Information Request No. 1
From: Haisla Nation
To: Northern Gateway Pipelines Inc.

Northern Gateway Pipelines Inc.
Section 52 of National Energy Board Application for
Enbridge Northern Gateway Project
NEB File OFF-Oil-N304-2010-01 01
Filed 27 May 2010

INFORMATION REQUEST NO. 1

GENERAL

Public Interest

1.1 Approved Production

Reference:
i) Exhibit B1-2 Volume 1- Application dated May 2010, Section 1.2, p. 1-3 (A1S95X)
ii) Exhibit B1-2 Volume 1- Application dated May 2010, Section 3, p. 3-1 (A1S95X)
iii) Exhibit B1-4 Volume 2 - Application dated May 2010, Section 1.6, p. 1-13 (A1S9X7)

Preamble: The purpose of the Project is identified as "to provide access for Canadian oil to large and growing international markets, comprising existing and future refiners in Asia and the United States West Coast" and to "new international markets". Further, the application states that "New markets and expanded transportation capacity are essential to the development of [approved but not developed] oil sands production, which has already been determined to be in the public interest".

Request:
a) Has the National Energy Board assessed that this development of oil sands production is in the public interest?

b) If not, which governmental entity does NGP say has assessed that this oil sands production is in the public interest?

c) What legislation was this public interest assessment based on?

d) What was the extent of public participation in this assessment?

e) What was the extent of First Nation participation in this assessment?

1.2 Need

Reference: i) Exhibit B1-2 Volume 1- Application dated May 2010, Section 1.2, p. 1-3 (A1S95X)
ii) Exhibit B1-2 Volume 1- Application dated May 2010, Section 3, p. 3-1 (A1S95X)
iii) Exhibit B1-4 Volume 2 - Application dated May 2010, Section 1.6, p. 1-13 (A1S9X7)

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Request: a) What is the basis for concluding that new markets and expanded transportation are essential to the development of [approved but not developed] oil sands production?

b) What international markets currently exist that Canadian oil cannot access through existing pipelines?

c) Please provide details demonstrating the actual need for the new proposed pipeline.

1.3 Project Alternatives

Reference: i) Exhibit B1-2 Volume 1- Application dated May 2010, Section 4.2, p. 4-1, and figure 4-1 (A1S95X)

Preamble: The purpose of the Project is defined as access for Canadian oil to west coast tidewater. The alternatives to the project are all based on an oil pipeline to the coast. A number of existing pipelines currently carry oil from the Canada's interior to the west coast.

Request: a) What alternatives to transportation by pipeline were considered? Was rail considered? Was trucking considered? Please provide copies of any studies showing the potential impacts, including environmental and socio-economic impacts of these alternatives.

b) Was the use of existing pipelines considered as an alternative to the Project? If no, why?

d) Were existing oil pipeline routes considered as an alternative to the project? If not, why?

1.4 Alternative Means of Carrying out the Project – Transportation Method

Reference: i) Exhibit B1-2 Volume 1- Application dated May 2010, Section 4.3, p. 4-4 (A1S95X)

Preamble: The Application identifies the alternative means of the Project as alternatives for the siting of terminals and pipeline routes within the constraints of a terminal near Edmonton and a terminal near Kitimat.

Request: a) What alternative means of a pipeline to the west coast using different starting and end points were considered?

b) Please provide any relevant reports or documentation.

1.5 Alternative Means of Carrying out the Project – Terminal Location

Reference: i) Exhibit B1-2 Volume 1- Application dated May 2010, Section 4.2, p. 4-4 (A1S95X)
ii) *Potential Pacific Oil Ports: A Comparative Risk Analysis*, Fisheries and Environment Canada, Vancouver, BC, February 1978

Preamble: The Application identifies a number of alternatives locations for the marine terminal, and relies on a 1978 Fisheries and Environment Canada working group assessment of environmental risk for potential ports (*Potential Pacific Oil Ports: A Comparative Risk Analysis*, document attached).

The 1978 Report states that "the comparisons are relative. Least risk does not imply no risk. Thus, a port/route identified as being 'least risky' in this analysis could, on comprehensive and detailed study, be found completely unacceptable from a Canadian point of view due to specific liabilities, inadequate benefits or the negative impacts of non-marine factors" (pp. 4-5).

The 1978 Report characterizes the potential values that could be impacted by oil pollution as economic values and social values. The economic values are characterized as commercial fishing, including the cost of cleaning boats and equipment and impacts to shore-based economic activities. The social values are characterized as amenities that define lifestyle for residents, and psychological effects of knowing that resource values are being impacted. The Report, however, makes no reference to traditional use values of Aboriginal Groups.

The 1978 Report acknowledges a lack of information with respect to the physical marine environment of the north coast: “For the north coast of British Columbia, oceanographic information is scarce and comes mainly from rather general, exploratory cruises carried out in the 1950s and 1960s. Long-term current measurements are lacking, so water circulation has to be inferred …” (p. 13).

Request:

a) Did NGP rely on the 1978 Report to select Kitimat and Prince Rupert as potential west coast port sites for further evaluation?

b) Have factors commonly used to assess risk of an oil spill changed since 1978?

c) Has additional knowledge about the [navigation] in Kitimat Arm and Douglas Channel been generated since 1978?

d) Has additional knowledge about the nature of the marine ecosystem and important marine species in Kitimat Arm and Douglas Channel been generated since 1978?

e) Has additional knowledge about environmental impacts of marine oil spills been generated since 1978?

f) What studies or analysis did NGP perform to update the 1978 Report? Please provide copies of all such studies or analysis.

g) Did NGP consider whether or how factors used to assess risk or the state of knowledge relied on in the 1978 Report have changed since 1978?

h) How was knowledge or information the has become available since 1978 used in determining potential marine terminal sites?

i) Were the potential impacts from non-marine components of the project, such as the marine tanker terminal and the pipeline through the Kitimat River valley, considered in limiting potential marine Terminal sites to Kitimat and Prince Rupert? If no, why not?

j) Were traditional use values of Aboriginal Groups considered by NGP in limiting potential marine terminal sites to Kitimat and Prince Rupert? If no, why not?

k) What steps, if any, did NGP take to supplement the oceanographic information for the north coast? Please provide copies of all studies or reports generated in this regard.

l) Was any supplementary information relating to current measurements or other aspects of the physical marine environment of the north coast considered in limiting potential marine terminal sites to Kitimat and Prince Rupert? If not, why?

Information Required to Assess Project

1.6 Assessment of Project

Reference: i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 1.1, p. 1-1 (A1S9X8)
ii) Terms of Reference, Joint Review Panel Agreement (A1R4D5)
iii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 4.1, p. 4-1 (A1S9X8)

Preamble: NGP's Application sets out to describe "the conceptual design of the pipelines and related facilities that comprise the Project together with the associated construction and the operation activities." Throughout the Application, references to "detailed engineering" are made in lieu of providing any engineering detail. The proponent proposes to carry petrochemicals though a mostly pristine, remote, mountainous, environmentally sensitive coastal region. The risks of this Project cannot be evaluated at this point due to the lack of detail in all aspects of engineering design. This in turn makes it impossible to assess the potential for effects of the project. Based on the information provided in the Application, NGP expects to have the Project approved solely on a conceptual basis.

The Joint Panel Review Agreement with the NEB (reference ii) provides Terms of Reference which include *Factors to be Considered During the Joint Review*. Among these are:

i. "The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out."

ii. "Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project."

iii. "Alternative means of carrying out the project, that are technically and economically feasible and the environmental effects of any such alternative means."

Due to the process which is laid out by the Terms of Reference and followed by all concerned parties, it is the responsibility of NGP to provide additional information so that the Joint Review Panel is able to assess the Project in a technically and scientifically sound manner in order to speak responsibly for the Canadian Public.

To enable a scientifically and technically sound assessment of the Project engineering specifics and plans must be provided for essentially every aspect of the pipelines, pump stations and terminals.

Furthermore, no mention is made in the Application of how NGP's proposed pipeline right of way will interact with the Pacific Trails Pipeline, which has received final approval from the BC Environmental Assessment Office and for which pre-construction activities are currently underway. Information is required on what the cumulative effects of the proposed Project will be as well as what mitigative measures will be enacted to ensure that these effects are avoided or minimized.

Request: a) Please provide the engineering specifics and other detailed information on each of the following:

i. A risk assessment of the pipeline and terminal portion of the project and the level of risk being targeted (including a comparison of international standards for evaluating risk).
ii. The pipeline design and engineering specifics that will address geotechnical hazards including landslides and acid rock drainage.
iii. The pipeline and storage tank design and engineering specifics that will address seismic risk.
iv. Reference to the specific design codes and standards being followed and the specific subsections therein related to ii and iii.

v. The pipeline materials.
vi. The precise location and type of appurtenances including valves, gaskets and all other fittings.
vii. Detailed characterization of bitumen, diluted bitumen, synthetic oil, and condensate.
viii. All reports and studies on the corrosive nature of diluted bitumen including information on sulphur, sulphur-reducing bacteria, stress corrosion cracking, hydrogen-induced stress corrosion cracking, and corrosion failure that NGP has proposed, undertaken, commissioned or is aware of.
ix. Details on pipeline welding procedures and mitigative measures which will be followed in the field to ensure QA/QC.
x. Details on pipeline inspection procedures and equipment and related schedules for inspection that will be employed.
xi. Details on pipeline monitoring procedures and logistics and schedule.
xii. Details on the engineering and design specifications for the Kitimat Terminal external floating roof tanks.
xiii. Details, including all reports and regulator correspondence, on Enbridge's history of leaks, ruptures, accidents, and regulatory infringements over the past ten years on all its pipelines and other facilities.

b) Please provide the detailed studies prepared, undertaken or commissioned by NGP which look at the cumulative effects of the proposed Project and the Pacific Trails Pipeline.

c) Please provide the detailed mitigative measures planned by NGP concerning the cumulative effects of the proposed Project and Pacific Trails Pipeline. Please provide separate reports on the cumulative impacts of the NGP Project in the context of the Pacific Trails Pipeline project that address each of the following issues:

i. Pre-construction and construction activities
ii. Operation and Maintenance
iii. Emergency procedures
iv. Decommissioning
v. Abandonment

Enbridge's Spill History, Environmental Record and Response to Incidents

1.7 Enbridge Spills History

Reference: i) Exhibit B24-2 Volume 5A – Additional Evidence June 2011, Section 5.9.3, p. 5-316 (A1Z6R1)

Preamble: The Application states that "Enbridge has an excellent pipeline safety record, notwithstanding the two events during the summer of 2010 on Lines 6A and 6B in the United States. In 2010, in Canada and the United States, Enbridge recorded 78 reportable spills along its liquid pipelines system."

Request: a) Is there a volume threshold for a "reportable spill" in Canada?

b) Is there a volume threshold for a "reportable spill" in the United States?

c) Please provide a log of all the spills, reportable and non-reportable, on pipelines constructed by Enbridge, identifying the pipeline construction date, the reason for the spill, the pipeline material, whether or not the pipeline is lined, the type of material being transported, the time and date of the spill, the time that elapsed between the spill and spill detection, the time that elapsed between spill detection and spill shutdown, the volume spilled, and the volume recovered.

1.8 Commitment to "extended responsibility"

Reference: i) Exhibit B21 – Additional Evidence June 2011 - General Oil Spill Response Plan, p. 1-1 (A28715)
ii) Exhibit B27-8 – NGP Response to JRP IR No. 1, Attachment JRP IR 1.2 Commitments Table (A2A4Q0)

Preamble: Enbridge's General Oil Spill Response Plan states that Enbridge spill response plan includes "a corporate commitment to 'extended responsibility' for emergency response along the marine transportation routes. Northern Gateway would take responsibility for maintaining an enhanced spill response capability in the event of third-party tanker spills, beyond what is required under Canadian regulations. The tanker owner would remain the responsible party if a spill were to occur."

Enbridge's response to JRP IR 1.2, the Commitments Table, includes the following commitments with respect to marine spills:

DOCUMENT REFERENCES	#	DESCRIPTION OF COMMITMENT	SOURCE OF COMMITMENT	PROJECT PHASE FOR IMPLEMENTATION	STATUS
NEB Application Volume 8C Section 5	J13	Emergency response will include pre-staging of equipment and logistics support to enable a rapid response that is better than current regulatory requirements (i.e., an intended response time of 6 to 12 hours within the Confined Channel Assessment Area).	Operations	Pre Operation	-Not Set-
General Oil Spill Response Plan, Section 8.1.1	J14	Northern Gateway will maintain or contract a reponse organziation capable, under the planning standards, of containing and recovering within 10 days or earlier, up to 32,000 tonnes of on-water oil.	Operations	Pre Operation	-Not Set-
TERMPOL Surveys and Studies -Binder 1 of 3 TERMPOL Study 3.15: General Risk Analysis and Intended Methods of Reducing Risk, Section 3.4	J22	The escort tugs and harbour tugs will carry response equipment that meets the requirements for a Tier 1 response. This equipment will include containment boom, anchors, skimmer system and temporary storage tanks for recovered oil.	Operations	Pre Operation	-Not Set-
TERMPOL Surveys and Studies -Binder 1 of 3 TERMPOL Study 3.15: General Risk Analysis and Intended Methods of Reducing Risk, Section 3.4	J23	Response equipment will be stored at several locations within the Confined Channel Assessment Area and Open Water Area. Locations will be determined as part of the response planning process and through discussions with participating Aboriginal groups and the Federal and Provincial government. Locally based staff will be trained in the effective deployment of response equipment.	Operations	Operation	-Not Set-
TERMPOL Surveys	J24	Northern Gateway will, in	Operations	Pre Operation	-Not Set-

and Studies -Binder 1 of 3 TERMPOL Study 3.15: General Risk Analysis and Intended Methods of Reducing Risk, Section 3.4		consultation with participating Aboriginal groups and directly affective public stakeholders, define areas of particular ecological sensitivity and assess whether installation of permanently located quick deployment first response systems is viable for the most critical of these locations.			

Request:

a) Is this the extent of Enbridge's commitment to 'extended responsibility' for emergency response along the marine transportation routes?

b) Does the current marine shipping and oil spill legislation and insurance fund regime cover losses of a cultural nature?

c) If not, will NGP's 'extended responsibility' extend to cover losses of a cultural nature resulting from an oil spill as a result of marine transportation?

d) Is there a potential for a spill to result from the proposed project and associated transportation that will result in damage or loss that exceeds the financial limit for liability that exists under the current marine shipping and oil spill legislation and insurance fund regime?

e) If yes, will NGP's 'extended responsibility' extend to cover potential losses in excess of the financial limit for liability that exists under the current marine shipping and oil spill legislation and insurance fund regime?

1.9 Ruptures and Leaks

Reference:

i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12, p. 12-1 (A1S9X8)

ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12.1, p. 12-1 (A1S9X8)

iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 1.6.1, p. 1-3 (A1S9X8)

iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference i), the Application states that integrity management entails risk identification and assessment and then briefly discusses how NGP aims to achieve this. In reference ii), the pipeline integrity program is defined as having a primary goal of preventing leaks and ruptures. Quality management, discussed in reference iii), entails the Project following Enbridge's "Quality Assurance and Quality Control (QA/QC) program". However, Enbridge has a history in numerous spills and leaks, as documented in its yearly Enbridge Corporate Social Responsibility Reports (documents attached) and it is important that full disclosure by Enbridge be obtained for each of these occurrences.

