

## **Contents**

Order of Appearances .....	1
Government of Canada Panel 2 .....	1
Examination by Mr. Barry Robinson for the Coalition .....	1
Approvals under the Navigable Waters Protection Act .....	2
Earthquake and tsunami hazards .....	2
Peak ground acceleration .....	3
Landslide inventories and landslide susceptibility mapping .....	4
Missing information .....	5
Pipeline integrity .....	5
Examination by Ms. Jennifer Griffith for the Haisla Nation .....	6
Examination by Mr. Jesse McCormick for the Haisla Nation .....	6
Permafrost and cathodic protection .....	6
Corrosion .....	7
Water-wetted underdeposit corrosion below over bends .....	7
Microbial corrosion .....	8
Examination by Mr. Dennis Langen for Northern Gateway Pipelines .....	8
Maps didn't show complete and current information .....	8
Highways are different than pipelines .....	8
Five pipeline incidents revisited .....	8
Examination by JRP Member Kenneth Bateman .....	9
Multi-layer coatings on the pipeline .....	9
Monitoring and mitigating underdeposit corrosion .....	9

## **Order of Appearances**

### **Government of Canada Panel 2**

Dr. Andrée Blais-Stevens	Mr. Bob Gowe	Dr. John Cassidy
Dr. Bill Santos	Mr. Eric Magnuson	Mr. John Clarke
Dr. Bernard Vigneault		

Examination by Mr. Barry Robinson for the Coalition 7133  
Examination by Ms. Jennifer Griffith for the Haisla Nation 7588  
Examination by Mr. Jesse McCormick for the Haisla Nation 7619  
Examination by Mr. Dennis Langen for Northern Gateway Pipelines 7833  
Examination by JRP Member Kenneth Bateman 7934

**Examination by Mr. Barry Robinson for the Coalition 7133**  
(ForestEthics Advocacy, Living Oceans Society & Raincoast Conservation Foundation)

## **Approvals under the Navigable Waters Protection Act**

Addressing Mr. Gowe, Navigable Waters Protection Program, Transport Canada, Mr. Robinson noted from [Exhibit E9-6-15](#) that “you indicate that there may be as many as 780 watercourse crossings along the pipeline. ... How many of those watercourse crossings would likely require an approval subject to sections 5(2) and 5(3) of the Navigable Waters Protection Act (NWP)? Do you have even an estimate?” Mr. Gowe replied that “at least 40 crossings would need approval.” He confirmed that those 40 approvals were under section 108(4) of the NEB Act. 7138

What’s the distinction between section 5, NWP and s. 108, National Energy Board Act, asked Mr. Robinson. Mr. Gowe said that “pipeline crossings would require approval under 108. Some of the temporary or permanent works associated with the construction or operation of the pipeline may require NWP approval.” 7148

Mr. Gowe explained that the NEB Act does not have a definition of “navigable waters” but “we administer it in the same manner.” He said that other than preliminary information, they have none of the detailed information required for approvals. Transport Canada has a duty to consult with Aboriginal groups and therefore requires evidence of consultation for each crossing. 7154

Mr. Robinson mentioned the proposed changes to the NWP which through Bill C-45 will be enacted in the creation of a new “Navigation Protection Act.” He said that in its current form, navigable waters would be limited to 62 rivers across the country. He asked Mr. Gowe, “If that Act were to be passed in its current form, how many rivers crossed by the Northern Gateway pipeline would require an approval under that new Navigation Protection Act?” Mr. Gowe said the Act is subject to change, and he does not have an answer. 7188

Mr. Robinson said that if Bill C-45 were to pass in its current form, “it would render several paragraphs of your evidence no longer accurate,” and he cites paragraphs 188 and 189 “which discusses how you determine navigability.” Mr. Gowe said, “An assessment of navigability would not be required.” 7201

“If Bill C-45 passes in its current form, do you have some process by which you will remove the inaccurate statements from your evidence and replace them with updated statements based on Bill C-45 if and when it passes?” Mr. Gowe: “That would depend on the timing and whether ... [it would be] useful information.” 7205

## **Earthquake and tsunami hazards**

Mr. Robinson brought up NRCan evidence, [Exhibit B9-6-30](#), and paragraph 59 which reads, “NRCan concludes that the approach taken, and the information provided in terms of earthquake and tsunami hazards, is sufficient at this point in the Environmental Assessment Review of the Application.” He confirmed that Dr. Cassidy of NRCan contributed to that conclusion. 7211

Referring to Appendix A, which is a long list of documents, primarily submitted by Northern Gateway Pipelines (NGP), Mr. Robinson asked if these were the only

documents a used in preparing the evidence. Dr. Cassidy said that they had used a variety of information which are not listed, but this “review was of documents provided by the Proponent.” 7220

