

## **Contents**

Order of Appearances .....	1
Gitxaala Nation Panel 3 - Environmental Effects.....	1
Introduction by Ms. Virginia Mathers for Gitxaala Nation .....	2
Gitxaala Nation Panel 3 - Environmental Effects.....	2
Examination by Mr. Richard Neufeld for Northern Gateway Pipelines.....	2
Gitxaala territory: a comparison of two maps.....	2
Shore types.....	3
Uniqueness of bitumen-based oils .....	3
Awareness of the evidence.....	3
The degradation of hydrocarbons, simply explained.....	4
Exxon Valdez spill and spill impacts vs natural effects debate .....	4
Cleanup pretty much hopeless .....	5
TAP II, game theory, and minimum regret.....	5
Two grounding scenarios, and an effective response is largely fanciful .....	6
Less than 20% oil recovery with Deepwater Horizon .....	6
Examination by Mr. Bernie Roth for Northern Gateway Pipelines.....	7
Examination by Sheila Leggett, Chairperson of the Joint Review Panel .....	7
Fuel oils as proxies for dilbit .....	7
Examination by Member Kenneth Bateman of the Joint Review Panel.....	8
Five statements that represent the JRP’s understanding of the evidence.....	8
The value of baseline studies .....	9
Intervention can cause more problems than it solves .....	9
Examination by Member Hans Matthews of the Joint Review Panel .....	10
Examples of sunken oil.....	10
It is bitumen that’s sinking.....	10
Remarks by Mr. Richard Neufeld for Northern Gateway Pipelines.....	11
Closing remarks by Sheila Leggett, Chairperson of the Joint Review Panel .....	11

## **Order of Appearances**

### **Gitxaala Nation Panel 3 - Environmental Effects**

Dr. Cynthia J. Beegle-Krause                      Dr. Jeffrey Short                      Ms. Leslie Beckmann  
(standing in for Mr. Brian Emmett)      Dr. Robert Spies

Introduction by Ms. Virginia Mathers for Gitxaala Nation 27940  
Examination by Mr. Richard Neufeld for Northern Gateway Pipelines 28020  
Examination by Mr. Bernie Roth for Northern Gateway Pipelines 28518  
Examination by Sheila Leggett, Chairperson of the Joint Review Panel 28546  
Examination by Member Kenneth Bateman of the Joint Review Panel 28580  
Examination by Member Hans Matthews of the Joint Review Panel 28695

Remarks by Mr. Richard Neufeld for Northern Gateway Pipelines 28789

Closing remarks by Sheila Leggett, Chairperson of the Joint Review Panel 28794

## **Introduction by Ms. Virginia Mathers for Gitxaala Nation 27940**

### **Gitxaala Nation Panel 3 - Environmental Effects**

Ms. Mathers introduced the witness panel members, their areas of expertise and the evidence they are qualified to speak to. Ms. Leslie Beckmann was filling in for Mr. Brian Emmett. All of the evidence is in Exhibits [D72-32-02](#) to [D72-32-07](#), and the witnesses CVs are in Exhibits [D72-32-07](#) & [08](#). Dr. Short is also author of a report in Exhibit [D72-80-2](#).

Dr. Jeffrey Short is an expert in the area of environmental chemistry. Dr. Cynthia J. Beegle-Krause is an expert in the areas of physical oceanography and oil trajectory modeling. Dr. Robert Spies is an expert in the area of marine biology and pollution effects. More details are in the transcript at 27940.

### **Examination by Mr. Richard Neufeld for Northern Gateway Pipelines 28020**

Commenting on the approaching close of these hearings, Mr. Neufeld noted that horses on a trail ride will pick up speed as they return to their barn, “and we’re close to the barn here.”

#### **Gitxaala territory: a comparison of two maps**

His first questions were to Ms. Beckmann. She agreed that Pottinger Gaherty Environmental Consultants (PGL), the firm for which she works, “was requested to assemble a group of experts to examine the potential marine effects on Gitxaala traditional lands and waters of a spill during tanker transport of bitumen. He asked whether PGL had questioned the map labelled Gitxaala Nation Traditional Territory [[Exhibit D72-32-03](#), Adobe 1]. Ms. Beckmann said it was provided to PGL by the Gitxaala and they did not question it. 28026