A look into Enbridge's operational history over the past decade reveals a high number of incidents, including leaks, ruptures and violations along its hazardous liquid pipelines in both Canada and the United States. Records of these spills are available in Enbridge's yearly "Corporate Social Responsibility" reports and elsewhere. Enbridge pipeline spills that have been documented during the past ten years have often caused environmental damage and occur for any number of reasons, including: human error, pump failure, gasket failure, pipeline failure, seam failure, over-pressure on pipes, corrosion, or rocks.

The list below contains a selection of Enbridge's spill history between 2001 and 2010, with data compiled from its own reports (attached). Enbridge must provide information on each of these incidents in terms of: regulatory response, lawsuits which arose, state of current litigation, spill lead-up, discovery, response and clean-up and changes Enbridge made as a result of each spill.

Selected Enbridge Liquid Pipeline Spills over the past Decade:

	Month	Location	Amount Spilled (L)	Product	Cause	Area Impacted
2010 reported spills[1]: **Unavailable** regulatory infractions[2]: **Unavailable**	September	Buffalo, NY	unknown	crude	puncture by rock	
	September	Romeoville, IL	946,000	crude[4]	rupture	Storm water ditch and waste water treatment plant
	July	Marshall, MI	3,785,000	diluted bitumen[5]	corrosion (final report not complete)	Kalamazoo River system and floodplain
	April	Virden, MB	2,500	crude	leak	Creek bed of Bosshill Creek
	April	Leech Lake, MN	unknown	crude	small leak	Leech Lake Reservation
	January	Neche, ND	500,000	SCO[6]	pressure	Agricultural land
2009 reported spills: **89** regulatory infractions: **25** fines: **$1,159,300**	September	Odessa, SK	175,000	crude	Rupture downstream of pump station	Surrounding land
	June	Floodwood, MN	19	crude	not known	
	March	Clearbrook, MN	190	crude		
	February	Kisbey, SK	112,000	"oil"[7]	rupture	Hay field
	January	Cheecham, AB	914,000	"oil"	failed vent valve at unmanned	Downwind area contaminated

					facility	by oil mist
2008 reported spills: **80** regulatory infractions: **12** fines: **$56,214**	July	Edmonton, AB	40,000	crude	feeder pipe spill	Edmonton Terminal
	April	Eldorado, KS	87,400	crude	storage tank corrosion hole	Eldorado Terminal
	April	Griffith, IN	41,300	crude	broken thermal relief line	Griffith Terminal
	March	Fort McMurray, AB	40,000	oil sands crude	drain line failure	Terminal
	February	Weyburn, SK	25,000	crude	human error	Truck facility
	January	Cromer, MB	100,000	crude	gasket failure	Cromer Terminal
2007 reported spills: **65** regulatory infractions: **14** fines: **$4,050**	November	Clearbrook, MN	51,700	crude	pinhole leak	2 deaths (explosion)
	April	Glenavon, SK*	990,000	crude	Rupture due to cracking from fatigue	unclear
	February	Rusk County, WI	477,000	crude	construction	Oil sprayed onto trees and vegetation
	January	Clark County, WI	187,000	crude	crack rupture	Farmland and drainage ditches
2006 reported spills: **61** regulatory	December	Sheridan County, MT	318,000	crude	failed nipple downstream of pump	Pasture (most recovered)
	March	Willmar, SK	97,500	crude	pump failure	Terminal with off-site impact

infractions: **10** fines: **$3,580**						
2005 reported spills: **70** regulatory infractions: **10** fines: **$101,114**	No specific spill reports were found through Enbridge reports or other sources. It is known through its 2005 Report, however, that Enbridge spilled a total of **1,562,000 L** of liquid petroleum products during the year.					
2004 reported spills: **69** regulatory infractions: **28** fines: **$207,278**	March	Parker County, TX	1,750	condensate	pipeline seam failure	Cattle stock pond
	February	Fort McMurray, AB	260,000	oil sands crude	valve failure	Along pipeline (uncontained)
	February	Grand Rapids, MI	159,000	crude	leak caused by dent from pipeline resting on a rock	Area soil and groundwater
2003 reported spills: **62** regulatory	January	Superior, WI	715,000 (80,000 into river)	crude	pipeline rupture during delivery from pipe to storage tank	Nemadji River (frozen at time of spill)

infractions: **21** fines: **$54,000**						
2002 reported spills: **48** regulatory infractions: **7** fines: **$16,900**	July	Cohasset, MN	954,000	crude	longitudinal seam weld fatigue crack	Marshlands
	May	Glenboro, MB	95,000	crude	pipeline seam failure	Agricultural land
	January	Kerrobert, SK	975,000	crude	leaking gasket	Industrial site
2001 reported spills: **33** regulatory infractions: **8** fines: **$46,000**	September	Binbrook, ON	95,000	crude	external metal loss	Surrounding land
	September	Fairbanks, LA	68,000 (plus natural gas)	“oily mixture”	unspecified	Land and creek
	February	Satartia, MS	16,000	crude	accident (struck by farm implement)	Farmland
	January	Hardisty, AB	3,800,000	crude	pipeline seam failure (cracking from fatigue)	Surrounding land and nearby slough

* Source: National Energy Board - Pipeline Spill Record; all other incidents were sourced from Enbridge Corporate Social Reports, 2002-2010

[1] Liquid (hydrocarbon) spills only (number may be higher if natural gas spills are included).

[2] Includes liquid pipeline and natural gas pipeline infractions.

[3] In US Dollars; fines represents payments to regulatory agencies and do not include clean-up or compensation costs.

[4,5] Enbridge, in its 2010 Report, states "crude oil" as having spilled from its Michigan Line 6B spill. It is known and documented that this was diluted bitumen, and it is misleading to list it as crude oil. Similarly, the Line 6A spill was product diverted from 6B and therefore also diluted bitumen.

[6] SCO is synthetic crude oil, a refined product of bitumen

[7] "oil" = normally Enbridge specifies crude oil when it is conventional crude; sometimes the company simply mentions "oil" as the product spilled, and it is open to interpretation whether it is synthetic oil, bitumen, or conventional crude.

Request: a) Please provide all information about the monitoring procedures, monitoring frequency and environmental protection procedures employed for each of the above noted projects.

b) Please provide detailed engineering and design specifications and QA/QC procedures used for materials and during construction and operation in each of the above noted projects.

c) Referring to the table of selected spills above, please provide information on each of the incidents according to:

i. Nature of product discharged by Enbridge into the environment
ii. Regulatory consequences
iii. Lawsuits and current state of litigation
iv. Factors leading up to the spill
v. Method of spill discovery
vi. Response and clean-up efforts
vii. Changes made to policy or procedure in terms of design, maintenance and / or inspection methods

Please provide copies of all available documentation relating to all matters referred to in c) i to c) vi above.

d) Enbridge in its 2010 report stated that "crude oil was spilled in Michigan, Line 6B spill". Does Enbridge concede that in fact the product that has spilled into the environment in this case was diluted bitumen? Was Enbridge unaware of the nature of the product it was spilling into the river? How does Enbridge explain this fundamental error in its 2010 report?

e) Declarations based on Enbridge's 2010 "Corporate Social Responsibility Report" indicate that between 2005 and 2009 0.000965% of diluted volume was spilled. Does NGP agree that, given the volume expected along NGP's diluted bitumen and condensate pipeline, a yearly spill volume of 402,000 litres be expected based on Enbridge's past performance? Please confirm the accuracy of this calculation.

f) The US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) provides detailed information on its website. Between 2006 and March 2011 there were fourteen significant incidents and ten federal enforcement actions involving Enbridge pipelines carrying hazardous liquids. By PHMSA definition, a "significant" incident entails one of the following conditions:

i. Spill of 7,950 litres
ii. A fatality or injury requiring hospitalization or
iii. A total cost of $95,000

Of the fourteen incidents mentioned above, one involved injury or death; all other twelve spills involved spills of greater than 7,950 litres in volume. The total number of reported spills by Enbridge during this period was over 300. Please confirm the accuracy of these statistics.

g) The fourteen significant incident spills mentioned above occurred along 6,070 km of hazardous liquid pipeline. This means approximately 2.3 significant incidents occur per 1,000 km of pipeline in just over five years. Please confirm the accuracy of these statistics.

h) When the numbers in the previous questions are applied to the proposed NGP Project, which would cover 2,354 km of hazardous liquid pipeline (two pipelines of 1,177 km each), one could reasonably expect 5.4 significant incidents to occur in a five year period. This translates to one significant spill (over 7,950 litres) per year from the proposed NGP Project. Please confirm the accuracy of these statistics.

i) The Keystone Pipeline, operational for only one year, has experienced a number of spills. Please provide all details available to NGP on each of these spills (including the nature of product spilled, cause of spill, resulting law suits and regulatory actions and destruction to environment).

j) Do you agree that from the experience of the Keystone Pipeline that the fact that a pipeline is new is no guarantee that there will be no spills?

1.10 Kalamazoo, Michigan Line 6B Spill – July, 2010

Reference:
i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12, p. 12-1 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12.1, p. 12-1 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 1.6.1, p. 1-3 (A1S9X8)
iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The rupture of Enbridge's pipeline on July 26, 2010 which spilled 3,785,000 litres of diluted bitumen into the Kalamazoo River system in Michigan is of great concern for a number of reasons:

1. The product is the same as NGP's proposed pipeline.

2. Prior to rupture, the pipeline showed numerous signs of internal corrosion which speaks of the corrosive nature of the product.

3. Enbridge had delayed in fixing the numerous locations where corrosion had been found, indicating a lack of sound and responsible judgment.

4. When the rupture occurred, the operators and SCADA mistook it for column separation instead of a leak. As such, response was delayed by almost 12 hours.

5. After the spill, Enbridge president and CEO Patrick Daniel denied that the product was diluted bitumen as opposed to conventional crude; this speaks once again to judgment but also to an apparent desire not to disclose the product.

Each of the five issues above must be addressed by Enbridge in a forthcoming and detailed manner.

Request: a) The US Department of Transportation Pipeline and Hazardous Materials Safety Association's (PHMSA) September 16 document provides the following information about Enbridge's Kalamazoo spill:

i. On June 4, 2008, Enbridge received the final report on the 2007 MFL inspections results from the tool vendor. The final report indicated a total of 140 anomalies requiring action within 180 days, of which 26 were repaired and 114 remain. Is this statement accurate? Please provide and fully explain Enbridge's failure to repair all anomalies promptly.

ii. The 2009 in-line inspection using ultrasonic technology identified 250 anomalies, 35 of which were immediately repaired, and 215 remain. Is this statement accurate? Please provide and fully explain Enbridge's failure to repair all anomalies promptly.

b) The PHMSA's January 21, 2010 Warning Letter to Enbridge, revealed that inspectors had discovered the following:

i. Internal corrosion monitoring was discontinued on the five hydrogen permeation monitors (Beta Foils) installed on Line 6B. Please confirm the accuracy of this finding. Why was monitoring discontinued?

ii. Two manually-interrogated monitors were discontinued in May 2006. Please confirm the accuracy of this finding. Why was monitoring discontinued?

iii. One remotely-interrogated monitor was discontinued in January 2006 and the other two remotely-interrogated monitors were discontinued in October 2007. Please confirm the accuracy of this finding. Why was monitoring discontinued?

iv. Enbridge representatives stated the monitoring was discontinued due to “communications/instrumentation problems”. Please provide a full and accurate explanation of what the reasons were for Enbridge’s failures to ensure adequate monitoring.

c) Please provide a copy of the PHMSA’s warning letter of January 21, 2010.

d) In a Detroit Free Press article published a week after the spill (document attached), it was revealed that warnings to Enbridge had been issued by both the Obama administration and the Department of Transportation (PHMSA):

- The Obama administration had repeatedly warned Enbridge Energy Partners about safety issues along its Lakehead pipeline system. Is this report accurate? Please provide copies of all warning letters and all other related documentation in Enbridge’s possession and control.

- Enbridge company officials were called to Washington earlier in the year [2010] for a meeting on what it deemed "a series of major failures." Some of the concerns specifically involved Line 6B. Is this report accurate? Please fully describe and provide all documentation relating to any such meeting.

- The U.S. Department of Transportation -- which oversees oil pipelines through its Pipeline and Hazardous Materials Safety Administration, or PHMSA -- raised additional concerns about Enbridge's record. Is this report accurate? Please provide all documentation relating to concerns raised by the United States Department of Transport.

- A senior Transportation Department official said the administration "repeatedly warned Enbridge in no uncertain terms that it needed to get its act together with regard to the safety of its Lakehead pipeline system." Is this report

accurate? Please provide details and copies of all documentation relating to these warnings.

- The official said PHMSA officials met with Enbridge senior leadership in February to tell them to "overhaul their entire approach to safety." Is this report accurate? Please provide all documents relating to this meeting.

e) Please provide detailed information concerning the findings of numerous anomalies along Line 6B.

f) Please explain why Enbridge failed to make the required repairs in a timely way.

g) Enbridge CEO and president Patrick Daniel delivered a speech in May, 2011 to Enbridge shareholders (document attached) which contained the following with regard to the Kalamazoo spill:

"From the outset we have worked closely with residents in the Marshall and Battle Creek area to address their individual needs. To date, we have met the cleanup deadlines and milestones set by the Environmental Protection Agency. "

Enbridge CEO Patrick Daniel

Does NGP now admit that documentation from US government bodies and media sources reveals that Enbridge both has failed to meet EPA milestones and has failed to meet individual needs of Marshall residents?

h) When Mr. Daniel made the statement quoted above, was he aware that it was not accurate?

i) If Mr. Daniel was unaware of the inaccuracies in his statement, why had he not been properly briefed?

j) When did Mr. Daniel become aware that his statement was inaccurate?

k) When did Mr. Daniel provide a public correction of this inaccurate statement?

l) With regard to EPA compliance, documents to Enbridge from the EPA since the spill include (documents attached):

October 5, 2010 – Notice of Disapproval regarding Enbridge's Supplement Resource Plans

June 17, 2011 – Notice of Oil Recovery Directive for Summer 2011

June 27, 2011 – Notice of EPA Determination of Enbridge Non-Compliance

June 28, 2011 – Notice of Potential Non-Compliance

Please detail all incidents of Enbridge's regulatory non-compliance pertaining to this incident and disclose all related documents.

m) With regard to addressing the individual needs of area residents affected by the spill, a Michigan Messenger article from January 31, 2011 (document attached) states that Enbridge is arguing that it is not legally liable for damages from the spill. Is this report accurate? Please provide all documentation relating to third party claims relating to the incident.

n) In a county court case in Michigan, the company argued that it cannot be held liable for the spill of diluted bitumen because it followed all relevant laws regulations and industry standards. Enbridge claimed the damage was not foreseeable. The company had often claimed after the spill that it would take responsibility in addressing the needs of affected people and businesses. A quote from the company in the court proceedings, contained in the article, said "The statements at issue, that were made in Defendents' press releases and brochure, were mere expressions of intention, not offer." Is this report accurate? Please make full documentary disclosure in relation to the litigation being referred to.

o) Apart from compliance issues with spill clean-up, there are many sources who expressed displeasure with Enbridge's handling of the situation. The EPA's June 28, 2011 letter to Enbridge was titled: "Re: U.S. EPA Notice of Potential Non-compliance in response to the Administrative Order issued by U.S.EPA on July 27, 2010,

pursuant to 311(c) of the Clean Water Act and Supplement to the Administrative Order issued by U.S.EPA on September 23, 2010 - Inadequate Enbridge Response Management". In the letter, the EPA expressed concern about Enbridge's senior management on-site involvement of the Kalamazoo spill. Please disclose the letter and advise whether Enbridge contests the accuracy of any aspect of the letter. If so, what aspects are contested and why?

p) Canada Business (www.canadabusiness.com) article *Enbridge: Under Pressure* posted April 7, 2011. Here the US Deputy Secretary of Transportation said:

"I am deeply troubled by Enbridge's detection of and response to this oil spill," said John Porcari, the deputy secretary of transportation, at a hearing in September [2010]."

