we waved and the participant would shake their head and point saying that they wanted to get out.

HARRIS, Q.C.:

Q. They wanted to get out. So that was - that's basically a self indication that their comfort level was beyond that and they wanted to finish, but there was no indication that their core body temperature was below 35 at this point?

MR. POWER:

A. No, because we would have stopped the tests,

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anyways.

HARRIS, Q.C.:

Q. So you - I take it, you know, if we're talking about conditions, and I would call the conditions that you were testing fairly moderate for Newfoundland offshore, 16 degrees of - 16 kilometres of wind and 8 degrees of temperature was the lowest that you went. They would be fairly moderate for the offshore Newfoundland, and I'm just saying that as a general observer, I haven't done any studies on it, but would you agree with that?

MR. POWER:

A. No, I do agree, and the objective of the first three phases of the project was to examine the effect of wind and waves, and with the water temperature, we did recognize that as a limitation in the study, which is why phase four, which is coming up in this fall, we will be testing in two degrees Celsius water and two degrees Celsius air.

HARRIS, Q.C.:

Q. So the six-hour standard, which I guess is what we're talking about here, two degrees body temperature loss within six hours using

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an immersion suit, that standard is based on temperature of two degrees?

MR. POWER:

A. The water temperature?

HARRIS, Q.C.:

Q. Water temperature of two degrees?

MR. POWER:

A. Yes.

HARRIS, Q.C.:

Q. And calm water?

MR. POWER:

A. Calm, circulating water, yes.

HARRIS, Q.C.:

Q. So calm, circulating water, no wind, no waves. And have you any idea what the -- or you know, as part of your scoping of your study, I guess, did you do any comparison with the average temperatures on a month-by-month basis in the Newfoundland offshore or in any particular conditions?

MR. POWER:

A. You mean for the work we've already conducted?

HARRIS, Q.C.:

Q. Yes.

MR. POWER:

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A. Well, as I mentioned earlier, the objective of the first three phases was to examine the effect of wind and waves and we weren't active -- we weren't able to actively control the temperature of the facility we were testing in. We were able to maintain a constant temperature for throughout the test, but we weren't able to say we want two degrees Celsius water, we want two degrees Celsius air.

HARRIS, Q.C.:

Q. Are you able to do that? Is your facility capable of doing that?

MR. POWER:

A. For phase four, we're going into our ice tank and we can control the temperature, so we will say two degrees Celsius water and two degrees Celsius air.

HARRIS, Q.C.:

Q. As I said, the standard or, I guess, the standard is based on whatever the prescriptive standard, we're calling that, was established, I guess, just as other standards are established, and you mentioned the standard that an individual 75 kilograms, for example,

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applied in liferafts. Clearly that standard is inadequate, and you're suggesting that by having a performance-based standard that somehow that would change. You know, somebody somewhere along the line decided that this standard of 75 kilograms was inadequate and either they're no longer using it or they're ignoring it when they're designing adequate safety measures. Isn't that the case now? I mean, I've heard recently, for example, that has been recognized. What you said here today -

MR. POWER:

A. Yes.

HARRIS, Q.C.:

Q. - has been stated publicly, and people are adjusting their activities accordingly, are they not?

MR. POWER:

A. Yes. The IMO standard I was referring to, 75 kilograms, is no longer the average weight.

HARRIS, Q.C.:

Q. But wouldn't -- when you're suggesting that -- what I'm trying to get at here is how is it that a performance-based approach to having a

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standard would make a difference if what you're saying here -- and let's say we'll adopt your standard based -- performance-based standard which is found on page 38, the suit must prevent a two percent drop in deep body temperature in conditions representative of the area of operation for the amount of time it would take search and rescue to respond. That seems to me to be a good starting point for developing a standard, but if you said that this is the standard, then it leaves it basically open to an operator or "the industry" or parties who are participating to interpret that based on whatever, you know, data they have available, whatever research is available, who does the research, how long it takes and all of that. Wouldn't it make more sense for government, say, or using the facilities such as yours, as National Research Council, to undertake or commission the research or get industry to do that, establish a standard for the Newfoundland offshore or a standard for the Arctic or a standard for the wind and weather conditions that you're going to expect, wouldn't that make just as much

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sense as saying, well, we have a standard now, but the standard doesn't tell you anything other than set guidelines?