Mr. Neufeld put up Figure 1, a map provided by the Government of Canada [[Exhibit E9-6-27](#), Adobe 4] on which a similar area is depicted as the Tsimshian First Nations Statement of Intent Boundary. The Chairperson determined that a comparison of the maps would be helpful and the witnesses were given an undertaking to “to confirm that the area laid out as the broader area within the evidence of the expert witnesses as being the traditional territory of the Gitxaala First Nation contains the traditional territories that are asserted by a variety of other First Nations.” 28050

Mr. Neufeld if PGL had “previously advised the Gitxaala First Nation in respect of environmental assessments for projects within [Gitxaala traditional territory as outlined on Figure 1.]” Ms. Beckmann said she could only speak for herself and knew of no previous work but said that “currently, we are working with Gitxaala on a number of projects.” He also asked if PGL had done work for Gitxaala about “assessments of risks

in respect of marine transportation,” and reports “on the fate and behaviour of fuel oils” in Gitxaala territory. Ms. Beckmann said she did not know. 28067

### **Shore types**

Mr. Neufeld asked about Section 3, which he said, “describes near-shore habitats, biological communities and key marine resources within the study area.” Section 3.2.5, [Adobe 3] contrasts shore types within the study area with those reported by Polaris for the Confined Channel Assessment Area (CCAA). Ms. Beckmann is frequently unable to reply to questions since she is not the author of the material. This discussion is best read in the transcript. 28099-28148

Mr. Neufeld noted Dr. Jeffrey Short’s involvement with a plaintiff group in respect of the Deepwater Horizon. He then ascertained that Dr. Short’s engagement for the NGP was in winter of 2011. On November 2, Dr. Short was questioning on behalf of the United Fisherman and Allied Workers Union, doing so, he said, because of his “enduring concerns regarding the possibility of oil sinking.” Mr. Neufeld asked, “So you were prepared to take the risk that in expressing those personal enduring concerns that your independence as an expert witness might be called into question?” When Ms. Roseanne Kyle objected, Mr. Neufeld said “That’s fine ... I’ll move on.” 28149

### **Uniqueness of bitumen-based oils**

4.9.2.1 of Section 4 [[Exhibit D72-32-05](#), Adobe 18] says, “*Materials to be shipped through the pipeline are broadly comparable with crude or refined oil shipped through pipelines or transported in marine tankers elsewhere when, in fact, they’re unique.*” Mr. Neufeld put it to Dr. Short “that the products to be shipped through this pipeline are being shipped through pipelines and by rail and in tankers throughout Canada and the world today.” Dr. Short replied, “I would take your word for that.” Mr. Neufeld asked, “Why you didn’t take the Applicant’s word for that in the Application then?” Dr. Short: “They are unique with respect to ... other oil sources [including heavy fuel oil].” 28172

Dr. Short’s concern is with unique characteristics of the bitumen-based products, not with respect to movement through transport infrastructure. “My concern was that their environmental behaviour, once accidentally released, could not be fully anticipated by or informed by our knowledge of seemingly similar products such as heavy fuel oils.” Mr. Neufeld asked, “So there’s a need then to ... examine the ecological and human health risks associated with these products?” Dr. Short agreed, and said that it has not been done adequately in the Application. 28195

### **Awareness of the evidence**

Mr. Neufeld asked if Dr. Short was aware of the ecological human health risk assessments. Ms. Kyle asked that exhibit numbers be provided. Mr. Neufeld said he did not have the exhibit numbers in front of him. He asked instead “Are you aware of the work done by Dr. Stevenson?” Dr. Short said, “If you could tell me which work by Dr. Stevenson you have questions about, I’ll be happy to respond.” Mr. Neufeld: “Well, tell me what your understanding is of what he did.” Ms. Kyle again insisted that the evidence be exhibited. Mr. Neufeld put up [Exhibit B16-33](#). Dr. Short said he had looked at that

document. Mr. Neufeld: “Have you also reviewed the work that was done by Dr. Stevenson, Dr. Horn, in respect of the Ecological and Human Health Risk Assessment associated with freshwater releases?” Dr. Short replied, “I have skimmed that. I’m not closely familiar with it.” 28207

### **The degradation of hydrocarbons, simply explained**

Mr. Neufeld said to Dr. Robert Spies, “In Section 5.1.1., you describe, I thought, fairly clearly and quite fairly the processes that serve to degrade hydrocarbons.” [[Exhibit D72-32-05](#), Adobe 20]. At Mr. Neufeld’s request, Dr. Spies provided an explanation of the process of degradation. Hydrocarbons degrade depending on chemical characteristics. The process takes more or less time depending on chemical makeup and processes in the environment. Ultimately, they will all go to carbon dioxide but there are a number of “intermediates”, some of which are toxic. Dr. Short said that the relative absence of normal alkanes in tar sands bitumen “is one of the major reasons that makes these materials different.” This discussion is best read in the transcript at 28238.