Please provide all available information or concerning Enbridge's detection of and response to this oil spill.

q) Over one year after the spill, the EPA's dedicated Enbridge spill website (www.epa.gov/enbridgespill) posts the following information:

"After a year of extensive cleanup work in the Kalamazoo River system, the U.S. Environmental Protection Agency has identified pockets of submerged oil in three areas covering approximately 200 acres that require cleanup. Work during the summer of 2011 is focused on:

- Revisiting shoreline areas cleaned up in 2010 where winter weather and spring floods exposed previously unseen oil or spill impacts.

- Recovering pockets of submerged oil in the sediment. EPA has identified three major submerged oil areas including the delta leading into Morrow Lake."

Please provide copies of all studies, reports, correspondence or the documentation concerning the impacts and effects of this major spill of diluted bitumen. Please provide a detailed explanation of

the implications that this spill, and the events occurring before and after the spill, have for the transport of the same substance by way of the NGP Project.

r) Please provide a detailed description of what Enbridge's QA/QC procedures were prior to the Kalamazoo, Michigan spill.

s) Please provide a detailed report on Enbridge's management of internal corrosion protection in Line 6B prior to the July 26, 2010 spill.

t) Please provide detailed information on why internal corrosion on Line 6B was an issue. Please confirm that Line 6B carries the same product as NGP is proposing for its pipeline from Bruderheim to Kitimat.

u) Please provide information on whether or not Line 6B had internal coating.

v) Please provide each inspection report, by Enbridge personnel as well as by regulatory inspectors, which found anomalies along Line 6B prior to the rupture.

w) Please provide the reports which detail Enbridge's decision not to fix all anomalies found during inspections along Line 6B prior to the rupture.

x) Please provide documentation of the meeting to which Enbridge was called in Washington in February 2010.

y) Please provide a detailed report on the detection of and response to this oil spill in terms of SCADA and the Edmonton operators of Line 6B. Include an exact timeline as well as details on the line shutdown and re-start while the rupture was still occurring.

z) Please provide a response to both the EPA's September 23, 2010 letter as well as the aforementioned quote by the deputy secretary of transportation.

aa) Please provide a detailed log of the number of times that Line 6B has registered false positives and the ensuing response both by SCADA and by operators.

bb) Please provide an in-depth case study of the causes and response to the Kalamazoo, Michigan spill of diluted bitumen in July, 2010.

cc) Please explain why Patrick Daniel at first denied that Line 6B was carrying diluted bitumen.

dd) Please provide a detailed analysis of the environmental and social impacts and effect of the Kalamazoo, Michigan spill in July, 2010.

ee) Please provide an explanation for why the EPA felt compelled to cite Enbridge with this requirement to submit a Response Management Work Plan Revision.

ff) The letter discussed in the preamble also references Enbridge's August 14, 2010 Response Management Plan which was submitted following the "U.S. EPA's August 13, 2010 determination that Enbridge's senior management involvement on-site was inadequate and not commensurate with the needs of the response organization established to meet the objectives of the Order [Administrative Order issued by the U.S. EPA on July 27, 2010]." Please provide a written explanation of how Enbridge's on-site involvement was inadequate.

gg) Please provide all correspondence between Enbridge and regulatory agencies after the July 26, 2010 spill, as well as the current status of any outstanding infractions.

hh) Please provide an explanation of Enbridge's community support and the current status of any litigation which resulted from the spill.

ii) Please provide a comparison between spill modelling from Line 6B and the actual spill effects documented since the July 26, 2010 spill.

jj) Please provide the evidence that the difference between diluted bitumen and conventional crude oil has been taken into account by

NGP in its spill modelling provided in the Application and its appendices.

1.11 Wisconsin Spill - February, 2007

Reference:
i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12, p. 12-1 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12.1, p. 12-1 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 1.6.1, p. 1-3 (A1S9X8)
iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The construction of Enbridge's Southern Access pipeline in Wisconsin began in 2007 and within the first year, 500 violations were cited by the Wisconsin Department of Justice (WDOJ). Included in the 500 were 282 wetlands violations and 176 land disturbance and erosion control violations near navigable water and wetlands. In 2009, the WDOJ determined that Enbridge must pay $1,100,000 in fines for more than 100 of its environmental law violations across 14 counties. These facts are documented on the WDOJ website (www.doj.state.wi.us) and the Wisconsin Wetlands website (www.wisconsinwetlands.org/enbridge.htm).

Construction violations were not the only mistakes made by Enbridge in Wisconsin at that time. An existing Enbridge pipeline ruptured outside the town of Curtis in January, 2007, spilling more than 109,800 litres of oil onto an adjacent farm field. According to a Journal Sentinel article from February 16, 2007 (document attached), an Enbridge spokeswoman said "the pipeline inexplicably cracked open"; the rupture spewed oil until an operator could shut down the flow from the operations center in Edmonton.

One month later, a Southern Access pipeline construction crew struck one of the existing pipelines on February 2, 2007, releasing 567,800 L of heavy crude into a Rusk County Farm field. The spill seeped into the groundwater, contaminating the local water table and was one of the largest pipeline ruptures in state history (Journal Sentinel February 16, 2007 article).

Request: a) Please provide documented details of the fines accrued by Enbridge by the Wisconsin Department of Justice for each of its environmental law violations.

b) Please explain how "the pipeline inexplicably cracked open". What was the actual cause of this pipeline rupture? Please provide a detailed explanation of what occurred including environmental monitoring reports, pipeline inspection reports, and other related studies, technical reports correspondence.

c) Please provide details of the cleanup efforts from the February 2, 2007 spill and how the groundwater was both affected and remediated. Please provide water testing and site remediation records.

1.12 Cheecham, Alberta Spill – January, 2009

Reference: i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12, p. 12-1 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12.1, p. 12-1 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 1.6.1, p. 1-3 (A1S9X8)
iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In January, 2009, a failed vent valve leaked at an unmanned facility near Fort McMurray, Alberta, spilling 914,000 litres of oil. Oil sprayed vertically 30 to 40 metres in the air and oil mist was blown off-site, contaminating an area of 450 metres by 1,500 metres downwind of the facility, as documented in Enbridge's 2010 Corporate Social Responsibility Report (document attached). The leak was undetected for two to three hours, and was not picked up by the detection system.

Questions and concerns are raised on a number of levels with regard to this spill and potentially similar issues with the NGP: mechanical failure risks, lack of leak detection by SCADA and the remoteness of most of the NGP pipelines. All pump stations (with the exception of the terminals) are unmanned, as is the entire 1,177 km of pipeline corridor.

Request: a) Please provide documentation and instrumentation detail on the SCADA monitoring system which did not immediately register the failed valve.

b) Please indicate in detail the differences between the monitoring thresholds on the Cheecham pipeline and the planned sensitivity for the NGP pipelines.

c) Please explain why the Cheecham monitoring system did not detect the leak.

d) What steps does NGP propose to take to ensure that the detection problems with respect to the Cheecham spill are not repeated in the context of the NGP pipeline?

1.13 Northern Gateway Project and Keystone Diluted Bitumen Pipelines

Reference: i) Terms of Reference, Joint Review Panel Agreement (A1R4D5)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12, p. 12-1 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12.1, p. 12-1 (A1S9X8)
iv) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 1.6.1, p. 1-3 (A1S9X8)

Preamble: The Keystone Pipeline transports diluted bitumen from Alberta to refineries in Illinois and Oklahoma; it was commissioned in 2010. The proposed extension of this system, Keystone XL, is currently undergoing regulatory assessment. The Keystone XL project aims to transport diluted bitumen from Alberta via pipeline to Texas.

The fact that the Keystone system and NGP carry the same oil product as well as the fact that they are new and/or proposed projects renders them worthy of comparison, even though they are run by different companies.

In a June, 2011 letter from the US Environmental Protection Agency (EPA) to the US Department of State (document attached), the EPA provided its comments on the Keystone XL Project's Draft Supplemental Environmental Impact Statement (SDEIS). This letter states that pipeline

oil spills are a very real concern and refers specifically to two of Enbridge's 2010 spills in Michigan and Illinois.

TransCanada's Keystone I pipeline carrying diluted bitumen has already spilled 4 times in six months of operation. However, the company's Environmental Impact Statement predicted 1.4 to 1.9 spills over 10 years (NRDC and Sierra Club Comment Letter to US Department of State, 2010, document attached).

Request: a) Do you agree that the Keystone routes do not face the geotechnical risks and hazards or the remoteness of the route the NGP pipeline will cross? If not, please explain why not.

b) Please provide a detailed plan on how NGP pipelines spill risk will differ from the Keystone I pipeline which, in its first 6 months, has already had 4 leaks.

c) Please provide a detailed comparison between Keystone I pipeline's EIS projection of spills and NGP's spill projection.

Aboriginal and Treaty Rights

1.14 Adverse Effects on Aboriginal Rights

Reference: i) Exhibit B24-2 Volume 5A – Additional Evidence June 2011, Section 5.9.3, p. 5-317 (A1Z6R1)

Preamble: The Application states that "Northern Gateway has determined that the Project will [sic] is not likely to cause significant adverse effects on the environment. Northern Gateway is therefore confident that the Project will not have significant adverse effects on those who depend on the land and water for sustenance, including Aboriginal groups who may exercise their Aboriginal or Treaty rights in the use of land for traditional purposes."

Request: a) Please clarify whether NGP has concluded that the Project will or that the Project is not likely to cause significant adverse effects on the environment.

b) Please define "likely".

c) Given this definition, was the Exxon Valdez oil spill likely?

d) Please define "significant"?

e) Did the Exxon Valdez oil spill have a significant effect on the environment?

f) Did the Exxon Valdez oil spill have significant adverse effects on those who depend on the land and water for sustenance, including Aboriginal groups who exercise their Aboriginal or Treaty rights in the use of land for traditional purposes?

g) Does NGP concede that its project will infringe the Aboriginal title of the Haisla Nation to lands along the proposed pipeline route and to lands at the proposed terminal site?

h) If not, explain the basis for this conclusion and provide all documentation relevant to this conclusion.

1.15 Socio-Economic Impacts – Direct and Indirect

Reference: i) Exhibit B24-2 Volume 5A – Additional Evidence June 2011, Section 5.9.3, p. 5-321 (A1Z6R1)
ii) Exhibit B3-16 Volume 6C – Application dated May 2010, Section 4 (A1T0G6)

Preamble: In response to Haisla Nation concerns about potential socio-economic impacts of the project, the Application refers to Vol. 6C, Section 4 for the socio-economic assessment.

Request: a) What parameters have been used to assess indirect socio-economic impacts on Haisla Nation traditional use of land and resources?

b) In what way does the socio-economic impact assessment consider indirect changes to Haisla Nation traditional use of lands and resources resulting from the presence of an industrial project and the fear of a spill or malfunction?

c) Please provide all relevant studies and documents obtained, prepared, undertaken, or commissioned by NGP relevant to this issue.

1.16 Archaeological permits for Haisla Territory

Reference: i) Exhibit B3-16 Volume 6C – Application dated May 2010, Section 3, p. 3-6 (A1T0G6)

Preamble: The Application states: "For heritage resources, the equivalent of the technical data reports are the permitting reports provided and that will continue to be provided to the permitting agencies in Alberta and British Columbia. These reports can be obtained by directly contacting ACCS in Alberta and the Archaeology Branch in British Columbia."

Request:

a) Please provide copies of all permitting reports provided to the Archaeology Branch in British Columbia in relation to the Project, for Haisla Nation Territory directly to the Haisla Nation on a confidential basis.

b) Please provide all information relevant to the illegal destruction of Haisla Nation culturally modified trees (CMTs) at the proposed terminal site.

c) Will NGP agree to not destroy further CMTs during the construction of its pipeline and terminal without First Nation consent?

1.17 Haisla Heritage Sites

Reference: i) Exhibit B3-18 Volume 6C – Application dated May 2010, Section 6, pp. 6-28 to 6-36 (A1T0G8)

Preamble: The Application identifies a number of potentially impacted Heritage Resources in Haisla Nation Territory (p. 6-28), including four with high heritage value at the Kitimat Terminal, including two rock art sites (p. 6-30).

The Application states: "Project-specific effects on heritage resources are mitigated to the standards established by the provinces. Provincial legislation is intended to ensure that these effects are not significant. Northern Gateway will record and add to the provincial databases sites encountered during project work, provided these sites are not held in confidence by the community" (p. 6-36).

Request:

a) Does NGP intend to destroy or alter any Haisla Nation Heritage Resources?

b) What mitigation measures are proposed for the high value sites at the proposed Kitimat Terminal?

c) What discussions has NGP had with the Province of British Columbia with respect to these proposed mitigation measures?

1.18 Socio-Economic Impacts on Traditional Land Use

Reference: i) Exhibit B3-16 Volume 6C – Application dated May 2010 (A1T0G6)
ii) Exhibit B3-17 Volume 6C – Application dated May 2010 (A1T0G7)
iii) Exhibit B3-18 Volume 6C – Application dated May 2010 (A1T0G8)

Preamble: This volume is titled "Environmental and Socio-economic Assessment (ESA) – Human Environment" and purports to contain an assessment of key issues that are of particular interest to regulators, participating Aboriginal groups, and other stakeholders. The volume includes assessments of socio-economic conditions, non-traditional land use, and heritage resources. It does not include an assessment of traditional land use.

Request: a) Have baseline studies been conducted to determine the levels of fish, wildlife and plant resources within the area potentially affected by the Project?

b) Have studies been conducted to determine or assess the traditional use of fish, wildlife and plant resources within the potentially affected by the Project?

d) Have the potential environmental and socio-economic impacts of the project on traditional land use been assessed?

e) Please provide copies of any environmental and socio-economic impact assessment for traditional land use by the Haisla Nation.