MR. POWER:

A. No, I agree. I agree with what you're suggesting, that we have to actually perform those tests in areas like you just mentioned. Conditions representative of the east coast of Newfoundland, conditions representative of the Arctic. We have to establish how those conditions affect the performance.

HARRIS, Q.C.:

Q. Um-hm. So there seems to be a bit more work to be done?

MR. POWER:

A. Yes.

HARRIS, Q.C.:

Q. And obviously your work so far has proven certain points, that wind and wave does have a quantifiable change in the performance of these immersion suits. So I guess the obvious -- from my perspective, the obvious is okay, let's define what are the wind and wave conditions that you're going to anticipate and water temperature conditions that you're going

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to anticipate in the Newfoundland offshore, figure out if you can test for them, and just go do it and set the standard based on that. Why would that not be a reasonable way of approaching this, other than changing the system entirely?

MR. POWER:

A. No, I agree.

HARRIS, Q.C.:

Q. Because that's just as reasonable as changing the approach, okay. So you're not able to say, based on your research, that you don't have enough information to show -- and I used that chart recently, the last chart that you show where the -- on page 45, I notice that these lines don't have any numbers associated with them, but they just show degrees of change and it's not showing up there on the screen here, but there's a -- my slide has a line that goes this way and then -

COMMISSIONER:

Q. That's the last one, I think.

HARRIS, Q.C.:

Q. There we go.

COMMISSIONER:

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Q. There it is.

HARRIS, Q.C.:

Q. We're getting lines coming up now. Okay, so that last line there decides that there's a sharp drop at a certain sea state, but we don't know where that is?

MR. POWER:

A. No, and this graph is just to represent the concept.

HARRIS, Q.C.:

Q. Sure.

MR. POWER:

A. It's not supposed to have any numerical value assigned to it.

HARRIS, Q.C.:

Q. So your concept is that as the sea state increases, you know, the higher the waves and as the wind increases, the performance of these suits deteriorates, but we don't know how much?

MR. POWER:

A. Exactly, and we're also suggesting that there may come a sea state where we may start seeing a linear drop in performance, but then there could reach a certain level, who knows what

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level that is, where performance could sharply drop.

HARRIS, Q.C.:

Q. So this is important information that we don't have?

MR. POWER:

A. Yes, we don't know. Maybe just like we assume the performance stays linear and maybe it does stay linear, but maybe the performance drops and if it drops, how much does it drop? And will you reach a certain condition where you could see a sharp drop in performance?

HARRIS, Q.C.:

Q. So there's no -- I mean, based on -- and obviously this is speculation, but the six-hour standard, based on this suit here, supposing it complies, and I understand it does, complies with this six-hour standard, it's not clear. In fact, it seems to be clear that it wouldn't give a six-hour performance in the wind and wave conditions that we find in offshore Newfoundland. Are you able to say that?

MR. POWER:

A. I'm not able to say that.

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HARRIS, Q.C.:
Q. But you are able to say that within three hours, it deteriorates because the loss of heat is greater and the ability of the body to maintain the heat is starting to be affected?
MR. POWER:
A. Right. In the conditions we tested in in our facility, so that includes the warm water temperatures and the suit we tested in, the participants were able to successfully thermal regulate. With regards to this suit, I'm not sure.
HARRIS, Q.C.:
Q. The difficulty that I have though, when you're testing -- well, you won't find out until you do the ice water test, right, because the ice water test will be the same temperature as the standard is.
MR. POWER:
A. Yes.
HARRIS, Q.C.:
Q. And that's -- so far you've only tested eight degrees. You'd have to go down considerably to two degrees before you start your testing, and then the idea would be to see how fast the