Mr. Robinson asked about seismic records for western Canada. Who holds those? Dr. Cassidy said, “The primary database in Canada that is used, for example, in the earthquake hazard model for the National Building Code of Canada comes from NRCan and that is the Canadian National Earthquake Database.” How far back does it go in Alberta and BC? Dr. Cassidy replied: “The first earthquakes in our database are from the written record, so going back to some of the early European explorers along the coast. So back into the late 1700s and 1800s are the first earthquakes in the database.” 7229

Dr. Cassidy gave a brief history of the records: The first earthquake recordings in this area were made in 1898, when a seismograph station was deployed in Victoria. There was also a global seismograph network in place, in the late 1800s and early 1900s that could record earthquakes in this region to roughly Magnitude 7. Since 1898 the seismic network has been continuously improving, and so the threshold or the detection level of earthquakes has been decreasing with time. 7240

Mr. Robinson turned to 2.44 in a reply from NGP to a federal government IR, [Exhibit B46-2](#). He summarized it as the Government of Canada asked Northern Gateway to change a statement that read, ““The Coast Mountains Region is the only part of the RoW where appreciable seismic motion may occur,” to “The Coast Mountains Region is the part of the RoW where appreciable seismic motions are most likely to occur.”

### **Peak ground acceleration**

Mr. Robinson said, “In question 2.44, you reference a measurement of peak ground acceleration (PGA) values of ... 10 to 12%g in the Coast Mountains and 8%g in the Rocky Mountain region.” He asked, “Could you explain what these values mean?”

Dr. Cassidy said, “Peak ground acceleration has been used for many years to describe the strongest level of shaking acceleration. A level of 1g (or 100%g) is gravity. Shaking stronger than 1g would lift you off your feet. Typically where we begin to see damage in poorly constructed buildings, is about 20 or 25%g (0.02 or 0.025g). For modern buildings, it’s higher than that. Now, rather than just looking at peak acceleration, we look at other frequencies of ground shaking; we look at spectral response values -- but PGA is still a commonly used reference, 8 to 10%, 10 to 12%, those are relatively low values.” 7249

[Exhibit B83-2](#) includes NGP’s view that there is “generally low seismic potential along the pipeline route.” Dr. Cassidy characterized it as, “The seismic hazard varies from low to moderate. Much of the route falls within the low seismic hazard category and, in the Coast Mountains, increasing to a moderate or a slightly higher hazard category. But generally, overall, a relatively low hazard, yes.” 7285

Noting that NRCan’s seismic evidence was prepared in 2011, Mr. Robinson asked if the large seismic event at the end of October 2012 off Haida Gwaii has informed their

understanding of faults. Dr. Cassidy said the data should be in within six months when they can begin to analyze it in detail. Mr. Robinson paraphrased the statement in evidence that “Haida Gwaii offers some protection to the Kitimat area from tsunamis generated from such events, ... or events along the Queen Charlotte fault.” Dr. Cassidy agreed. Mr. Robinson quoted, “There are no faults or identified sources of landslides near the Project [area] that could generate a large tsunami.” Dr. Cassidy said, “There are no known active faults, is what I would say.” Dr. Cassidy suggested that more questionse with regard to tsunami risk should be left until the Prince Rupert hearings. 7304

### **Landslide inventories and landslide susceptibility mapping**

Turning next to Dr. Blais-Stevens, from NRCan’s Geological Survey of Canada (GSC), Mr. Robinson said he wants to refer to NRCan’s assessment of the Proponent’s evidence on geotechnical science and natural hazards -- particularly landslides. He reviewed Dr. Blais-Stevens’ evidence, as with Dr. Cassidy confirming that she had used other sources in the preparation of the evidence, and not just NGP’s documents. And he confirmed that she had prepared landslide inventories and landslide susceptibility mapping for the “Sea to Sky Transportation Corridor” and the “Yukon/Alaska Highway Corridor.” 7337

Mr. Robinson asked if doing these assessments is “a two-step process [in which] you, first of all, create the inventory of landslides in the corridor ... and then you prepare the landslide susceptibility map?” She agreed, and added that the later stage requires, “in addition to the surficial geology, knowing about the bedrock.” At his request, she described the process she followed with the two highway projects. With Sea-to-Sky, she assessed a corridor going up to the height of land, approximately 5km on each side of the highway; with the Yukon/Alaska Highway project, the corridor was 20 km in total. She uses historical records and geological records to obtain the landslide history, and the BC Highways records for a rock fall inventory. 7366