1.19 Environmental Bonding

References: N/A

Preamble: The Project has the potential to cause severe environmental degradation to Haisla Nation lands and waters.

Request: a) Will NGP provide an irrevocable letter of credit, in an amount negotiated with the Haisla Nation, to address cleanup costs and compensation in the event of a spill or spills?

b) Will NGP, prior to construction, provide an irrevocable letter of credit to cover the full costs of decommissioning and restoration of the pipeline and the terminal facility?

c) If the answer to either a) or b) is no, please explain why not.

PIPELINE

Pipeline Location and Route

1.20 Location and Route

Reference: i) Terms of Reference, Joint Review Panel Agreement (A1R4D5)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 2.3.3, p. 2-5 (A1S9X8)
iii) Exhibit B 19-4 Volume 3 Application Update dated December 2010, Section 2.4, p. 13-14 (A1W8Y6)
iv) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 2.2.2, p. 2-1 and 2-2 (A1S9X8)

Preamble: In reference ii), it is stated that one of the primary reasons for selecting the eastern pipeline route is that it follows existing rights-of-way, and that road access for construction and maintenance is consequently better. If the proposed route in references ii) and iii) followed existing rights-of-way in British Columbia as it does in Alberta, it would preclude the need to blast two 5.5 km tunnels through the Coast Mountains. This route would add approximately 250 km to the proposed pipeline but would significantly increase comparative safety and significantly lower environmental risk.

NGP states that the proposed location of the proposed Kitimat Terminal was selected in part due to “limited effects on watercourses, waterbodies, marine and aquatic vegetation and habitat, and important fish areas.” It was also selected in part due to “limited potential effect of shoreline oiling”.

Request: a) Please explain why the proposed pipeline does not follow existing rights-of-way (primary Highway 16 and Highway 37), when this would allow for better road access and less incursion into pristine areas.

b) Please provide copies of all correspondence, studies, analyses and discussions of the merits and drawbacks of this alternate route.

c) Please indicate whether NGP would accept as one of the conditions for project approval, a relocation of its proposed pipeline to the existing rights-of-way.

d) Please qualify and quantify "limited effects" by using GNOME modelling (which has been done before for this area of the North Coast and is therefore available) and not only a mass-balance approach as contained in the Application. Modelling areas must include the Kitimat River estuary.

e) Please provide a detailed accounting of NGP's experience, if any, with tunnel blasting for pipelines.

f) Please explain how it is possible to know the extent and potential effect of shoreline oiling. Please provide copies of all modelling, analyses, reports, studies and other documentary records relating to the shoreline oiling issue.

Pipeline Design and Safety

1.21 Valve Locations

Reference: i) Exhibit B1-22 Volume 3 – Application dated May 2010, Appendix F, p. F-5 (A1S9Z5)

Preamble: The Application identifies the following valve locations:

KP	Valve Location Description	Oil	Cond.
1086.9	Hoult Creek	X	X
1124.7	Clearwater Pump Station	X	X
1143.3	Wedeene River	X	X
1148.4	Little Wedeene River	X	X
1149.4	Little Wedeene River	X	X
1153.3	Tributary to Kitimat River #5	X	X
1172.2	Kitimat Terminal	X	X

Request: a) For each of the segments between these valves, what is the maximum volume of liquid that will be in the segment at any one time?

b) For each of the segments between these valves, what is the minimum delay between the detection of a leak and the closing of the relevant valves?

c) For each of the segments between these valves, what is the maximum amount of product that could spill, presuming the valves are closed with minimum delay?

d) For each of these valves, what factors could delay or prevent the closing of the valve?

e) For each of the segments between these valves, what is the maximum delay between the detection of a leak and the closing of the relevant valves?

f) For each of the segments between these valves, what is the maximum amount of product that could spill, presuming the valves are closed with maximum delay?

g) For each of these segments, what is the first water body which would be impacted by the spill?

h) For each of water bodies, do they drain into the Kitimat River?

h) For each of these water bodies, do they drain into Kitimat Arm?

1.22 Pipeline Design and Materials

Reference:
i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 3.1, p. 3-1 (A1S9X8)
ii) Exhibit B 20-2, Northern Gateway response to request for additional Information, dated March 2011, Section C.1.1, p. 14 (A1Y3U9)
iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 5.1, p. 5-1 and 5-2 (A1S9X8)
iv) Exhibit B 19-4 Volume 3 Application Update dated December 2010, Section 5.1, Table 5-1 and Table 5-2, p. 5-1 (A1W8Y6)
v) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 5.10, p.5-7 (A1S9X8)
vi) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 5.14, Table 5-7, p. 5-8 (A1S9X8)
vii) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference ii) the pipeline design approach is stress based (“Barlow’s formula” in Enbridge Standard D06-101). The Standard also states that the engineer must assess whether additional loadings (e.g., seismic loads, landslides) require additional pipe strength or protective measures. Little information, however, is given regarding the design methodology that will be used to consider these additional loadings.

Further to reference ii), a published article by Nyman et al., (2008) as well as the Pipeline Research Council International (PRCI) guidelines (Honegger and Nyman, 2004, documents attached) indicate that strain-based design should be used for pipelines that may be subjected to ground deformation. No reference, however, to strain-based design is made in the document. Only a passing reference to Enbridge's "strain management plan" is made but it is not clear what this plan entails. As well, no mention is made of the pertinent ISO standard 23469: Bases for design structures – Seismic actions for designing geotechnical works.

In reference iii) two different standards, CSA Z245.1 and API Spec 5L, are listed as possibilities to which the line pipe will be designed. In reference iv) a range is listed for minimum wall thickness of the pipeline parameters. Thicker pipeline is safer though more expensive.

Two different steels are listed as potentials for the pipelines. Grade 483 (X70) steel is listed for the pipelines on p. 5-1 but then on p. 5-2, it is stated that "the feasibility of using Grade 550 (X80) steel and associated reduced wall thicknesses for all , or a portion of the oil pipeline will be evaluated during detailed engineering." This is not clarified in reference iv), and thus it is important that the type of steel that will be used for the proposed pipelines is disclosed. The choice of steel is integral to pipeline integrity and longevity.

In reference v) it is stated that buoyancy control might be required along some sections of pipelines which are located under watercourses and in wetlands. The buoyancy control will be achieved through the use of pipe weights, concrete coating or screw anchors. There is a danger, however, that weights used for this purpose can move or twist the exterior pipeline coating. This can result in disbondment (when coating detaches from the pipe) allowing for corrosion and cracking to develop and grow. In reference vi) the table lists localized conditions and standard mitigation methods. Under the "Pipeline buoyancy control" condition, however, no mention is made of exterior coating protection.

Request: a) Please provide detailed information regarding the design methods that will be used to assess additional loadings of landslides and seismic conditions.

b) Please provide strain-based design information which includes reference to both the PRCI guidelines as well as to ISO standard 23469.

c) Please describe the “strain management plan”.

d) Please list the differences between CSA Z245.1 and API Spec 5L and provide the criteria on which the standard was selected.

e) Please elaborate on the choice of wall thickness and provide the pros and cons which led to the final decision of wall thickness for both the oil and the condensate pipelines.

f) Please disclose the type of steel planned for the pipelines and detailed reasoning behind its choice.

g) Does NGP agree that X80 steel can have inherent susceptibility to hydrogen-induced cracking when welded? Does NGP propose to use X80 steel? How will NGP address the inherent hydrogen induced cracking problem?

h) Does NGP agree that X80 steel pipe is more difficult to weld than lower strength materials and that the welding parameters are therefore far more stringent and must be done under careful observation? How does NGP propose to address this issue?

i) Please provide the detailed design which demonstrates exactly how the technology and methods that NGP proposes to employ for buoyancy control will not constitute any risk to exterior coating integrity. Please provide evidence that there will be no damage to exterior pipe coating when utilizing these buoyancy control measures.

j) Please provide information on how, should the exterior coating be compromised in any way, this will be addressed in terms of both notification and repair.

1.23 Pipeline Product Characterization

Reference:
i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 4.2.2, p. 4-1 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Table 4-2, Section 4.2.2, p. 4-2 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 4.3.2, p. 4-3 (A1S9X8)
iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: NGP proposes that the pipeline will operate as a batched pipeline, alternating between diluted bitumen and synthetic oil. NGP's Application fails to specify either the diluent to be used or the percentage of diluent to be blended with the more viscous bitumen. Without a detailed schedule, protection of both the workers and the environment is difficult when exact knowledge of the released product is lacking. The operation of a batched pipeline has significant implications for spills, since determination of environmental effects, as well as containment and clean-up strategies, is directly dependent on the characteristics of and constituents in the product released.

With regard to the chemical nature of the diluents that are added to reduce the viscosity of the bitumen, it is known that the exact composition varies among shippers. An analysis of each potential diluent, however, is required in order to determine the potential health and environmental impacts of a leak or rupture.

In reference ii), Table 4-2 lists the average sulphur (w/w) of diluted bitumen as 2.7%. Due to the known corrosive nature of sulphur in metal pipelines, more information is required to ascertain the actual operating conditions and operating parameters. Standard deviation of the average sulphur value should be stated, as well as a discussion provided on the possible negative effects of sulphur on pipeline integrity which is not mentioned at any point in the Application. Crandall (2002) states that Athabasca Dilbit and SynBit have 3.7% sulphur and 2.8% sulphur, respectively (document attached). These values are higher than those listed in the Application.

In references i) and iii), the products which are planned for the Project's pipelines have not been fully characterized either physically or chemically.

Only average sulphur is listed for condensate; only sulphur and Ni plus V are listed for diluted bitumen.

Benzene, a known carcinogen, is a component of diluted bitumen and condensate, and was of great concern after Enbridge's Kalamazoo spill in July, 2010. On the EPA's website dedicated to Enbridge's spill, it states the following:

> "The air sampling results have shown one chemical – benzene - at a level of potential concern for long-term health."

Information is required on the content of this chemical.

Request:

a) Please provide precise information concerning the product that NGP proposes to run through the oil pipeline. Please provide documentation of the scheduling.

b) Does NGP agree that the blending of bitumen with condensate will vary with the viscosity of the bitumen and with the type/source of the condensate?

c) Does NGP agree that each blend will have different chemical composition?

d) Does NGP agree that at different times NGP proposes to deliver an entirely different product through the pipeline – synthetic oil?

e) Does NGP agree that the composition of the product that NGP proposes to transport will also change based on such factors as cost and availability?

f) Does NGP agree that it is therefore impossible for NGP to predict, in advance, the composition, or even the nature of the substance to be found in its proposed pipeline?

g) Since the composition of neither bitumen nor its diluent is constant or consistent, please provide information on how the blending will be monitored.

h) Please provide complete chemical characterisations of the diluent(s) that NGP proposes to use to blend the bitumen. Since the exact composition may vary among shippers, please provide analyses which cover all variations.

i) Please provide studies which establish the potential health and environmental impacts of a leak or rupture of a pipeline carrying diluted bitumen.

j) Please provide all available information concerning the potential health and environmental impacts in relation to the diluent component of the spill.

k) Please provide the standard deviation of the average value given for sulphur in diluted bitumen.

l) Please provide the average value and standard deviation of sulphur in synthetic oil.

m) Please explain the discrepancy between the projected average sulphur content of diluted bitumen in the NGP Application (2.7%) and the average sulphur content of diluted bitumen as discussed in Crandall (2002): 3.7%.

n) Please provide a detailed examination of the possible negative effects on pipeline integrity from this higher sulphur content both in general and as compared to conventional crude oil. Please provide copies of all studies, reports and correspondence in NGP's possession and control relating to this issue.

o) Please provide the complete characterisation of bitumen, synthetic oil, condensate and diluent upon which the Project has based its risk assessment, design integrity and determination of toxic effects on biota and habitat in the case of a spill.

p) Please provide detailed information, including human health and ecological toxicity studies, on the diluent(s) to be used. If the diluent will vary, this too must be detailed in terms of how and

when, and additional human health and ecological toxicity studies must be supplied.

q) Please provide information on how the detailed design of the pipeline, appurtenances, storage facilities and marine terminal take into the account the properties of bitumen, including increased acidity, particulate matter and sulphur content.

r) Please provide a detailed description of the heavy metal component of bitumen.

s) Please provide all available information and documentation on spill impact and effects related to the heavy metal content of bitumen.

t) Please provide all available information on spill impact and effects related to benzene content in condensate and diluted bitumen. Please include all monitoring data and public warning documentation following the Kalamazoo spill in July 2010.

u) Does NGP anticipate that precipitation of solids will occur in the diluted bitumen pipeline or the diluted bitumen storage tanks? If so, provide details.

v) If the answer to question u) is “no”, please provide details on how NGP will ensure that no precipitation of solids will occur in the diluted bitumen pipeline or the diluted bitumen storage tanks.

1.24 Corrosive Nature of Diluted Bitumen

Reference:
i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 4.2.2, p. 4-1 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Table 4-2, Section 4.2.2, p. 4-2 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 5.3, p.5-2 (A1S9X8)
iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Enbridge’s Application shows no evidence of consideration being given to the unique risks posed by diluted bitumen. Diluted bitumen is significantly more corrosive to pipeline systems than conventional crude oil.