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temperature of the body decreases and whether it meets that six-hour standard?
MR. POWER:
A. We'll also be examining the effect of -- if you remember what I was referring to earlier with Anne with regards to the heat flow equivalent in waves and increased water velocity. So when we actually do the test in the ice tank, we're going to be testing in calm, circulating water, but also with wind and the increased water velocity past the participants to replicate the heat loss due to waves.
HARRIS, Q.C.:
Q. So the wave and water, you're going to -- are you going to try to replicate the conditions in the Newfoundland offshore? Are you again doing this staged experiment to see what -- whether it's linear or not?
MR. POWER:
A. Staged experience, one step at a time.
HARRIS, Q.C.:
Q. So this could take another two or three years?
MR. POWER:
A. I'm not sure.

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HARRIS, Q.C.:
Q. Not sure, but the pace that you've been going so far, it seems to be at that stage. Okay, so it seems pretty clear, however, from your adoption of a performance-based standard that the time that it takes for search and rescue to respond is a clear outside parameter for the performance of these suits. That's fair to say, is it?
MR. POWER:
A. Yes.
HARRIS, Q.C.:
Q. So clearly that has to be taken into account, especially when we don't know what the performance of these suits is in the wind and wave conditions that's available.
MR. POWER:
A. Correct.
HARRIS, Q.C.:
Q. So that would, I guess, echo what the Commissioner has said in the past, that time is still of the essence when it comes to search and rescue, regardless of whether you have a perfectly performing suit meeting the standard or not?

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MR. POWER:
A. Yes.
HARRIS, Q.C.:
Q. And the standard, you talked about the water ingress into suits and I think there's some indication that the heavier the seas, the more likely that there would be a water ingress as well.
MR. POWER:
A. I'm not sure of that relationship, if stormier sea states create more water ingress.
HARRIS, Q.C.:
Q. I think one of the studies in your paper refers to that. I don't know which one now.
MR. POWER:
A. They test it in rough weather conditions. So this included waves and wind and they found that this resulted in more water leakage into the suit compared to the 60-minute swim in calm water.
HARRIS, Q.C.:
Q. So that may have an effect on water ingress as well and the standard that applies to the suit or the suits that are being used or the standard that we're talking about, the two

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degree temperature drop in calm water, is based on dry conditions?

MR. POWER:

A. No, actually that's a good point. The thermal tests, before the thermal tests are conducted, you'd conduct the water leakage tests. So you record the amount of water leakage that goes into a suit. Then you add it to the suit before the thermal protective tests start.

HARRIS, Q.C.:

Q. What's the effect of that?

MR. POWER:

A. So as we saw earlier, water ingress can decrease the suit's insulation. That's the Tipton and Balmi study I referenced earlier. So the idea is that you conduct the water leakage test first, record how much water, pour it into the suit before you start the thermal protective test. If the suit still passes the thermal protective test with that water in it, then it's approved.

HARRIS, Q.C.:

Q. So in other words, that's adjusted for -- so if a suit passed the test, the water is taken into account?

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MR. POWER:

A. Yes.

HARRIS, Q.C.:

Q. Okay. Well, those are all my questions, Mr. Power. Thank you very much.

MR. POWER:

A. Thank you.

COMMISSIONER:

Q. Thank you, Mr. Harris. CEP, Mr. Earle?

MR. JONATHAN POWER, EXAMINATION BY V. RANDELL J. EARLE, Q.C.

EARLE, Q.C.:

Q. Mr. Power, the area of moisture inside the suit, and we've had some suggestions from some people that there's a great deal of value in wearing this high-tech underwear that purports at least to wick away the moisture from your body, but I take it in a sealed suit like that, it would still be within the suit, and you've demonstrated that if the subject has 500 millilitres of water applied to them before they get in the suit, that there's a dramatic decrease in deep body temperature.