She said these maps are “to provide baseline geoscience information for decision makers.” 7390

Citing a reference to “B.C. Train Stability Mapping Users Guide” in NRCan’s evidence, Mr. Robinson asked if the guide differs from the approach taken by NRCan. Dr. Blais-Stevens mentioned that NRCan used colour coding. She had never compared the two results. 7394

Mr. Robinson asked her about paragraph 74 where NRCan wrote, “The review of Enbridge’s assessment of potential landslide effects on the pipeline corridor can not be completed without the information that NRCan had requested (i.e. mapping of the geohazards on airphotos).” He said that on October 5, 2012, NGP filed a series of geohazard maps (Exhibits B133-1 to B133-32), and he understood that “those maps identify geohazards in approximately 1-kilometre or 1,000-metre corridor.” Dr. Blais-Stevens said, “In many areas, it's just the corridor and, sometimes, it's outside of the corridor, but ... it's not very clear if they've reached height of land in their ... inventory.”

Asked if these are landslide or geohazard inventory maps, she said, “They are landslides. The labelling is different. There are some geohazards that are not specifically landslides.

... Our typical way of labelling would be to use Cruden and Varnes' classification from 1996.” Asked if these maps provide any rating of landslide susceptibility, Dr. Blais-Stevens said, “No, it’s an inventory.”

Mr. Robinson: “Has NRCan prepared a landslide susceptibility map for the Northern Gateway Pipeline route?” Dr. Blais-Stevens: “No, unfortunately.” She said it would be more effective if the height of land was clearly shown on the maps. 7436

Mr. Robinson asked, “Will NRCan be ground truthing any portion of the Northern Gateway mapping?” Dr. Blais-Stevens said, “I don’t know.”

### **Missing information**

In its evidence, NRCan stated that Enbridge had not adequately described how project elements and activities may have effects on geology, terrain conditions and geohazards. Mr. Robinson asked, “Since preparing that evidence has Northern Gateway provided NRCan with any additional information that would address this gap?” Mr. Clarke replied and Dr. Vigneault confirmed, “We haven’t received additional information on this topic.” 7451

Mr. Robinson introduced as an AQ a paper entitled, “Landslides Impacting Linear Infrastructure in West Central British Columbia”. One of its authors is Dr. Blais-Stevens. It covers an area from just east of Burns Lake to Kitimat. She verifies that the report indicates that 5 pipelines have been damaged by landslides, a number of roads were also damaged, and some cases a landslide that damaged a pipelines also damaged a road. Her report also talks about beetle kill and climate change as events that could increase the potential for landslides. Reading from the report, Mr. Robinson asked, “Does it remain your opinion today that the ... rugged topography of west central B.C. ... poses serious challenges for linear development?” She replied, “Yes, I would emphasize the rugged topography.” 7468

### **Pipeline integrity**

Mr. Robinson referred to paragraphs 12 to 22 dealing with pipeline integrity in the NR Can evidence. As with the previous witnesses, Dr. Santos confirmed that the evidence listed Proponent’s documents, but not other information, materials, or sources which were used in the preparation of the evidence. 7534

Mr. Robinson said, “NGP’s proposed external coating for the pipelines is fusion bond epoxy (FBE).” He introduced as an AQ a paper entitled, “The Effect of Surface Preparation on Residual Stresses in Multi-Layer Coatings and the Consequences for Disbondment Following Construction Damage and Exposure in In-Service Stress”. One of its authors is Dr. Santos. 7546

Mr. Robinson said, “I understand that you have done some research on multi-layer coatings, and in particular, high performance composite coatings or HPCCs. Can you tell me what the advantages are of PCCs over FBE coatings? Dr. Santos replied, “One of the advantages is its added external layer for external mechanical damage possibilities in terms of withstanding damage potentially during construction.” He explained that “The

key layer in a pipeline coating is the FBE, and that's ... usually referred to as the corrosion layer in terms of preventing corrosion."

Mr. Robinson asked, "If a pipeline Proponent wanted to build a world-class pipeline, would it be your opinion that they would use an HPCC or composite coating rather than FBE?" Dr. Santos replied, "Not necessarily. It does depend on the application and where." He also noted that the Proponent has indicated it may include a multi-layer coating for areas where mechanical damage could occur in the detailed engineering design.