Mr. Neufeld asked if Dr. Spies’ evidence said that “oil buried in sediments without exposure to oxygen will not appreciably degrade.” Dr. Spies agreed. “Once the oil is mixed in to fine grain sediments, for instance, which often occurs in marshes or, in the case of the Exxon Valdez, deep in some of these cobbled beaches that had layers of sand in them, once they get mixed into there, they’re very slow to degrade and it depends on bringing the oil into contact with seawater that has both nutrients and oxygen in it.” Citing residual oil from a tank that had ruptured in McClure Bay in Prince William Sound (PWS) in the 1964 earthquake, Dr. Spies said, “these things can last for decades under the right circumstances.” 28263

### **Exxon Valdez spill and spill impacts vs natural effects debate**

Mr. Neufeld put up Chapter 5 of “Long-Term Ecological Change in the Northern Gulf of Alaska,” a book edited by Dr. Spies [[Exhibit D72-32-08](#), Adobe 13]. Mr. Neufeld said, “For a number of species there’s been continued scientific debate regarding exactly how the [Exxon Valdez oil spill (EVOS)] affected them. ... There seemed to have been two distinct camps amongst the scientific community on that [question]. Kind of like the Hatfield’s and McCoy’s with beakers, as far as I could see.” The longer term effects are potentially there versus these effects are attributable to a natural force. Dr. Spies: “Generally your characterization is correct.” 28274

They discussed the evolving scientific “convergence” of the effects of EVOS on herring. Dr. Spies said it would be incorrect “to characterize it as saying that we’ve eliminated the oil spill as a direct cause of the population crash. There’s a lot of uncertainty.” “I don’t think it’s ever going to be finally settled. ... They’re not recovering, and it could well be ... changes in the ecosystem, such as the increasing population of humpback whales. ... They eat so much herring.” Herring may not have a good year until the situation changes with humpbacks. Herring are in a “predator pit.” Mr. Neufeld: “The great difficulty is ... to tease out effects of the spill from these other natural forces.” 28285

Mr. Neufeld said that modelled, not measured, estimates for pink salmon in 1990, the year after the EVOS, were for 1.9 million fewer adult pinks, followed by record returns in

years to follow. He said this is an example of the difficulty of ascribing impacts to the spill or to natural forces. Dr. Spies said, “We’re pretty poor at predicting how populations fluctuate, particularly salmon.” 28302

Mr. Neufeld quoted text related to EVOS SCAT (shoreline cleanup assessment teams) results: “The cumulative length of visibly oiled beach segments inside PWS decrease from 783 km in 1989 to 10 km by 1992.” [Exhibit D72-32-09, Adobe 6]. Dr. Short said, “Those estimates were made by contractors to Exxon ... based on the data that ... was available to them as a result of the surveys. My subsequent work called into question the accuracy of those estimates in a pretty profound way.” 28306

### **Cleanup pretty much hopeless**

Mr. Neufeld asked about post-1993 surveys. Dr. Short said, “The first survey I was involved in was in 1997. ... The objective of that study was to see how effective the technique was to attempt to remove the oil that was still present. The results of that study showed that it was pretty much hopeless. ... There were large rocks on this armoured beach and while the effort could successfully remove some of the oil that was accessible to it, over the winter the storm would rearrange the surface rocks on the beach and expose more oil. We estimated it would take about 10 more such efforts to thoroughly remove the oil. ... The approximate cost ... was in the order of \$65,000 to remove one gallon of oil at that time. We concluded that yes, the effort was effective in that it reduced the oil on the beach. But it was not so effective that it would be [an] economically reasonable remediation technique.” 28337

### **TAP II, game theory, and minimum regret**

Mr. Neufeld turned to Section 6.2.5 in the Gitxaala evidence. [Exhibit D72-32-05, Adobe 54] “This lists the types of calculations or the uses that TAP II (trajectory analysis planner) computer forwarded trajectories are put to. In reply to questions, Dr. Beegle-Krause said that TAP looks at surface contaminants so it’s looking at surface statistics, it is a two-dimensional model and it has an option for some weathering models. 28357