MR. POWER:

A. Well, no, we haven't demonstrated that. This was just the initial observations I reported today. The analysis is still ongoing before we can say with certainty that 500 mils of water did create a significant drop in deep body temperature.

EARLE, Q.C.:

Q. So it's possible that something else could have created the drop?

MR. POWER:

A. We're not sure until we take a look at the data fully.

EARLE, Q.C.:

Q. Well, let me ask you this. Are you aware of any studies on the effect of sweat within a suit, in terms of the effect on the subject?

MR. POWER:

A. So when you say the effect on the subject, do you mean sweating and then going into cold testing conditions?

EARLE, Q.C.:

Q. Yeah.

MR. POWER:

A. No, I'm not.

EARLE, Q.C.:

Q. Based on your observations, would you -- do you have any reason to believe that the idea that having a suit which moves the moisture away from the body would have a benefit?

MR. POWER:

A. Yes, I would believe that.

EARLE, Q.C.:

Q. You would believe that?

MR. POWER:

A. Yeah. As Mike Taber referred to yesterday in his presentation, the ability to wick sweat away, so sweat is water, water has 23 times the thermal conductivity than air. So that means water is able to transfer heat 23 times faster. So to be able to get that water away from your skin, you would then be able to prevent that 23 times faster rate of heat loss.

EARLE, Q.C.:

Q. But the question that comes to my mind is that's all very well if you're out cross country skiing and you've got an atmosphere that the moisture can be carried away into. But if you're in one of these sealed suits, it's like the garden in a bell jar. You still got the moisture in the atmosphere. And I

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think we do know that heat conducts differently in a moist atmosphere than in a dry atmosphere, don't we?

MR. POWER:

A. Yes.

EARLE, Q.C.:

Q. So would we not have to consider the fact that sweating creates a moist atmosphere inside the suit?

MR. POWER:

A. Yes.

EARLE, Q.C.:

Q. Now, on page 16 of your paper, and I'm not sure how that translates in terms of the actual exhibit, but you've listed advantages and disadvantages of prescriptive-based standards and performance-based standards, and the thing that immediately comes to mind to me, with a prescriptive-based standard, there's nothing out there that says you can't exceed the standard, is there?

MR. POWER:

A. No.

EARLE, Q.C.:

Q. But your proposition, as you would describe

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it, the checklist approach, is that human nature is such that if there's a prescriptive standard, good enough will do, so to speak. Is that your proposition?

MR. POWER:

A. Yes.

EARLE, Q.C.:

Q. Well, looking at your list of disadvantages for performance-based standards, the three of them there seem to be carrying the common factor of human behaviour that, you know, requires regulators, inspectors and operators be highly qualified. That requires somebody to say we've got to have the best people to do this job. Your management systems must be adaptive and closely monitored in order to change to the system if required. That's really a function of the quality of the people who are running that management system, is it not?

MR. POWER:

A. Yes.

EARLE, Q.C.:

Q. And regulators and operators must work together harmoniously to provide the best

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solutions available. That's a motivation thing. It's about, okay, we've got to get the best solution, not we've got to save the most dollars. Agree?

MR. POWER:

A. Yes.

EARLE, Q.C.:

Q. And even your last two ones where you show no disadvantage allows for continuous upgrading of system, allows for adaptation of new technologies. Again, these depend upon motivated participants. I mean, you can allow for continuous upgrading of the system, but if the participants are not motivated, if they're not driven to upgrade, what met the standard last year or five years ago will continue to do, won't it?