### **Examination by Ms. Jennifer Griffith for the Haisla Nation 7588**

Ms. Griffith read from [Exhibit E9-21-12](#), a federal Government response to a Haisla Nation IR, a statement that concluded that "A general duty to protect and preserve the Indian interest in reserve land has never been found to exist [for the Crown] in the context of any case." She asked Mr. Magnuson, from Aboriginal Affairs and Northern Development Canada (AANDC), if this is still a current response. He said, "Yes, it is." She responded, "Are we to understand that AANDC does not see itself playing a role in protecting reserve lands from spills?" He replied, "No, Aboriginal Affairs still has a role in working with First Nations to protect the reserve land." 7591

Ms. Griffith said, "AANDC goes on to state that it has worked with the Haisla Nation to develop a Level 1 Emergency Response Plan." Mr. Magnuson explained, "The Level 1 response plan is a reference to our arrangement with the Government of British Columbia who has responsibility for emergency management within the province." Ms. Griffith asked how many levels there are and is Level 1 the most or least comprehensive. Mr. Magnuson said it is at the lower end of the scale. 7603

Ms. Griffith: "Does a Level 1 Emergency Response Plan do anything to prevent an emergency like the rupture of a pipeline upstream of a reserve or at the terminal across from Kitimat IR 2?"

Mr. Magnuson: "A Level 1 response plan actually focuses more on the decision-making, management and response planning capacity of a general nation for both the governance, administration, and employees within a level of government, as well as some communications with the community."

Ms. Griffith: "I take it that a Level 1 response plan does not do anything to prevent an emergency; correct?"

Mr. Magnuson: "No, it's actually being able to respond in a more quickly and organized fashion to reduce impacts of an event."

### **Examination by Mr. Jesse McCormick for the Haisla Nation 7619**

#### **Permafrost and cathodic protection**

Mr. McCormick quoted from a federal Government response to NGP ([Exhibit B41-4](#)), "NRCan recommends that Enbridge comment on whether there is any possibility of traversing sporadic or mountain permafrost along the proposed pipeline path and if

encountered what contingencies or pipeline design changes including CP (cathodic protection) system design would have to be made?” 7620

He asked why it is important for a pipeline to have a cathodic protection system. Dr. Santos replied that there are two forms of corrosion protection for pipelines: one is the coating and second is CP. If there is a failure in the coating, CP can then act to protect whatever potential risk there is for external pipeline corrosion.

Mr. McCormick: Can permafrost affect the reliable operation of a pipeline’s cathodic protection system? Dr. Santos said, you might have to increase the CP current. The discussion went to the implication of sporadic permafrost on a CP system; Dr. Santos pointed out that the CP is a backup corrosion protection system which is there should the coating fail. And NGP’s evidence is that ““no significant permafrost has been identified to date.” 7628

Mr. McCormick was concerned about the use of the word “significant” in the foregoing phrase. It was not resolved, but Dr. Santos concluded it by noting that CSA Z662, the relevant pipeline standard, requires that a CP system be changed as required by the circumstances during the life of the pipeline. Readers can follow this discussion in the transcript from paragraph 7647.

### **Corrosion**

From NRCan evidence, [Exhibit B9-6-30](#), Mr. McCormick noted NRCan’s interest in external and internal corrosion. Dr. Santos confirmed that NRCan’s concern in both cases is with all types and mechanisms of corrosion. 7703

Mr. McCormick said that “Noting your responses to Mr. Chris Peter ... yesterday ... I'd just like to confirm that diluted bitumen is a corrosive product.” Dr. Santos said, “Our definition of what would be considered corrosive for a crude oil is that you need the presence of water to be there in order to initiate internal corrosion on a pipeline system. So dilbit or diluted bitumen, as you mentioned, without water, we would consider as another crude oil.” 7713

### **Water-wetted underdeposit corrosion below over bends**

A lengthy and detailed discussion about corrosion unfolded. It touched on a number of questions: a) the possibility of water-wetted particles conglomerating in a pipeline, leading to water-coated metal and hence initiating a corrosion process (7727); b) an AQ called “Computational Fluid Dynamic Study of Solids Deposition and Heavy Oil Transmission Pipeline” which was co-authored by NRCan and Enbridge personnel and which reports that such water-wetted particles can accumulate and that incidents of such accumulations are “strongly correlated to locations downstream of overbends” (7738); c) that mitigation of these effects might be possible by maintaining an unspecified minimum flow velocity downstream of over bends or by the use of mechanical cleaning. (7763).