Mr. Neufeld noted that “the [TAP II modelling] examples were selected to illustrate the concerns of the Gitxaala within a framework of meaningful climatic variation.” Before discussing this, Dr. Beegle-Krause explained some terminology she would be using, derived from game theory since “in terms of both planning and trajectories, the mathematics of game theory has been applied to strategies and developing appropriate strategies for both planning and response.” 28383

She said, “There are two main strategies. One is called maximum win. ... You look at the probability of events and then you take the most probable action as the one you plan for. It makes sense in terms of buying equipment; you’re buying the equipment for what’s most likely to happen. But NOAA [applied] a different aspect to these mathematics called minimum regret.” “In the minimum regret viewpoint one wants to understand very low probability but high risk scenarios. ... The TAP approach provides you the statistics to look at the low probability events which may be of very high consequence.” 28386

Mr. Neufeld asked, “So your job was not to look at the probability per se but to look at the low probability event and then translate that into some scenarios?” Dr. Beegle-Krause was more precise: “To calculate all of the scenarios that were possible ... and show illustrative examples of spills that would have consequences that were important to Gitxaala.” 28406

Dr. Beegle-Krause said she did not look at what caused a spill, but instead at where spills could start. Mr. Neufeld asked if the information provided in this work “was then fed into the assessment of scenarios that is included in section 8 of the report.” [[Exhibit D72-32-07](#), Adobe 28]. Section 8 is entitled “Expert opinion on consequences of spill or malfunction in modelled location.” Dr. Beegle-Krause said, “[In] Section 6 I described the TAP methodology and calculations. In section 8 I was asked to calculate some ship drifts and releases. Those are separate from the calculations in section 6.” 28412

### **Two grounding scenarios, and an effective response is largely fanciful**

Ms. Beckmann said that Dr. Spies, Dr. Short, and Mr. Emmett then prepared the two scenarios in Section 8. These are both powered groundings of laden tankers. Mr. Neufeld said that in both cases, “the tethered escort tug and the escort tug, as well as all of the other prevention measures that are committed to by Northern Gateway to prevent these sorts of incidents are assumed to not prevent the incident.” Dr. Short said, “The point of this scenario was to start with the fact of the spill.” Mr. Neufeld: “It’s assumed that there is no effective containment of the spill or effect -- no effective response?” Dr. Short replied, “Yeah, we assume that and that was informed by experience from the Exxon Valdez. If you have a catastrophic release, the notion that you’re going to mount an effective response, even if you get started immediately, is largely fanciful.” 28437

### **Less than 20% oil recovery with Deepwater Horizon**

Mr. Neufeld asked, “Would you agree with me -- although I don’t believe that you’ve professed to be an expert in spill response -- that spill response capability and techniques around the world have improved since 1989?” Dr. Short replied, “I would agree that there have been improvements.” He noted that with “the Deepwater Horizon where you had an enormous amount of infrastructure and material and personnel available, despite all of that, the overall recovery rate of oil was below 20 percent. The overall recovery rate of oil in the Exxon Valdez was below 15 percent.” He attributed this in part to the scale of “a catastrophic release, things happen so quick that they go beyond control of containment and oil starts going places, you have a hard time even telling where it went. That would be particularly true in this case where if the oil were to sink.” 28458

Mr. Neufeld cited some planned response activities and reiterated that the two scenarios don’t include any effective response. Dr. Short said, “That’s correct insofar as we assume that those will have negligible effectiveness.” The discussion about the ineffectiveness of response “in the case of a catastrophic release of this size” continued. Dr. Beegle-Krause said “I’ve done about 200 spills but, from our discussions of those of us in the business, no one has been to the same spill of national significance twice. They’re always different: different conditions, different fuels.” 28462

Mr. Neufeld asked, “Is it more conservative to assume that there is no response than to assume there’s effective response?” Ms. Beckmann replied, “I don’t know.” Dr. Beegle-Krause said that from her experience, before development occurs, a risk assessment is made in which “no response is assumed when you are looking at potential risks.” Mr. Neufeld ended his questioning. 28490