MR. POWER:

A. Yes.

EARLE, Q.C.:

Q. Now you're a member of the CGSB group for these suits?

MR. POWER:

A. Yes.

EARLE, Q.C.:

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Q. Representing your employer. It seems to me that your group is fairly heavily weighted in terms of people who will ultimately hope to sell the product and ultimately have to buy the product. You've got a lot of producers and you got a lot of people who are described as users, although I would suggest to you that consumers might be a better description because oftentimes the person who has to buy and the person who ultimately uses are not the same person. The question I have for you is has there been any thought given to whether this kind of structure of standard setting body is well adapted to a goal-based standard?

MR. POWER:

A. I don't -- I'm not sure.

EARLE, Q.C.:

Q. So you're not aware of any?

MR. POWER:

A. No.

EARLE, Q.C.:

Q. Are you aware of any literature which examines -- and this is a point that you have made in your paper, you know, you really require a robust audit system and a robust challenge

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almost to the setting of the goals. It's got to be a challenging and dynamic situation and in particular, those people who will assess whether the standard has been met will be required to be very competent and skilled, and I was just wondering have there been any studies of how the audit function has worked in these kinds of performance based standards?

MR. POWER:

A. I'm not aware of any myself, no.

EARLE, Q.C.:

Q. Okay. One of the realities of what we're dealing with here, and the description may not please everybody, but in some ways we're dealing with a mouse regulating an elephant in that the reality is we have a regional board regulating companies that are global in scope and their wealth and access to resources is almost beyond comprehension. And I'm wondering, again in the context of the performance based standards, are you aware of any studies that have looked at, you know, issues like imbalance between the resources of the regulated and the regulator and this sort of thing?

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MR. POWER:

A. No, I'm not aware of any.

EARLE, Q.C.:

Q. Okay. Thank you very much, Mr. Power.

COMMISSIONER:

Q. Okay, thank you, Mr. Earle. Mr. Martin, counsel for the families?

MR. MARTIN:

Q. No questions.

COMMISSIONER:

Q. No questions, okay. Ms. O'Brien for the families of the pilots?

MR. JONATHAN POWER, EXAMINATION BY MS. KATE O'BRIEN

MS. O'BRIEN:

Q. Yes. Good afternoon, Mr. Power. My name is Kate O'Brien. Listening to you here today, it's really clear that you have put a lot of certainly your professional life into work that really to me seems designed at creating a better standard. Is that fair to say?

MR. POWER:

A. Yes.

MS. O'BRIEN:

Q. Okay, and you've put a lot of work into thinking about, you know, whether the standard

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should be prescriptive or whether they should be performance-based, also fair to say?

MR. POWER:

A. Yes.

MS. O'BRIEN:

Q. Okay. So why is it that you feel that a standard is even needed?

MR. POWER:

A. Why is a standard needed?

MS. O'BRIEN:

Q. Yeah.

MR. POWER:

A. Well, we have to be able to provide -- if we're shifting towards a performance-based standard, performance has to be demonstrated. So we have to provide some guidelines or standards for the ability to actually demonstrate that level of performance.

MS. O'BRIEN:

Q. Okay. So without a standard is the risk that people might be out there in, you know, clothing that won't protect them?

MR. POWER:

A. Exactly.

MS. O'BRIEN:

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Q. Okay. So as I'm sure you're aware, because you're a member -- you're sitting on the CGSB, that we don't have a standard in Canada right now for the suits that pilots who are operating offshore wear. Are you aware of that?

MR. POWER:

A. Yes, that was discussed yesterday.

MS. O'BRIEN:

Q. Yeah. Were you aware of it before yesterday?

MR. POWER:

A. No, I was not.

MS. O'BRIEN:

Q. Oh, okay. So I take it this has not been -- you know, you're sitting now on the CGSB looking specifically at helicopter transportation suits and so are you saying that it's never been a topic of discussion at that board that there is no equivalent standard for flight crew?

MR. POWER:

A. I've only been a member of the board since the summer of last year, and during my time on the board, it hasn't been discussed.