Dr. Santos acknowledged that the Northern Gateway pipeline will have overbends and that underdeposit corrosion may be a potential issue. 7785

### **Microbial corrosion**

Mr. McCormick asked if NRCan had evaluated potential risks associated with microbial corrosion in its review and does NRCan agree that it may present an internal corrosion risk. Dr. Santos said it had been evaluated and it is a potential mechanism for corrosion, especially if you were to develop deposits in a pipeline. 7815

Mr. McCormick mentioned a 2006 rupture in Prudhoe Bay which was the result of one area of the pipe bottom having completely corroded from internal microbial activity. But he also asked if microbial corrosion can present an external corrosion risk when microbes in soil attack the steel at coating “holidays” or defects. Dr. Santos said, “That is also a potential mechanism that could occur or has occurred in another area.” 7820

### **Examination by Mr. Dennis Langen for Northern Gateway Pipelines**

7833

#### **Maps didn’t show complete and current information**

Mr. Langen pulled up [Exhibit B75-2](#), the Semi-Quantitative Risk Analysis (SQRA), page 16 and had Dr. Blais-Stevens read the 2<sup>nd</sup> paragraph which says, “The geohazard evaluation considered threats within the project effects assessment area (PEAA), as well as hazards outside this corridor that could potentially affect the pipeline. For example, rock fall, avalanches, debris flows and various forms of slides were assessed to distances of sometimes several kilometres from the Route Revision U and were typically assessed to the height of land above the corridor. Approximately 250 km of the route (20%) has associated geotechnical threats.” Dr. Blais-Stevens said she had read this and understood it. [Her criticism](#), made earlier today, was that the maps did not show this information, or were not adequately labelled.

#### **Highways are different than pipelines**

Citing her experience with highway developments, Mr. Langen asked her whether mitigation measures for geohazards affecting surface developments like highways may differ at times from mitigation measures for subsurface developments like pipelines, and even that the subsurface nature of a pipeline may, in itself, offer mitigation with respect to geohazards. Dr. Blais-Stevens agreed, but offered the disclaimer that she is not a mitigation expert or a geotechnical engineer. 7846

Still on the SQRA, last paragraph on page 15 which says, “Much of geotechnical work supporting the application was used to eliminate many significant hazards through routing choices. The present geohazard evaluation now only considers residual hazards associated with the current Route Revision U.” Mr. Langen said, “Effectively, Northern Gateway has ... used its inventory of geohazards to, in part, mitigate geohazards by way of routing.” Dr. Blais-Stevens agreed that this is the case. 7854

#### **Five pipeline incidents revisited**

In earlier questioning today, [the discussion](#) was about five pipeline incidents caused by landslides. Mr. Langen returned to that discussion and had a more fulsome discussion with Dr. Blais-Stevens about the details of those incidents, when the pipelines were built,

and the state of geohazard analysis at the time. He emphasizes that none of those incidents are at locations on the NGP route. 7862

As an AQ, Mr. Langen puts up a presentation of Dr. Blais-Stevens' - a geohazard literature review of the Trans Mountain Pipeline and of the proposed Mackenzie Valley Pipeline and of landslide susceptibility mapping. Mr. Langen said, [You are of the opinion] that geohazard assessment is an evolving science and is qualitative in nature, albeit it's informed by quantitative values or quantitative data. Professional judgment and opinion come into play significantly in any geohazard assessment. The more quantitative data that someone has available, the party who is opining, the expert who is opining, is likely in a better position to come to a better conclusion. "Would you agree with that?" She does, and with that Mr. Langen was finished. 7907

### **Examination by JRP Member Kenneth Bateman 7934**

Member Bateman misunderstood about coatings. Dr. Stanos explained that FBE, fusion bond epoxy, is a one-layer coating applied externally. A multi-layer system is a three-layer coating which consists of FBE, an adhesive layer, and then a polyethylene external layer, which is, in a way, a type of multi-layer coating. It is a different type than an HPCC coating or a High Performance Composite Coating as described earlier. 7935

#### **Multi-layer coatings on the pipeline**

Member Bateman: Is it your opinion that a multi-layer coating resists impacts better than the single and, therefore, would be better suited in rocky areas?

Dr. Santos: Yes.

Member Bateman: Would you recommend a multi-layer composite coating through the mountain areas?

Dr. Santos: Areas where there's a potential for rock or hard material to strike the pipe, yes.

Member Bateman: Would you also recommend composite coating, multi-layer coating, along the whole length of the pipeline route?

Dr. Santos: Again, I think it goes back to my previous response this morning that it depends on the location 7949

#### **Monitoring and mitigating underdeposit corrosion**

Member Bateman asked, "What is the state of the art technology for monitoring and mitigating underdeposit corrosion? Dr. Santos replied, Difficult question about monitoring. The state of the art today is mechanical pigs to clean up deposits. And then monitor to see if there is wall loss. 7955

This marks the end of the Prince George hearings.

The next sitting is in Prince Rupert  
Monday, December 10, 8:30am  
Chances, 240 West 1st Avenue