### **Examination by Mr. Bernie Roth for Northern Gateway Pipelines 28518**

Mr. Roth put up the references for Dr. Short’s second report [[Exhibit D72-80-2](#), Adobe 14] to discuss an apparent contradiction or inconsistency with respect to evidence provided by Dr. Bruce Hollebhone to Dr.Short. 28519

### **Examination by Sheila Leggett, Chairperson of the Joint Review Panel 28546**

#### **Fuel oils as proxies for dilbit**

The Chairperson asked Dr. Short if it was his view that “crude oil such as intermediate fuel oils or heavy fuel oils are not a reasonable proxy for how spilled dilbit might behave?” Dr. Short said, “In general, that’s a correct understanding ... That might be a fair proxy for some particular purposes but it would be hazardous to assume that it’s a good proxy across the board.” The Chairperson asked where it might be a good proxy. Dr. Short replied, “Possibly, if it has the same density and viscosity characteristics that vary with weathering initially in a similar fashion as dilbit, it could be a good proxy for anticipating how the oil might spread on the sea surface. ... I would really caution you to pay attention carefully to the specific comparisons that you have in mind when using proxies.” 28546

The Chairperson asked what factors should be considered to understand whether it might be a reasonable proxy or not? Dr. Short mentioned how viscosity and surface tension vary with temperature and weathering state would be “initial important concerns if you were going to use this in an oil spill model about where it’s going to go. If you’re concerned whether or not these are amenable to dispersion by application of a dispersant then the surface tension and viscosity are again important.” He also spoke about “the extent to which the two have comparable proportions of asphaltenes ... and resins [which] then plays into their susceptibility to form emulsions.” 28555

She asked, “What is required in order to accurately model dilbit fate and behaviour that isn’t already available?” Dr. Short replied, “The dearth of information on variability. ... How different we could expect these products to vary depending on what part of the formation they came from, how deep in the formation they came from, what the extraction process was.” 28567

The Chairperson asked about the specs that NGP has submitted about products that can be shipped in their pipelines. Dr. Short said that blending bitumen with diluents results in “a two component -- pseudo-component mixture, one of which is very prone to evaporative loss and the other of which is very not. That’s different from an intermediate fuel oil. And what you really worry about if there’s a spill is, okay, once you’ve lost this

volatile fraction, fugitive fraction, what are the properties of what remains. And it's the properties of what remains that contain the uncertainty that bothers me." 28573

### **Examination by Member Kenneth Bateman of the Joint Review Panel**

28580

Mr. Bateman said that "Environment Canada gave evidence ... [if] there was a spill of a product of the specifications that the Applicant is proposing, it will float, at least initially. Then subject to evaporation and weathering and other considerations, its composition will begin to change. The evidence ... was that it's simply not known ... whether the product over time will sink or whether it will continue to be buoyant, it may be on the surface, it may be under the surface but it will not sink to the sea floor."

"We have the evidence of the experts that are from Northern Gateway and they believe that there's more certainty with respect to the product remaining buoyant and ultimately being available for, I guess, bio-remediation."

"What I'd like to understand from this panel is, is your position the same as Environment Canada; it's simply not known and more research is necessary ... or [it] will be sinking to the sea floor?" 28581

Dr. Short replied, "We would agree with Environment Canada's position that there's not enough information available to us at present to make clear conclusions with regard to whether it could sink all the way to the bottom." He said that a wider spectrum of products should be tested, with test conditions "more closely aligned with what might be encountered in the receiving waters. ... There remains compelling cause for concern for the possibility that, at least in the more brackish waters in the summer, that oil might sink, possibly to the bottom." 28586

The Chairperson asked, "Does it matter the exact composition of the products if we know the density specification?" Dr. Short replied that the density spec for NGP is under 940 kg/m<sup>3</sup>. "What I would like to know in addition to that is what the corresponding density spectrum is of the undiluted bitumen, the bitumen prior to dilution, because that's potentially the density that could be attained by the material once it's released in the environment and sufficient weathering occurs." He said there were other properties of bitumen which are not given, and detailed analysis routinely done for refineries. 28592

### **Five statements that represent the JRP's understanding of the evidence**

Mr. Bateman said that with NGP's witness panel number 2, "five statements seemed to emerge that represented our understanding of their evidence." He said he intended to "walk [the witness panel] through those same five points." The points relate to real world oil spills, not dilbit, in a marine environment. 28602