MS. O'BRIEN:

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Q. Okay. I notice in your report, you referenced -- page 18-19 of your report, you reference some of the other standards that are in existence globally and are you aware that the European standards, they do have a standard that covers flight crew? Are you aware of that?

MR. POWER:

A. No.

MS. O'BRIEN:

Q. Okay. It's there on page 18 of your report anyway. You've listed the standard there and you'll note when you look at the title of the standard, it covers both passengers and flight crew. So you know, given that you're working in standards, the standards are obviously near and dear to your heart. Does it surprise you that we do not have, in this country, a standard to cover what flight crew are wearing when they're operating offshore?

MR. POWER:

A. Again, I've only been a member of the Board for about a year right now and during my time, there hasn't been any discussion about it. During my time, we've been looking at and

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opening the current suit standard. So with regards to one for aircraft crew, there may have been discussions had in the past before my time, before I joined the board.

MS. O'BRIEN:

Q. Okay. Do you personally think that -- you said that you feel that standards are important. You said that you feel that standards are important because if you don't have a standard, you have people out there and you don't know how they're going to be protected at all, right? Do you feel it's important that we have some sort of standard that will cover flight crew?

MR. POWER:

A. Yes, in my personal opinion.

MS. O'BRIEN:

Q. Okay. It seems to me -- you know, Mr. Commissioner said today that he's thought a number of times, wondered why it is we don't have a particular standard that covers offshore workers in this jurisdiction, you know, when we're dealing -- you know, one national standard would really cover people working in this really harsh environment, and

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I have to say it occurs to me that, you know, although the flight crew may be only a small percentage of the 1800 workers or so that we have operating offshore, in terms of every flight that goes out there, over ten percent of that flight is flight crew and in some cases, it's more than that and it keeps striking me as strange that we just don't have anything to cover those flight crew. I realize that's more of a statement on my part. Anyway, those are all my questions for you, Mr. Power. Thank you.

COMMISSIONER:

Q. Okay, thank you, Ms. O'Brien. C-NLOPB, Ms. Crosbie?

MR. JONATHAN POWER, EXAMINATION BY MS. AMY CROSBIE

MS. CROSBIE:

Q. Good afternoon, Mr. Power. My name is Amy Crosbie and I represent the Canada Newfoundland and Labrador Offshore Petroleum Board and I just have a couple of questions for you. When you -- your paper deals with prescriptive and performance based standards and I just want to get you to clarify. When you talk about it in your paper, you're

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talking with respect to standards, not with respect to regulations? Is that correct?

MR. POWER:

A. Correct.

MS. CROSBIE:

Q. And you haven't come here today to put yourself forward as an expert with respect to prescriptive or performance based regulations?

MR. POWER:

A. No.

MS. CROSBIE:

Q. Okay. So when Mr. Earle asked you whether you were aware of any research or studies with respect to, I think as he put it, the mouse and the elephant, which he was discussing the regulatory regime in Newfoundland, that's not an area that you intended to comment on in your paper?

MR. POWER:

A. No, not at all.

MS. CROSBIE:

Q. That's all I have, thank you.

COMMISSIONER:

Q. Thank you, Ms. Crosbie. Well, I have no further questions. I understand precisely

your position and what your report says and I want to thank you for coming here at our request. I also want to thank those who asked questions, because all this helps to expand our knowledge of the whole of the subject matter of the reports. So this concludes this particular public session or series of sessions on the experts' reports. Thank you very much for your participation.

CERTIFICATE

We, the undersigned, do hereby certify that the foregoing is a true and correct transcript of a hearing heard on the 30th day of June, 2010 at Tara Place, 31 Peet Street, Suite 213, St. John's Newfoundland and Labrador and was transcribed by us to the best of our ability by means of a sound apparatus.

Dated at St. John's, NL this
30th day of June, 2010
Cindy Sooley
Discoveries Unlimited Inc.
Judy Moss
Discoveries Unlimited Inc.