Request: a) The 2004 crude oil pipeline inspection in Prudhoe Bay, Alaska revealed severe internal microbial corrosion (Lilly et al., 2006, document attached). A March 2006 oil spill of 208,460 litres at the same site was confirmed by the Alaska Department of Environmental Conservation as having been caused by internal corrosion (document attached). Does NGP agree that internal corrosion on the pipeline carrying crude oil is a significant risk factor in oil spills?

b) The Crude Oil Policy Association's 2009 Quick Reference Guide states that both of the average sulphur and the average acid concentrates of diluted bitumen are eight times higher than in average benchmark crudes. Does NGP accept the Association's figures as accurate?

c) Does NGP concede that diluted bitumen contains significantly higher levels of corrosive substances than crude oil?

d) The National Petrochemical and Refiners Association (document attached) state that the maximum acid concentration of diluted bitumen can reach eighteen times that of acid concentration in crude oil. The Association has found that tar sands derived bitumen contains significantly more abrasive quartz sand than conventional crude. Does NGP accept the accuracy of the National Petrochemical and Refiner's Association report? Does NGP accept that diluted bitumen is significantly more corrosive than crude oil?

e) In an email dated November 23, 2010, NGP stated: "The pipelines will not transport hydrocarbons containing significant corrosive substances and therefore an internal pipe coating will not be needed". Please explain how it is that in late 2010 NGP still was not aware of the corrosive nature of the substances that NGP is proposing to move through its pipelines?

f) Does NGP now agree that it would be transporting "significant corrosive substances"? Given the obvious error in NGP's email, does NGP now agree that internal pipe coating will be needed? Please provide all studies, reports, correspondence and written analyses assessing the risks, costs and benefits of internal pipe coating.

g) Does NGP agree that an internal pipe coating would reduce the risk of corrosion-based spills of diluted bitumen?

h) Only six years after construction of a crude oil pipeline in Texas, microbial and internal corrosion forced the replacement of 1,520 metres of pipe (United Pipelines Systems, 2005, document attached). Please provide NGP's analysis of this incident and how it fits with NGP's assertion that it will not be transporting "hydrocarbons containing significant corrosive substances".

i) A study of Alberta's hazardous liquid pipeline system prepared by the Alberta Energy and Utilities Board in 2007 (document attached) indicates a total of 5,333 incidents over the course of a sixteen year time span. The same study indicates that internal corrosion accounted for 49% of reported pipeline incidents in the Alberta hazardous liquid pipeline system. Does NGP accept the accuracy of the Alberta Energy and Utilities Board study? Given internal corrosion accounted for over 2,600 incidents within the period studied, does NGP now retract its assertion that NGP pipelines "will not transport hydrocarbons containing significant corrosive substances"? If no, why not?

j) Please provide detailed information as to how NGP proposes to monitor changes in the corrosive properties of the product it proposes to transport.

k) Please provide your rate of corrosion calculations based on flow and content of fluid.

l) Please provide copies of all studies, correspondence and reports in NGP's possession and control that relate to NGP's design decision not to protect the pipelines with internal coating.

m) Please provide a detailed cost estimate of including an HPDE liner in the pipeline to lessen internal corrosion risks.

n) Does NGP accept that the 2006 spill in Alaska due to internal corrosion underlines significant risk that is applicable to the proposed pipeline?

o) Please provide a detailed analysis of the 2006 spill Alaska due to internal corrosion and explain the steps that NGP proposes to take to avoid similar spills due to internal corrosion.

p) A comparison to Alberta's hazardous liquid pipeline system and that of the US reveals four times greater number of incidents in Alberta from 1990 – 2005 (Alberta Energy and Utilities Board Study 2007, document attached); US Department of Transportation and Pipeline Hazardous Materials Safety Administration website information, document attached). Does NGP take issue with any aspect of the above-noted reports? Does NGP agree that the substantially greater number of incidents in Alberta are due to the fact that the American system runs predominantly on standard crude in its oil pipelines while Alberta runs predominantly oil sands derived oils? If not, what is NGP's explanation for the significantly higher rate of incidents in Alberta? Please provide all reports, studies and correspondence relating to this issue.

1.25 Pipeline Integrity

Reference:
i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 5.3, p. 5-2 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 12.1.2, p. 12-2 (A1S9X8)
iii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 10.2.5, p. 10-5 (A1S9X8)
iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference i), it states that the pipelines will be externally coated; there will be no internal coating. Microbial corrosion of pipelines is a major source of pipeline failure. Microbial activity within the pipeline or pipeline exterior (soil to pipe interface) leads to corrosion of uncoated pipe or areas of pipe with coating holidays. Sulphur is present both in soil and in steel and this risk is therefore high.

In discussing protective coatings in reference i), NGP provides no discussion on hydrogen damage which is possible from myriad sources. Any movement of soil can nick or scrape the pipeline surface, or external hydrogen blistering can result in unprotected areas of pipe which then rapidly corrode.

Reference i) provides no information on how the pipeline will address the issue of freeze/thaw cycling and its potential for external coating damage. The yearly occurrence of such cycling ensures pipeline damage in areas of coating holidays. Maintenance and inspection details must therefore also be provided which speak to this particular concern.

In reference ii), pipeline monitoring programs are discussed. The Application, however, makes no mention of the effects of sulphur on the integrity of the pipeline. Sulphur damage leads to serious degradation of pipelines. This has major implications for inspection and monitoring of pipeline materials and welds prior to burial and once the pipelines are in use.

No information is provided in the Application on the potential for stress corrosion cracking. This is a major feature of any Integrity Management Program for pipeline maintenance and is not discussed in reference i). This potential damage has major implications for inspection and monitoring of pipeline materials and welds once the pipelines are in use.

In reference iii), pipeline installation is very briefly described. Detail is needed on the pipeline trench excavation and whether the pipelines will be lowered onto hardened soil or onto backfill. Direct placement on packed soil is known to cause pitting corrosion along the bottom of the pipeline.

Request:

a) Please provide a discussion of the potential for damage to pipelines by microbial corrosion and provide the precise pipeline design which addresses this issue.

b) Please provide details on how hydrogen damage will be inspected for and monitored. Details should be provided concerning how effective monitoring for external coating damage will be carried out.

c) Please provide design information which addresses the potential for freeze/thaw cycling to damage external pipeline coatings, and provide the mitigation plan should such damage occur.

d) Please provide a detailed discussion of the pipeline monitoring and inspection practices that will be employed to lessen or address sulphur damage to the pipelines.

e) Please provide a detailed discussion of the monitoring and inspection practices that will be employed to monitor and inspect for stress corrosion cracking.

f) Please provide a detailed plan for lowering the pipeline segments into the trench, and including a description of the trench bed preparation.

1.26 Cathodic Protection

Reference: i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 5.4, p. 5-3 (A1S9X8)
ii) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference i), the cathodic protection (CP) system for the pipelines is discussed briefly. Information is required, however, on how the CP system will address such varying soil resistivity that will inevitably be encountered over the length of pipeline. NGP will need to explain how the CP system will address the known potential for geomagnetically-induced currents in northern British Columbia (Trichtchenko, document attached). A CP system which does not adequately address varying current demand will result in corrosion from under-protection or hydrogen damage from over-protection.

The CP system section in reference i) does not discuss the important requirement for online monitoring of selected test posts as well as all rectifier units. This is essential for remote areas; monitoring stations should be installed at intervals not greater than 3 km along the pipeline according to ISO 15589-1. The Application does not include details of CP monitoring plans on this matter.

Request: a) Please provide details on how the CP system will address varying soil resistivity encountered over the length of the pipeline, and how the pipelines will be protected from corrosion due to varying current demand.

b) Please provide details on how the CP system will address the know potential in northern BC for geomagnetically-induced currents.

c) Please provide detailed information on the capability of SCADA to monitor and adjust CP continuously. As well, please confirm that monitoring stations of the CP system will be installed at intervals not greater than 3 km along the entire pipeline, as per ISO standards.

1.27 Welding, Valves and Fittings

Reference: i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 1.6.3, p. 1-3 (A1S9X8)

ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 5.2, p. 5-2 (A1S9X8)

iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 5.5, p. 5-4 (A1S9X8)

iv) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference i), the Application states that a joining program, "which includes welding procedures and non-destructive examination (NDE) inspection specifications, will be developed...". Welding procedures are a vital aspect of pipeline integrity since the smallest flaw can lead rapidly to corrosion. It is therefore not sufficient to refer to procedures being developed in the future.

It is stated in reference ii) that a joining program will be developed in accordance with OPR-99. Welding procedures, however, differ according to whether X70 or X80 steel is being used for the pipelines.

In reference iii), it is stated that all valves and fittings will be compatible with the line pipe to which they are connected. It is unclear what is meant by this general statement.

Request: a) Please provide the specific welding procedures and the detailed joining program for the type of steel to be used.

b) NDE inspection specifications are vital aspects of pipeline maintenance and integrity, particularly in the case of pipelines running over such remote and often rugged terrain. Please provide detailed information of the proposed NDE inspection specifications.

c) It is not possible to assess the environmental effects of the Project without the Construction Environmental Protection and Monitoring Plan (EPMP) is submitted. Please submit the detailed Construction EPMP.

d) It is not possible to assess the environmental effects of the Project without the detailed commissioning plan being submitted. Please submit the detailed commissioning plan.

e) Please provide assurance that there will be no obstruction in the pipelines, valves and fittings for running in-line inspection tools.

Pipeline Monitoring

1.28 Pipeline Right-of-Way Maintenance

Reference: i) Exhibit B24-2 Volume 5A – Additional Evidence June 2011, Section 5.9.3, p. 5-321 (A1Z6R1)

Preamble: In response to Haisla Nation concerns about monitoring the pipeline for leaks and spill, the application state: "Vegetation on the 25-m wide permanent ROW will be controlled to allow monitoring of the ground conditions over the pipelines".

Request: a) Is it Enbridge's intention to keep the entire 25-m wide pipeline corridor free of vegetation?

b) How will vegetation control be achieved in environmentally sensitive areas and near water bodies?

c) If Enbridge intends to use methods other than manual brushing in these areas, what are these methods?

d) What are the environmental impacts associated with these methods?

e) What are the human health impacts associated with these methods?

1.29 Effectiveness of SCADA

Reference: i) Exhibit B1-5 Volume 3 – Application dated May 2010, Section 11, p.11-2 (A1S9X8)

Preamble: The Application describes the SCADA system and states: "The SCADA system was developed and is currently supported by Enbridge staff. … It has many proprietary features built in that allow Enbridge to safely maximize pipeline capacity while minimizing risk."

Request: a) Was the SCADA system in use on Line 6A in the United States?

b) If yes, how much time elapsed between the spill and spill detection? How much time elapsed between spill detection and spill shutdown? How much product was spilled?

c) Was the SCADA system in use on Line 6B in the United States?

d) If yes, how much time elapsed between the spill and spill detection? How much time elapsed between spill detection and spill shutdown? How much product was spilled?

e) Please provide the following information for any spills from Enbridge pipelines in which the SCADA system was in use: time elapsed between spill and spill detection; time elapsed between spill detection and spill shutdown; and volume of product spilled.

1.30 Aerial Monitoring - Snow

Reference i) Exhibit B3-1 Volume 6A – Application dated May 2010, Section 2.5.1, p. 2-14 (A1T0F1)

Preamble: The Application states that the pipeline right-of-way will be monitored through aerial reconnaissance, to provide an overview of the state of the right-of-way.

Request: a) What monitoring process will be used during the months in which the right-of-way is covered in snow?

b) What monitoring process will be used during periods when aerial reconnaissance is impossible due to inclement weather conditions?

1.31 Inspection and Maintenance

Reference: i) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 5.6, p. 5-4 (A1S9X8)

ii) Exhibit B 1-5 Volume 3 - Application dated May 2010, Section 5.6, Table 5-3 and Table 5-4, p. 5-5 (A1S9X8)

iii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 5.12, p. 5-7 (A1S9X8)

iv) Exhibit B 1-5 Volume 3 – Application dated May 2010, Sections 8.5 – 8.7 p. 8-4 and p. 8-5 (A1S9X8)

v) Exhibit B 19-4 Volume 3 Application Update dated December 2010, Sections 8.5 - 8.7, p. 20 - 22 (A1W8Y6)

vi) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 9.3, p. 9-12 (A1S9X8)
vii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 10.2.8, p. 10-6 (A1S9X8)
viii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 12.1.1, p. 12-1 (A1S9X8)
ix) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference i), a brief description of scraper trap facilities is provided. Cleaning will be an important issue as a part of regular maintenance since running cleaning pigs of different type and potentially with agents and solutions can reduce deterioration of the internal surface of the pipeline. Other inline inspection (ILI) methods will likely also be used. If NGP intends to run inspection and cleaning tools in all sections of the pipelines, then facilities for running pigs would have to exist in all piping stations.

In reference ii) the design parameters of the scraper trap facilities are listed. However, no lengths are mentioned in the tables. It is important for the launchers and receivers to be long enough, as some of the tools might be longer than others.

In reference iii) the use of signs and markers is discussed, including where marker signs will be placed. There are signallers built into the pipe to detect passage of any type of pigging device, but no mention is made of their location.

In references iv) and v), oil and condensate piping at pump stations is discussed. Since inline inspection will be performed along discrete pipeline sections, some if not all of the pump stations should be equipped with launchers and receivers. This, however, is not discussed in the Application.

In references iv) and v), the instrumentation and controls provided for each pump station are listed. No mention is made, however, of pig signallers. For inline inspections to be performed between pump stations, these signallers are necessary.

In references iv), v) and vi), various buildings needed for the pump stations and Kitimat Terminal are discussed. It is stated that all pump stations and the Terminal will have workshop space, among other areas. Inline inspection tools can be large, and the area of these workshops is

not stated. Clarification is required that inline inspection tools can be accommodated in these areas.

In reference vii), the pipeline cleaning and pressure testing is described. Internal cleaning scrapers will remove construction debris upon completion of each section of pipeline. The Application does not discuss the fact that this an important opportunity to establish the baseline condition of the pipeline. Future inline inspections can then use this data for comparison purposes, when searching for corrosion or other problems.

In reference viii) there is brief discussion concerning prevention programs which aim to maintain pipeline integrity. It is stated that integrity measures are based on operating regime and consideration of product, pipeline route and associated hydraulics. The Application does not state, however, that all amenities required for inline inspections will be put in place, even though these are key to the maintaining of pipeline integrity and therefore safety.

Request:

a) Please provide information on where NGP intends to run cleaning pigs. For example, is the intention to be able to run them in all sections? Or is the intention to run them through multiple sections at a time?

b) Please provide information on where NGP intends to run other ILI tools.

c) Please provide more information on where exactly facilities for running pigs will be located. If only at the Bruderheim Station and Kitimat Terminal, as currently indicated in the Application, please explain in detail how inspection and cleaning will occur.

d) Please provide the dimensions of the launchers and receivers for both the oil pipeline and the condensate pipeline.

e) Please provide information on where the signallers will be built. If the plan is not to install them around launchers and receivers, please provide the reasoning since this can assist in running the tools.

f) Please discuss which pump stations will be equipped with launchers and receivers.

g) Please provide rationale on why some may not be thus equipped, considering the fact that this might become a limiting factor for running inspections later on.

h) Please provide information on where pig signallers will be installed.

i) Please provide confirmation that workshop space at pump stations will be able to accommodate inline inspection tools where it is anticipated that launchers and receivers will be used.

j) Please provide confirmation that workshop space at Kitimat Terminal will be sufficient to accommodate inline inspection tools.

k) Please provide information on the intention to run inline inspections to establish the baseline condition of the pipelines during cleaning and pressure testing. If the intention is not to run ILI, please provide supporting reasoning.

l) If the answer to k) is that ILI will in fact be run during this period, please provide the schedule of such testing and whether it will be done after or during initial tests, using the same water.

m) Please provide a detailed list of all amenities required for ILI which will be put in place to ensure that integrity and safety are maintained.

1.32 Monitoring and Supervisory Control and Data Acquisition (SCADA)

Reference:
i) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 12.1, p. 12-1 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 11.1, p. 11-1 (A1S9X8)
iii) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: In reference i) the Application states that the pipelines will be monitored to identify defects. It does not discuss, however, what exactly will be monitored. There are recently-developed systems installed on pipelines which “listen” for hits on a pipeline and could help avoid third-party damage, or mitigate the size of a spill should damage occur. Such damage to the pipelines could occur during construction or while the pipelines are operational.

In reference i) the Application discusses monitoring programs, which include CP, in-line inspections, investigative excavations and slope stability monitoring. It is important that a baseline survey be performed which would allow for monitoring changes and defect growth once in-line inspections begin.

Further to reference i) the discussion of the slope stability monitoring program does not discuss the use of inline inspection tools which have inertial navigation. Such tools are used to detect the center line of the pipelines and are typically run in lines where land movement is possible, such as the planned NGP route. The tools detect how much the pipeline has moved and therefore establish the resulting strain.