1. "A significant oil spill, particularly if it reaches the intertidal zone, will affect the natural marine environment, including the surface water." Dr. Spies said, "We'd largely agree with that statement," and he explained briefly, and expanded the concern into the midwater zone. 28605



2. *“The impact [this is of a spill] would be particularly negative to species sensitive to the toxic properties of oil in the affected marine area, particularly those whose habitat is primarily on the surface water.”* Dr. Spies again: We generally agree with that, but aside from toxic effect from, for instance, dissolved hydrocarbons, ... there's also other aspects, such as direct coating. 28612

3. *“A marine environment will, after the initial impact of an oil spill, naturally restore itself to its pre-spill environmental state.”* Dr. Spies said, “We don't necessarily agree with that statement. ... There's a tendency for spills ... to return towards a pre-spill condition, but ... there are potential important exceptions.” He said that the dynamic aspects of ecosystems are complex and outcomes are unpredictable. This question resulted in some discussion, including of potential effects such as a shift to new equilibria after a spill. 28616

### **The value of baseline studies**

Mr. Bateman asked about the value of baseline studies. Dr. Short said, “Baseline studies are invaluable for assessing what effects after an event are. ... Some baseline studies ... are more important than others, particularly those that focus on the apex predators. It's been widely acknowledged in the terrestrial ecological literature that ... an ecosystem that can support wolves is fundamentally in pretty good shape. Because to support a healthy wolf population, that means an awful lot else has to be in good shape too. That applies ... to marine ecosystems as well. Dr. Beegle-Krause added that “there are also documented socio and economic changes that can be lasting from a spill.” 28652

Mr. Bateman explored the question as to whether the herring decline in Prince William Sound was a result of the EVOS or natural effects, and what he understood the evidence to indicate, that the herring decline was of natural causes and that EVOS was not the cause. Dr. Spies said, “The point we would like to ... leave you with is that, usually in ecosystems, there's not a single causative factor, it's often a combination of different sorts of things combining. ... There's still significant scientific opinion that the spill may have played some role, in addition to other natural varying factors.” Dr. Short added, “It's more accurate to say that we don't have a clear idea, one way or another. ... That's because, in part, we didn't know what measurements to take at the right times after the spill.” 28660

4. *“Full recovery by oil-affected species with few, if any, exceptions occurs over time.”* Dr. Short: “I think that full recovery can occur. It would not necessarily occur, depending on the interactions that are triggered. 28677

### **Intervention can cause more problems than it solves**

5. *“Human intervention, in the marine oil spill, can help direct and accelerate the natural restoration process of the environment and species recovery.”* Dr. Spies said, “Unfortunately, we have some current examples where the intervention during clean-up has caused more problems than it's solved. He described examples from EVOS, where aggressive cleanup resulted in delayed recovery of various species. One example was focus, a small brown algae that's a keystone species in the intertidal zone. Hot water washing killed off the focus community resulting in not just a recovery of focus, but of

the sheltering and nutritional habitat it forms and consequently the delayed recovery of other species, such as snails and limpets. Dr. Short mentioned that the use of dispersants in the Deepwater Horizon “may have caused more problems than it solved.” He also said that the presence of alkanes in conventional oils accounts for most of the biodegradation that can occur. Their absence in bitumen may mean that bioremediation is off the table and only mechanical means of recovery are effective. 28681

## **Examination by Member Hans Matthews of the Joint Review Panel**

28695

### **Examples of sunken oil**

Mr. Matthews asked, “Have any one of you ever seen sunken oil?” Dr. Short said he had, at the Wabamun, Alberta, spill. Dr. Spies had seen sunken oil “all over the bottom of Santa Barbara Channel” from natural petroleum seeps. He said it has a very long half life, and could be thousands of years on the bottom. He also mentioned two examples from “the literature.” Dr. Beegle-Krause also described three sunken oil spills. One was a small spill of orimulsion in Florida which separated into diluent and “the sticky stuff on the bottom.” Another was a barge of slurry oil – heavier than sea water - that was holed after Hurricane Katrina and the oil sunk into the bottom on the offshore. The third was a heavy Brazilian crude which left oil at the surface and the heavier oil travelling along the bottom of the Delaware River. This spill resulted in closure of a nuclear power plant, a closure of a fishery, and a shipping closure on the river. Philadelphia was running out of heating oil and food. She said, “It's easy to turn something off and it's easy to close a fishery. It's very hard to open them again.” 28697