The SCADA monitoring system, it is thought, will alert operators to abnormal operating conditions, including spills or leaks. Diluted bitumen, however, has a tendency to give "false positives" in pipelines, which renders interpretation of SCADA data and therefore discovery of leaks very difficult. This is of critical concern when one considers that operators on the NGP pipelines are in Edmonton, many hundreds of kilometres away from most of the pipeline. A "false positive" occurs when the pressure inside a pipeline drops below the pressure at which the natural gas condensate evaporates. This is known as "column separation" or "slack line" in the industry and can cause a bubble which impedes the flow of oil. What is grave is that column separation and pipeline leaks generate similar signals to SCADA.

Request:

a) Please explain in detail the type of monitoring to be installed along the pipelines. If "listening" technology is not planned, please provide all reasoning behind this decision, and how safety from third-party damage will otherwise be monitored.

b) Please provide information on the baseline survey which will be undertaken. If one is not planned, please provide detailed reasoning and risk assessment as to why not.

c) Please provide details on establishing the initial center line of the pipelines, as well as subsequent use of inertial mapping to detect movement of the pipeline, since this region is known for ground movement due to various causes.

d) Please provide a detailed explanation of column separation which occurs in diluted bitumen pipelines.

e) Please provide the detailed changes to the SCADA monitoring system which account for and remedy the problem of false positives in a diluted bitumen pipeline.

1.33 Land Acquisition

Reference: i) Exhibit B1-3 Volume 1 – Application dated May 2010 Section 8, pp. 8-1 to 8-4 (A1S9X6).

Preamble: The Application identifies land acquisition issues for fee simple and Crown lands along the pipeline route and for the terminal sites. It identifies the necessity to acquire rights from private landowners and the Crown, but makes not reference to Aboriginal interests in land.

Request: a) Please identify steps taken to identify what potential encumbrances, both registered and unregistered, exist over the proposed terminal site.

b) Please identify all steps that Enbridge proposes to take to address the Haisla Nation's underlying Aboriginal title to the proposed pipeline route and proposed terminal site.

c) Does NGP agree that the Haisla Nation is the only Aboriginal Nation claiming Aboriginal rights within and Aboriginal title to the proposed terminal site?

1.34 Impacts to Marine Species in Upper Kitimat Arm

Reference: i) Exhibit B3-12 Volume 6B – Application dated May 2010, Section 3, p. 3-3 (A1T0G2)
ii) Exhibit B3-12 Volume 6B – Application dated May 2010, Section 5, p. 5-1 (A1T0G2)
iii) Exhibit B3-13 Volume 6B – Application dated May 2010, Section 10, p. 10-27 to 10-29 (A1T0G3)

Preamble: In reference i), the Application states "For localized areas such as Kitimat Arm, the distribution and habitat of non-commercial species is not defined" (reference i), p. 3-3).

In reference ii), the Application also states "Where marine habitat loss related to the construction of the Kitimat Terminal cannot be avoided,

habitat restoration, enhancement and/or creation will be provided to compensate for any harmful alteration, disruption, or destruction of fish habitat (HADD) or marine fish habitat (reference ii), p. 5-1).

In reference iii), the Application states that movement patterns and habitat use of eulachon in the upper Kitimat Arm are not well known (reference iii), p. 10-27), and that the exact spawning locations for rockfish have not been identified (reference iii), p. 10-29).

Request:

a) Please explain how a marine habitat compensation program will be developed when "the distribution and habitat of non-commercial species in Kitimat Arm is not defined".

b) Please explain how NGP is confident that a marine habitat compensation program can be developed without knowing what it is to compensate for.

c) Please explain how potential impacts on eulachon and rockfish can be mitigated when the distribution of or spawning locations for these species have not been identified.

d) When NGP reached its conclusion relating to its ignorance of fish distribution and habitat, did it seek this information from the Haisla Nation?

e) Given NGP's lack of knowledge about fish distribution and fish habitat in the Kitimat Arm, has NGP commissioned detailed baseline environmental studies? If no, why not?

1.35 Restrictions on Access for Fishers

Reference:

i) Exhibit B3-15 Volume 6B – Application dated May 2010, Section 13, p. 13-26 (A1T0G5)

Preamble: The Application states that the Project will limit marine fisher access in the marine PDA and identifies that recreational fishers will be excluded from the terminal area, including Moon Bay Marina down to Bish Cove, which is a noted fishing area.

Request:

a) What are the potential impacts of the exclusion of fishers from the terminal areas including Moon Bay Marina down to Bish Cove on Haisla Nation food, social and ceremonial fishers?

b) What potential mitigation measures does NGP anticipate implementing with respect to restrictions proposed to be placed on Haisla Nation food, social and ceremonial fishers?

1.36 Kitimat Terminal Storage Tanks

Reference:
i) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 9.1, p. 9-2 (A1S9X8)
ii) Exhibit B 1-5 Volume 3 – Application dated May 2010, Section 9.2.4, p. 9-8 (A1S9X8)
iii) Exhibit B 1-23 Volume 3 – Application dated May 2010, Appendix I, p. 9-8 (A1S9Z6)
iv) Exhibit B 1-5 Volume 3 - Application dated May 2010, Appendix B, Table B-1 p. B-3 (A1S9X8)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: A study which reviews the past forty years of storage tank accidents found that 86% involved petrochemicals (Chang and Lin, 2006, document attached). Furthermore, external floating-roof tanks, by a wide margin, were the most common type of tank involved in these petrochemical accidents.

In references i) and ii), it is stated that the impoundment reservoir has only 10% more capacity than the largest tank in the Kitimat Terminal. In an earthquake, all 14 tanks (11 for diluted bitumen or synthetic oil and 3 for condensate) will be simultaneously affected and could develop leaks. This remote impoundment reservoir is shown in reference iii) on drawing I1. It is unclear whether or not each tank area will hold 110% of tank volume, or if only the remote reservoir will be designed to capture tank contents (and the contents of how many tanks).

In references i) and ii), the natural period of vibration of sloshing liquid is not discussed. It is know that for a 74-meter diameter tank, the natural period of vibration of sloshing liquid is about 10 seconds (Malhotra et al., 2000, document attached). Therefore, the response of sloshing liquid will be controlled by long-period waves which, due to an earthquake, can travel hundreds of kilometres away without significant attenuation. Most ground motion prediction equations, however, terminate at periods below 10 seconds. Therefore, the amplitude of long-period waves is not sufficiently characterized in design standards.

In reference i), NGP states that external floating roof storage tanks will be used. The dynamic response of a roof floating on sloshing liquid in a tank is complex. Seismic design standards, as discussed in reference iv), do not address the analysis and design of floating roofs. The deck of a pontoon floating roof can be torn by radial shortening caused by large vertical displacements. The deck can pull the pontoon inward causing it to buckle. The pontoon can be damaged by circumferential bending due to large vertical displacements. All of the failure modes described above have been observed during past earthquakes (Chang and Lin, 2006; Liebe 2006, documents attached). Damaged floating roofs have sunk or caused fires. Floating roofs have been damaged by earthquakes hundreds of kilometres away because long-period waves which control the response of floating roofs can travel very far without significant attenuation.

In reference i), the external floating roof tanks are described. In code-based seismic design, the loads are reduced by a factor of 3 for mechanically anchored tanks and by 2.5 for unanchored (self-anchored) tanks. This is part of API Standard 650 as listed in reference iv). As a result of these reductions, the code-designed tanks are expected to behave in a nonlinear fashion during the design ground shaking, as described in Malhotra (2000) (document attached). The nonlinear responses can be in the form of base uplifting (Malhotra, 2000; Cortes et al., 2010, document attached) and base sliding. Base uplifting can rupture the base plate causing a leak. Base uplifting and sliding can rupture the piping connections. In a code-based design, base uplifting and base sliding are not explicitly computed. As a result, required flexibilities in piping connection are not computed. Note that even anchored tanks are expected to uplift during design ground shaking because base anchors are designed to resist on the reduced loads.

Reference i) discusses pipe racks and reference iv) lists the codes by which these racks will be designed. In a code-based seismic design of pipe racks, the loads are reduced by a factor of 3. As a result, the pipe racks are expected to behave in a nonlinear fashion during design ground shaking. Nonlinear responses can be in the form of base uplifting, base rocking and yielding of the pipe rack structure. All of these responses can damage the supported pipes. Nonlinear responses are typically not computed in a code-based seismic design.

The storage tanks from reference i), designed to standards listed in reference iv), are expected to experience inelastic response during design

ground shaking. If the inelastic response occurs for a sufficient number of cycles, low-cycle fatigue damage can occur (Cortes et al., 2010; Malhotra, 2002) (documents attached). In a code-based design, the cyclic aspect of earthquake loading is not explicitly considered.

In Lieb (2006) (document attached), the published study lists roof sinking, rain, vapour and corrosion as the primary vulnerabilities of floating roof storage tanks.

Request:

a) Please provide the detailed rationale for including external floating-roof tanks in the Project.

b) Please provide detailed confirmation that the remote impoundment reservoir and berms around individual tanks have sufficient capacity to contain simultaneous leaks from all 14 tanks during an earthquake.

c) Please provide specific information on how long-period motions will be characterized for computing the response of sloshing liquid in oil and condensate tanks.

d) Please provide an in-depth description of the seismic analysis and design of floating roofs. This description should include details of:
   i. Interaction between sloshing liquid and floating roof
   ii. Stresses induced in the deck due to geometric shortening
   iii. Bending of pontoon due to vertical motion
   iv. Measures taken to prevent leaks in the floating roof

e) Please provide a clear and detailed explanation of how the nonlinear response associated with base uplifting and base sliding will be computed if load reduction factors are used in seismic design of storage tanks at the proposed Kitimat Terminal.

f) Please provide a clear and detailed explanation of how the interaction between the foundation, structure and the fluid will be considered in seismic design of tanks.

g) Please provide a clear and detailed explanation of how the nonlinear responses of the pipe racks will be computed if load reduction factors are used in seismic design of pipe racks.

h) Please provide a clear and detailed explanation of how the cyclic aspect of earthquake loading will be considered in the design of structural systems that are prone to inelastic deformations such as:

i. Bottom-shell connection of tanks
ii. Pontoon and deck of floating roof
iii. Pipe rack structure

i) Given the high likelihood of severe rain events in Kitimat, both in terms of intensity and accumulation, please list the extra precautions taken in design, operation and maintenance planning for the floating roof storage tanks.

j) Please provide copies of all reports, studies, correspondence and other documentation in NGP's possession or control that discusses earthquake-related risks at the proposed Kitimat Terminal.

MARINE TRANSPORTATION

1.37 Use of Double Hulled Tankers

Reference: i) Exhibit B24-2 Volume 5A – Additional Evidence June 2011, Section 5.9.3, p. 5-313 (A1Z6R1)

Preamble: The Application states that double hulls reduce the probability of spill due to groundings or collisions.

Request: a) Please provide reports or studies that show the relative spill risk for single hulls versus double hulls.

b) Is diluted bitumen generally more corrosive than conventional crude oil?

c) Please provide reports or studies that show the relative spill risk for single hulls versus double hulls when the product being transported is diluted bitumen.

d) Is synthetic crude generally more corrosive than conventional crude oil?

e) Please provide reports or studies that show the relative spill risk for single hulls versus double hulls when the product being transported is synthetic crude.

IMPACTS OF OIL ON FISH

1.38 Impacts on Fish from Oil Spills in Other Ecosystems

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The preface and introduction to Vol 7B: *Risk Assessment and Management of Spills - Pipelines* state that the purpose of this document is to "enable strategic development of prevention and response measures for the most sensitive types of land and water along the pipeline route, including identifying follow-up and monitoring." The Application also states that "Northern Gateway will integrate spill prevention and mitigation measures into standard operational practices [into a risk assessment of potential spills that] addresses effects on terrestrial and freshwater ecosystems by selecting and evaluating key components to characterize potential effects, highlight potentially vulnerable species and identify sensitive habitat areas. Effects on air, soil, groundwater, surface water, vegetation, fish, birds, mammals, amphibians, and reptiles are discussed."

For planning a spill response, Vol 7B can be regarded as the problem formulation stage for an ecological risk assessment for oil spills into the various aquatic ecosystems adjacent to or crossed by the proposed pipeline. It also serves to inform the public of the potential ecological, human health, social and economic hazards and risks of oil spills during the pipeline's operation.

However, the conclusion to Vol 7B states that "*if a spill were to occur* [emphasis added], chronic toxicological effects can be assessed by completing human and ecological risk assessments, which provide an indication of the degree of risk to biota and human health, and help to refine cleanup and mitigation measures."

A post-spill risk assessment would be inadequate and inappropriate. The risk assessments and clean-up and mitigation design should be done BEFORE a spill, and cover as many of the spill scenarios and contingency plans as possible. When there is a spill, the appropriate response is a thorough and on-going monitoring and assessment of damage to fish, impacts on critical events such as fish spawning, recruitment, growth, and escapement, the proportion of fish habitat that is no longer productive, the impacts on fish populations, fisheries, and the local economy, and the rate at which there is recovery from damage. Plans for monitoring should be in place prior to a spill.

Overall, the discussion of the possible effects of oil spills in Vol 7B is incomplete and superficial. Few references were cited, with no focus on plausible exposure scenarios, or the impacts of oil on specific life stages of the fish species endemic to the Kitimat River. There is insufficient work referenced to adequately understand and assess the risks and to define appropriate mitigation for such risks.

There is a rich literature on the ecological impacts of oil spills and the toxicity to aquatic species of the components of oil. In particular, there has been significant recent experience that is highly relevant to pipeline spills into rivers (Pine River, BC, 2000; Kalamazoo River, Michigan, 2010), to the effects of medium and heavy oils on marine and freshwater species (Exxon Valdez oil spill (EVOS), 1989; medium crude oil), the Wabamun Lake spill, 2005, heavy fuel oil), and to the expertise and technology needed to manage and contain oil spills (the Deepwater Horizon blowout, 2010). Unfortunately, there was little positive gained from these spills because Vol 7B provided only scattered and incomplete references to some aspects and did not review each in a comprehensive or cohesive way.

Request:

a) For the EVOS, please review the literature on effects on fish species of different life stages, with particular reference to the nature and consequences of the toxicity of oil to early life stages of pink salmon, the mechanism by which spawning shoals were contaminated, and the subsequent effects on growth and survival of adults at sea after exposure to oil as embryos.

b) For the Wabamun spill, please describe the behaviour of heavy oil in fresh water and the effects of the oil, and of the clean-up, on

nearshore and offshore fish spawning habitat, and on fish reproduction.

c) For the Kalamazoo River, please compare the nature of the oil spilled to the diluted bitumen, condensate, and synthetic oil that may be shipped in the NGP pipeline, and describe the behaviour of the oil as it is spread and weathered, the extent and duration of sediment contamination, and the results of any studies on toxicity to fish or impacts on fish populations.

d) For the Deepwater Horizon, please compare the oil spill response capability in the US Gulf Coast (i.e., the amount, quality, and availability of equipment, vessels, and industry and government expertise) to that available for responding to spills into the Kitimat River within 24 hours of the spill.

1.39 Pine River Spill

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Most of the information about the Pine River spill exists in government and consultants reports that are not easily accessed. From the scattered references to this spill, however, it appears that it had major acute impacts (fish kill within 24 hours for up to 30 km downstream); that the water, riverbanks, and sediments were heavily contaminated, and often to toxic levels, for weeks to years; that benthic invertebrate communities were damaged for more than a year, and that sediments may still be contaminated. In addition to fish kills, a major concern would be the long-term impact on trout embryos and trout recruitment of the PAH released from residual oiled sediments.

Request: a) Please provide copies of the documents by Baccante 2000, Alpine 2001, Pembina 2001, Pennart et al. 2004; and others relied on in NGP's discussion of the Pine River spill.

b) Please provide information on whether the Pine River is similar to, or different from the Kitimat River. Include considerations of the hydraulic conditions, total flow, nature and movements of bed sediments, fish habitat, and fish communities, and indicate how the aquatic ecosystem in each river would respond to an oil spill.

c) There are inconsistencies among the data provided on the Pine River spill (p. 7-1 and p. 7-10) related to the volume of oil spilled (half of 950 m^3, 865 m^3, or < 30 m^3 in an earlier chapter). Please provide information on how these numbers were derived, or correct them if they are in error.

d) There are also apparent inconsistencies related to recovery time. On p. 7-10 "water quality returned to baseline conditions in less than three weeks (Pennart et al. 2004, internet site), and sediments were contaminated for two years," while on p 7-24 "concentrations of hydrocarbons (including PAH) in water, sediment and algae returned to levels below detection limits at all but one site, within three months (Alpine 2001)." Please provide information to resolve these inconsistencies or to explain the conclusions in greater detail.

e) Oil remained in sediments for two years after the Pine River spill, but Pennart et al. (2004) are quoted as stating that "dissolved PAH concentrations were well below any effect threshold for sensitive species in the river". Please provide information on where these concentrations were measured, with reference to surface waters and to interstitial waters of bed sediments, where fish embryos develop.

f) PAH concentrations were within water quality guidelines three weeks post-spill. Please provide information on how quickly fish species respond to oil in water, what the minimum exposure time is required, and how that varies with the life stage exposed.

g) Please provide information on delayed effects, and how long impacts will be evident if embryos are exposed to toxic concentrations of PAH.

h) Please provide information on whether the quoted water quality guidelines are up-to-date (when they were last revised), and whether they are based on petroleum derived alkyl PAH, total PAH, or on the USEPA Priority 16 PAH.

i) Please provide information on whether monitoring of the Pine R spill is ongoing, and whether it included measures of survival and emergence of fish embryos from contaminated sediments.

j) Please provide information on dissolved PAH concentrations measured during or after the Pine R spill, what concentrations were associated with the observed fish kill, and whether they corresponded to the lowest observable effect concentrations reported in the literature for sensitive fish species.

k) "After two years, the Pine river ecosystem… had almost returned to baseline conditions (Pembina 2004)." Define "almost".

l) "Most of the recovery of hydrocarbons that reach lakes or other slow-moving water bodies occurs within the first week" (Reference iii), p. 7-10) Please provide information on whether this refers to removal of oil mixed in sediments or only to floating oil on the water surface.

1.40 Kitimat River

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Kitimat River and its tributaries vary widely in their total discharge due to high seasonal fluctuations in precipitation and snow cover. For part of the year, low flows may lead to exposed gravel bars and shoals and extensive reaches may be shallow braided channels. At other times, high flood waters may submerge all bars, and strong currents may re-work

channel locations and shapes. Under these conditions, conventional oil recovery systems may not function efficiently, and the oil may travel the length of the river very rapidly before they can be deployed.

Request:

a) Please provide information on the hydraulic conditions (discharge rates, range of current speeds, river width and depth) of the Kitimat River at high and low flow rates, and the technology that would be deployed for oil recovery.

b) Please provide information on the transit time of oil from all potential spill sites (stream crossings; areas where the pipeline is within 1 km of the river) to the estuary?

c) Please provide information on how long it will take for oil recovery equipment to be deployed to stop the flow of oil into or down the Kitimat River for each potential spill site or tributary spill site.

d) P. 7-10: “PAH levels may remain above sediment quality guidelines, unless remediated”: Please provide information on how sediments are remediated, how long it would take, and how it would disturb the river’s ecosystem.

e) Assuming a spill of 2000 m^3 at the Hunter Creek Crossing, please provide information on the extent (distance downstream) of sediment contamination and depth to which it would be contaminated (and remediated). Please provide information on how clean the sediments should be once remediated.

1.41 Other Studies

Reference:

i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: There is a reference to oiled beach experiments (Blaise et al) wherein oil in sediments remained toxic to algae for 65 weeks following a controlled

spill. There are other publications on the same experiment. One demonstrated that sediment PAH remained bioavailable to fish for the same length of time (65 weeks)[1].

Request: a) Please review the Hodson et al (2002) paper within the context of sediment contamination of the Kitimat River, and indicate how this paper influences NGP's conclusions about potential impacts of a spill.

b) Please review reports of other experimental oil spills in Canada and abroad, and, and indicate how this paper influences NGP's conclusions about potential impacts of a spill.

1.42 Freshwater Fish and Fish Habitat of the Kitimat River

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application states that "the key issues of concern for fresh water fish and fish habitat are loss of biodiversity and abundance of key species." Based on "pipeline corridor studies and fish habitat surveys… the pipeline route has been realigned to accommodate sensitive habitats, important fish stocks and runs, known traditional and non-traditional harvest areas and fish species at risk."

As well, "mitigation measures" were "incorporated into the project design and include limiting disturbance areas within the pipeline RoW, selecting watercourse crossing techniques on the basis of the biological and physical conditions and adhering to construction least-risk periods for fish species present, where possible… Where adverse effects cannot be

[1] Hodson, P.V., Ibrahim, I., Zambon, S., Ewert, A., and Lee, K. 2002. Bioavailability to fish of sediment PAH as an indicator of the success of in situ remediation treatments at an experiment oil spill. Bioremediation Journal 6(3):297-313.

avoided or mitigated, a compensation plan will be developed in cooperation with DFO".

Sockeye salmon were singled out as an unusual river-spawning race, and therefore highly vulnerable to a spill at Hunter creek where they spawn, and where the pipeline first crosses a tributary of the Kitimat River. Pink salmon were also deemed most vulnerable on basis of their 2-year life cycle, which allows little opportunity for recovery if a year-class is lost due to toxicity.

Request:

Fish Species

a) Please define the size and nature of the fisheries resources at risk in the Kitimat River, in terms of the abundance of each species present during one or more of their life stages.

b) P. 11-1: Please define "key species" in terms of relative rarity; economic and social value to sports and First Nations fisheries, value to other ecosystem components (e.g. bears, eagles), and overall productivity.

c) Please provide information on the productivity of each species, and their relative value from a sports, commercial, or cultural perspective.

d) Please provide information on how mortality of forage fish and invertebrate prey species would affect the growth of different life stages of salmon and trout.

e) Please provide information on which life stages of fish are the most sensitive to oil exposure, and why. Please support this response with a literature survey to avoid the contradictions in Vol 7B among statements that "eggs and larvae", "juveniles", and "emergence in spring" are most sensitive.

f) P. 7-25: Please provide additional information on why the stock of sockeye that spawns near Hunter Creek is unique, the consequences to this stock of toxicity to adults, to eggs and embryos, and to juveniles, and appropriate remedial measures, if any.

g) Please provide information on the nature and value of compensation which would be required if this stock of sockeye were lost.

Habitat

a) Please provide information on the timing and use of habitat (spawning, nursery, growth, reproduction) by each life stage (spawning adults, embryos, fry, juveniles) of each fish species that inhabits the river during one or more of its life stages.

b) Please describe which part of the river each species uses at each life stage, including migration routes.

c) Please identify and map critical habitat, including the spawning shoals of all the species of fish that use the river for reproduction (e.g. various species of salmon and trout, eulachon, Pacific lamprey, forage species).

d) Please provide information on which of these habitats would be affected by an oil spill, and to what extent.

e) P. 7-24: Please provide information on changes to habitat suitability caused by oil spills or oil spill clean-up, such as warming following removal of vegetation, and whether these habitat changes have been considered in assessing potential impacts.

f) The review of the Pine River spill reported 50-70% mortality of fish in the first 30 km downstream of the spill. What is the distance from Hunter Creek to the estuary at Kitimat River? Please provide a graph or table showing how many species of fish would occupy this section of the river throughout the year.

g) P. 11-10: Please address in detail the specific effects of changes in sediment concentrations, water temperature, and nutrient concentrations on salmon, trout, and other species as a result of construction activities, a potential spill, or the clean-up of a spill.

h) P. 11-25: Please provide additional details of the Habitat Compensation Program that is under development, when it will be completed, and whether it will be reviewed before construction begins.

1.43 Nature of Petroleum Products to be Transported Via Pipeline

Reference: i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)

ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)

iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The primary materials to be shipped by pipeline are synthetic oil, diluted bitumen, and condensate. While some details are given about each product, the description of their chemical and physical properties is incomplete, and does not permit an understanding of the nature or extent of their hazards to the Kitimat River ecosystem. As well, much of the information given is inaccurate or incorrect. In Section 7.2, volatile organic compounds (VOCs) are said to include benzene, toluene, ethylbenzenes, xylenes (BTEX) and polynuclear aromatic hydrocarbons (PAH), implying that PAH will disappear quite rapidly after a spill. This is not the case, and is only relevant for low molecular weight PAH, i.e. the two-ringed naphthalenes with one or two alkyl substitutions (C0 to C2). Higher molecular weight PAH will persist in aquatic ecosystems after a spill because they are not very volatile.

There is a growing literature suggesting that the components of oil that are acutely lethal and responsible for fish kills are the volatile, light weight components. As indicated, these may disappear quickly following a spill due to evaporation, dilution, and biodegradation, although they apparently persist long enough after a spill to cause fish kills for tens of kilometres downstream (e.g. the Pine River Spill in BC). The residual oil is heavier and sinks to the river bottom where it can mix with sediments and cause chronic toxicity to early developmental stages of fish, resulting in recruitment failure and weak or missing year classes.

The compounds associated with chronic toxicity are the alkyl polynuclear aromatic hydrocarbons (alkyl PAH), particularly the alkylphenanthrenes.[2] These may comprise 0.5 to 1.5% by weight of most liquid crude oils, but a much higher proportion (up to 6% by weight) in heavy crude oils, bitumen, and refined products such as heavy fuel oils (e.g., Bunker C).[3] Bitumen

[2] Hodson, PV, CW Khan, G Saravanabhavan, L Clarke, RS Brown, B Hollebone, Z Wang, J Short, K Lee, T King. 2007. Alkyl PAH in crude oil cause chronic toxicity to early life stages of fish. pp 291-300, In : *Proc 28th Arctic and Marine Oilspill Program Tech Seminar,* Env Sci Tech Div, Env Canada, Ottawa.

[3] Wang, Z., Hollebone, B., Fingas, M., Fieldhouse, B., Sigouin, L., and Landriault, M. 2003. Characteristics of spilled oils, fuels, and petroleum products: 1. Composition and Properties of Selected Oils. EPA/600/R-03/072, US Environmental Protection Agency, Washington, DC.

and heavy fuel oils cause the same toxic effects on fish embryos as crude oils (e.g. Alaska North Slope crude spilled by the Exxon Valdez). However, toxicity increases in proportion to the concentrations of alkyl PAH, which means that bitumen and heavy oils are among the most chronically toxic of petroleum products. Condensates, which are similar in composition to lighter fuel oils such as diesel, should also be rich in alkyl PAH.

To understand the hazard of oil to fish, and the risk of toxicity following an oil spill, it is critical to know the chemical composition of the oil, particularly its concentrations of low molecular weight compounds and alkyl PAH. Section 4.2 of Vol 7B describes Chemical Properties of the oils to be transported but provides inadequate data on the PAH content of each product (Table 4-2, p. 4-3). While alkyl PAH includes hundreds of individual components, only 7 are reported, so that the 'sum of PAH' is likely grossly underestimated as: Bitumen - ~30 mg/kg; Synthetic Oil ~325 mg/kg; and Condensate ~435 mg/kg. In contrast, Table 4-3 (p. 4-7), footnote b, indicates that "approximately 2% of the condensate consists of PAH and alkylated PAH compounds" (this is a concentration of about 20,000 mg/kg).

Request:

a) Please provide a complete and detailed analysis of the chemical constituents, and their concentrations, of synthetic oil, diluted bitumen, and condensate.

b) Please provide detailed information on the concentrations of low molecular weight VOCs, including BTEX, and the more persistent and higher molecular weight PAH, including the sum of alkyl naphthalenes, alkyl anthracenes, alkyl phenanthrenes, alkyl fluorenes, alkyl chrysenes, alkyl pyrenes, alkyl dibenzothiophenes, alkyl naphthobenzothiophenes, etc.

c) Please describe how synthetic oil is prepared, including its parent materials, its typical chemical composition, and how it differs chemically from crude oil and from diluted bitumen.

d) Please indicate what percentage of each product would be considered "volatile".

e) Please provide more information on the expected or measured acute and chronic toxicities to fish of synthetic oil, diluted bitumen, and condensate based on relative concentrations of VOCs and alkyl PAH.

1.44 Distribution of Oil in the Kitimat River

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Overall, the potential distribution of oil coverage following a spill is loosely described in Vol 7B, section 9. The morphometry, and, at times, flow characteristics are described, but not in relation to the ultimate fate and distribution of oil after a spill, and only under a very limited set of conditions (summer high flow). As well, data on water and sediment quality guidelines, as well as methods of measuring water/sediment contamination are lacking. The extent of contamination, the types of substrates being contaminated, and the duration of contamination must be better described.

Weather and seasonal factors (temperature, wind speed, water level, snow cover) must also be considered since these factors will affect the potential distribution of oil, which will impact mitigation measures and subsequent monitoring. For example, if a spill occurred with snow cover, what would the effect be during a sprint melt? “Freezing of freshwater would affect how hydrocarbons are partitioned” (p. 4-4) – does this refer to hydrocarbons being held in the top ice layer? Other questions that must be addressed are: during what portion of the year is there ice in the Kitimat River? Is the river open or frozen at the edges? Are there ice dams or stranded ice flows on bars? What are the implications for spread and recovery of spilled oil?