### **It is bitumen that's sinking**

Mr. Matthews said if we look at weathering alone, not about mixing with suspended particles, what submerges or sinks? “Can you separate condensate from bitumen and have bitumen sink?” Dr. Short said, “For a material like dilbit where you have a relatively heavy bitumen product mixed with a relatively light ... diluent, there's an evaporation curve that [is] initially very rapid and ... after that, it's a lot slower. The very rapid phase consists of largely removing most of the diluent. Subsequently, you're removing the lighter fractions ... present in the bitumen itself along with whatever's left of the diluent. By the time you get to what's sinking, is initially a mildly weathered form of the bitumen. Mr. Matthews: “Bitumen is the material that's actually sinking?” Dr. Short: “Yes.” 28729

Mr. Matthews asked, “Would they be little droplets or would they be big balls or would they be pancakes, or what actually falls? ... What would we see?” Dr. Short replied, “It could be any of the above. It could be all of them.” He described “tar logs” in the Wabamun spill. Dr. Beegle-Krause said that in Texas there are annual tar ball events. “These have been traced to asphalt volcanos. Some of the tar balls ... have been bigger than a flatbed truck. ... You can have small droplets” 28741

Asked how long it takes for a droplet to sink, Dr. Beegle-Krause said it depends on local turbulence. In quiet water it can sink slowly. If there's a lot of mixing, it can be continually brought up. 28751

Mr. Matthews said it was mentioned that once the sunken oil reached the bottom, it would eventually degrade. Dr. Short said that the asphaltenes and resins are one of the most difficult fractions of oil to degrade. If it mixes below the surface of the sediments, then “you run out of oxygen real quick [and] microbial processes slow way, way down and that leads to ... scores of years to centuries.” Dr. Spies added that in “Santa Barbara Channel, we looked at hydrocarbon degradation rates subsurface in about 60 feet of water and they’re practically non-existent below a couple millimetres in the bottom sediment, so oxygen didn’t penetrate very far usually. Okay, so they just sit there.” 28758

Mr. Matthews asked Dr. Beegle-Krause about the heavy Brazilian crude and the slurry oil, and how it compares to dilbit. Dr. Beegle-Krause replied that slurry oil is not as viscous as bitumen, but is heavy and will sink, though it tends to break up because of wave action. Brazilian crude forms tar balls. “What we’re concerned about with the diluted bitumen is it’s a different product than what is shipped; whereas in these cases it was exactly the same product that was shipped.” 28767

Mr. Matthews asked, with these examples, “roughly what percent of the oil spilled made it to the bottom?” Dr. Beegle-Krause said that for DBL 152 (the barge in the Gulf of Mexico) all of sunk but for some surface sheen at the beginning – all 3 million gallons. For the orimulsion, all of the bitumen “made it to the bottom with only surface sheens.” She could not say for the Philadelphia spill. 28771

### **Remarks by Mr. Richard Neufeld for Northern Gateway Pipelines** 28789

Mr. Neufeld said that it is not Northern Gateway’s intention to seek permission to seat a rebuttal panel on this case, so that should clear the way for us to proceed through to argument.

Mr. Neufeld added that NGP had filed its first motion “this morning” [[Exhibit B225-2](#)] with respect to the proposed conditions [[Exhibits A346](#)], specifically that “the JRP confirm that in issuing its Potential Conditions it did not intend to preclude Northern Gateway from continuing work on the Project necessary to comply with pre-construction conditions and that the definition of "Construction" should not be interpreted to include investigative work, including geotechnical work, of this nature.”

### **Closing remarks by Sheila Leggett, Chairperson of the Joint Review Panel** 28794

The Chairperson said, “We’ve now come to the end of the questioning phase of the joint review process. Kenneth, Hans and I would like to thank all parties for the substantial time and effort that they’ve put into this phase of the hearing.” 28794

She addressed final argument, reminding people that the process was set out in Procedural Direction Number 12 [[Exhibit A303-1](#)]. Final argument will be in writing followed by oral responses. 28797

All parties wishing to participate in final argument must file written argument with the Panel by noon Pacific Time on the 31st of May, 2013. Parties should clearly address the recommendations and conditions they believe that the Panel should make in its final report.

Only parties that file written argument by the deadline will be able to present oral argument. Oral final argument will take place in Terrace, British Columbia starting on the 17th of June, 2013.

“Safe travels to everyone here in the room. Thank you.”