Request:
a) All hypothetical spills described in the application occur in summer when “environmental effects would be greatest” (p. 9-23). Please

explain this statement in detail and provide an equivalent analysis for other seasons.

b) Please describe the spread of oil in winter in relation to snow and ice, and describe how oil would be recovered under these conditions.

c) Please provide detailed analyses of the extent of contamination of water, stream banks, vegetation, gravel bars, and bed sediments where fish spawn during each season under different flow regimes.

d) Please specify the fate of different hydrocarbon groups found in the three petroleum products (BTEX, alkanes, PAH, heavy waxes, asphaltenes) in terms of evaporation, dispersion, and stranding potential, during each season.

e) The hypothetical spill near Hunter Creek of 2000 m^3 is the largest volume of oil that could be spilled because that is the volume held between valves in the pipeline. Please re-analyze the spill scenario to estimate the volume of oil spilled if a valve was destroyed, e.g. by an avalanche or landslide.

f) The transit time of an oil spill from Hunter Creek to the estuary of the Kitimat River was estimated to be less than 24 hours. Please provide information on the extent of weathering in summer at high flow with temperatures of 15ºC or greater, and in winter with low flows, but lower temperatures, and indicate how this would affect transit times, distribution of oil, and the nature of the oil deposited on river banks and in sediments.

g) Please provide an analysis of the primary routes of exposure for different life stages of fish (e.g. direct uptake of compounds across the gills, food chain, direct contact with oil in sediments, exposure of eggs to contaminated interstitial waters).

1.45 Establishing Baselines

Reference: i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)

ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)

iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)

iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application indicates that baseline conditions for e.g. air, soil, hydrogeology, surface water resources, were not measured. However, in areas not impacted by human activity, contaminant concentrations were assumed to be low and/or below detection. A complete description is needed of the contaminants that would be measured (total petroleum hydrocarbons or TPH, benzene, toluene, ethylbenzenes, and xylenes, or BTEX, and polycyclic aromatic hydrocarbons, or PAH) to establish baselines and to monitor conditions during and after a spill. As well, a monitoring schedule of water quality issues is missing, and more details are required to justify sufficient mitigation and adequate monitoring studies.

Request:

a) Please indicate which hydrocarbons would be measured for baseline contaminant data for soil and sediments (section 7.3.1), and please provide current national and provincial water quality criteria for each.

b) Please provide details on how TPH, BTEX, and PAH in water and soil/sediments would be analyzed. Please include the range of specific analytes, detection limits of methods and instruments used, the frequency of monitoring, and QA/QC.

c) Please indicate whether TPH, PAH, and/or BTEX concentrations were measured as baseline conditions for surface water resources along the entire pipeline right-of-way.

1.46 Contamination of Sediments by Spilled Oil

Reference:

i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application provides some discussion of hydrocarbon stranding and re-mobilization after a spill, with no estimates of how long the oil would remain in the river system following a spill. The fate of oil is mainly defined as a surface phenomenon., i.e., "The remaining diluted bitumen would be located on the water surface, on riverbanks or vegetation, and as dispersed diluted bitumen carried downstream" (p. 9-26). For the case of diluted bitumen spills, the proposed fate of the oil is that it would be physically washed out of the river, but there is no discussion of the effects of chronic oiling of the estuary (section 7.5.3).

Based on the EVOS, a major concern is the entrainment of oil into gravel bars or shoals where salmon, trout and other species spawn. In the case of the EVOS, oil was entrained into pink salmon spawning shoals at stream mouths by rising and falling tides.[4] As a consequence, embryos were exposed to high concentrations of PAH that partitioned from stranded oil (oil droplets, coatings on gravel) into interstitial waters. In a salmon river such as the Kitimat or its tributaries, surface waters circulate through gravel shoals due to the pressure gradients associated with ponds, riffles and bars (hyporheic flow).[5] If oil is mixed with water due to turbulence associated with riffles and rapids, or if oil is stranded on gravel shoals at low water and then mixed during subsequent floods, exposure scenarios similar to the EVOS can be created and cause toxicity to eggs and embryos of salmon and trout.

Overall, there is no discussion of the long-term persistence of oil, aside from losses by evaporation and the flow of oil out to the estuary (downstream to contaminate other areas). References must be made to the effects of weathering and photo- and biodegradation. For residual oil that persists in the environment, descriptions of routes of exposure of the different life stages of fish, along with the necessary duration of exposure to get toxicity, and concentrations, are lacking in the application and are necessary to understand the risk of residual oil in sediments.

[4] Carls, M.G., and Rice, S.D. 2007. Fish embryo sensitivity and PAH toxicity In Envuironmental Impact of Polynuclear Aromatic Hydrocarbons. Edited by C. Anyakora. Research Signpost, Kerala, India. pp. 1-32.

[5] Tonina, D., and Buffington, J.M. 2009. Hyporheic Exchange in Mountain Rivers I: Mechanics and Environmental Effects. Geography Compass 3(3): 1063-1086.

Request:

a) Please provide information on the anticipated spread and fate of the oil in the Kitimat River at high, medium, and low flow rates, including how turbulence might entrain oil into water and how hyporheic flow would carry oil into sediments.

b) Explain the distribution and effects of oil that sinks and/or mixes with sediments. Also explain how the sinking tendency of oil would influence exposure and toxicity of fish embryos buried in sediments to residual oil.

c) For each of diluted bitumen, condensate and synthetic crude oils, please estimate the proportion of spilled oil that would be entrained in sediments under different flow and temperature scenarios.

d) Please provide information on the potential concentrations in bed sediments of spawning shoals following spills of diluted bitumen, condensate, and synthetic crude in low flow and high flow conditions.

e) Please provide information on the concentrations of alkyl PAH and total petroleum hydrocarbons in interstitial waters of bed sediments of spawning shoals contaminated by diluted bitumen, condensate, and synthetic crude oil at concentrations estimated in d).

f) Please provide information on the impacts of chronic oiling of downstream reaches and the estuary of the Kitimat as oil is flushed out of sediments in the first year following a spill.

g) Section 7.4.2 reviews groundwater flow (hydrogeology) and the next section jumps to surface water resources. Please discuss stream-sediment interactions and sub-surface water flows.

h) Please indicate the extent to which surface water contamination by spilled oil will contribute to ground water contamination in recharge zones.

i) Please define “environmental protection measures” (reference iii), p. 7-22) and provide examples.

j) Please provide information on how the geographic extent and depth of penetration of sediments will be estimated for each type of spilled oil.

k) Please provide information on how the actual extent and depth of sediment contamination will be measured and mapped.

l) Please provide information on the technology and methods for cleaning oil-contaminated sediments, and the estimated cost per kilometre of river.

1.47 Acute and Chronic Effects of Oil Exposure

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application does not break down acute effects (primarily mortality caused by narcosis) and chronic effects. “Hydrocarbons have the potential to affect fish species… [by] exposing them to acute or chronic toxicity.” (P 7-22) – This is an inappropriate use of the terms acute and chronic toxicity. Chronic and/or sub-lethal effects that must be individually considered are: cancer from exposure to carcinogenic, mutagenic, teratogenic PAH, effects on early life stages of fish, such as malformations that affect behaviour, growth, reproduction, and survival (and, thus, recruitment into the population), and effects on sexual maturation, spawning migrations and behaviour, disease from impacted immune function, and emigration to feeding grounds (e.g. salmon).

Request:
a) Please explain what is meant by “exposing them to acute and chronic toxicity”.

b) Please provide more information about the toxicity of VOCs, including concentrations that are toxic – to humans, and to the biophysical environment.

c) Please define “biophysical environment”.

d) Please provide a summary of what is known in terms of mechanisms of toxicity that cause toxic effects (metabolism of PAH

in fish versus invertebrates, as well as transfer through the food chain).

e) Please provide a tabular summary of the most recent water quality and sediment quality guidelines for Alberta, British Columbia, and nationwide.

f) Please analyse these guidelines to determine whether they are based on recent publications (e.g. post 2000) reporting the chronic effects of very low concentrations of PAH on sensitive early life stages of fish?

g) Please indicate the extent to which these guidelines rely on application factors (aka safety or uncertainty factors) rather than actual data, and the size of those factors.

1.48 Chemical Constituents that Cause Toxicity

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Overall, the discussion of effects of a pipeline spill on freshwater ecosystems is incomplete. In particular, there was no explanation of the toxicity of the different constituents of oil, especially PAH, as described in a growing body of literature since 1997 (after the EVOS). Crude oil typically contains 0.5 to 1.5% by weight of PAH (5 000 – 15 000 ppm), depending on its source. The majority (90 – 95%) are alkyl PAH, the forms associated with chronic toxicity to fish, and can comprise hundreds of compounds (refer back to IR 1.6 – requests for physical and chemical descriptions of petroleum products).

Request:
a) Please provide a detailed summary of the constituents that cause acute or chronic toxicity in the petroleum products to be transported by the pipeline (diluted bitumen, synthetic oil, condensate), including the EPA priority 16 PAH, plus the sum of C0 to C4 alkyl

naphthalenes, anthracenes, phenanthrenes, fluorenes, chrysenes, pyrenes, dibenzothiophenes, naphthobenzothiophenes, etc.

b) Please provide a literature review of the concentrations of whole oil or specific oil components (e.g. alkyl PAH, BTEX, alkanes, etc.) that cause acute and chronic toxicity to fish species endemic to the Kitimat River. Include the endpoint measured, concentrations, duration of exposure required to cause toxicity, and the relative sensitivities of different life stages of fish.

c) Please use the literature review requested in b) above to assess whether the federal and provincial guidelines for petroleum hydrocarbons will be adequately protective of fish in the Kitimat River, and whether site—specific guidelines are needed.

1.49 Life Stage and Species Sensitivities

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application provides insufficient references to data on the relative sensitivities of different life stages of different fish species to the toxic constituents of oil. The spring “emergence period” for fish larvae that the application states is the most sensitive time for exposure is an oversimplification because the timing of emergence is species-dependent and emergence does not all occur at once. The same is true for spawning times and incubation times for developing embryos buried in spawning shoals. In the literature, toxic effects are often linked to concentrations of toxic constituents (i.e. PAH), none of which are reported here.

Request:
a) Please provide details on specific effects of oil on different life stages of fish, for as many species as possible.

b) Please describe the toxicity of different hydrocarbons in terms of EC50s and LOEC/NOECs for comparisons.

c) Where data are available, please express toxicity in terms of “total petroleum hydrocarbons” and “total PAH”.

d) Please provide a summary of the spawning and emergence times for each fish species in the Kitimat River.

1.50 Effects of Weathering on Toxicity

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Weathering is a process that begins immediately following a spill, and will change the chemistry and properties of the oil. The effects of weathering on the exposure and the toxicity of the constituents of oil to of aquatic organisms, are not discussed. The most immediate effects of weathering are the loss of low molecular volatile components that are acutely toxic (may cause fish kills), leaving a heavier residue, rich in PAH, that is chronically toxic. “Weathered oil is more likely to sink in seawater than freshwater because of the differences in density” (p. 4-4). This is an error in interpretation – seawater is denser than freshwater, so oil is more likely to sink in freshwater, particularly if there are inorganic particulates in the water.

Request:

a) Please define the effects of weathering on the distribution and ultimate fate of the condensate, synthetic oil, and diluted bitumen.

b) Please provide information on how weathering of oil will affect the extent of contamination of fish habitat, and the exposure of different life stages to the components of oil that are acutely and chronically toxic.

c) Please provide more information on the persistence of oil in sediments, and the extent to which the toxic components are mobilized by water washing.

d) Please provide information on the expected concentrations of alkyl PAH and other constituents of oil in interstitial waters of contaminated sediments.

1.51 Effects of Submerged Oil That Persists After a Spill

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The effects of sunken or submerged oil that persists are often downplayed throughout the application. “Non-recovered dispersed and residual stranded hydrocarbons would continue to weather and degrade over the ensuing months to [a] year” (p. 9-27). Several months to a year is a considerable duration of exposure from water and/or sediments for aquatic life, and must be considered in the application. “Residual hydrocarbon contaminants in sediments would likely cause mortality of benthic invertebrates.” (p. 7-24). If fish embryos are also incubating in these areas, mortality or chronic toxicity of embryos would also likely occur.

Request:
a) Please provide an assessment of the effects of oil that becomes submerged and persists in sediments. Please include the impacts on benthic species, including invertebrates and fish embryos.

b) Please comment on the biodegradation potential for persistent oil, including which microbes are present in the water of sediment of the Kitimat River according to their oil-degrading ability.

1.52 Long-Term Consequences of Toxicity

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)

v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application also does not address the long-term consequences of toxicity, specifically, the impact on returns of migrating salmon exposed as eggs, fry, and juveniles in the Kitimat River. With the current proposal, the impacts of oil toxicity cannot be understood because the extent and duration of possible contamination are not covered in sufficient detail.

Request:

a) If recruitment of one year class of a given salmon species is wiped out by an oil spill, please indicate the time required for the population to recover. Also indicate whether oil will persist such that subsequent year classes will be exposed.

b) For each salmon species in the Kitimat River and its tributaries, please indicate how much impairment of recruitment can be sustained before the fishery collapses.

c) Please describe the ecological, social, and economic costs of toxicity.

d) Based on fish closures the followed oil spills in other ecosystem (e.g. Wabamun Lake), please provide a review of what determines a closure for specific fisheries and how long they are closed.

e) Please provide a detailed summary of fish species harvested in the Kitimat River and its estuary (separate recreational sport fishing and fishing by First Nations communities), including the number collected annually, and when fishing seasons occur. Also indicate the socioeconomic and/or cultural impacts of a closure on First Nations communities.

1.53 Effectiveness of Booms and Skimmers in a Fast-Flowing River

Reference:

i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application claims that containment booms could restrict the downstream movement of hydrocarbons and would prevent hydrocarbons from entering sensitive areas. The application goes further to state that clean-up procedures would be selected based on chemical composition of the hydrocarbon spilled, yet few details are provided about the effectiveness of booms and skimmers as mitigation strategies. As well, most of the discussion sounds purely hypothetical.

Request:

a) Please provide information on how long it would take for booms or skimmers to be deployed to stop the flow of oil into or down the Kitimat River for each of the tributary crossing points.

b) Please provide additional details for mitigation measures, including contingency plans for the various spill scenarios.

c) Please provide additional details for mitigation measures, including contingency plans for the various river flow scenarios (i.e., low flow to full flood).

1.54 Can Oil Spills be Detected and Intercepted Before They Travel Down River?

Reference:

i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application does not indicate the feasibility of intercepting a spill. “Most of the recovery of hydrocarbons that reach lakes or other slow-moving water bodies occurs within the first week” (p. 7-10). Does this indicate removal of floating oil on the water surface only? Typically, how much oil is actually recovered in flowing water? Overall, there is no discussion of how long it would take to detect and intercept a spill before it transits a fast-flowing river. There is a need for more details about detection of spills, but also clean-up procedures for synthetic oil, diluted bitumen, and condensate – for various scenarios (spill locations along the pipeline right-of-way). An example is provided of diluted bitumen cleanup

– p. 7-10: “Flush[ing of] mobile portions from surface waters and oiled substrates into collection areas… [to] be collected and transported offsite.” However, detailed plans addressing the utility of such methods are required.

Request:

a) Please indicate how feasible flushing of mobile oil to collection areas would be in a fast-flowing river, and describe whether collection areas are preselected.

b) Please provide an analysis of how much damage would be done to river habitats by flushing and other oil recovery methods, and how damage would be monitored.

c) Please provide information on reaction speeds to oil spills in the Kitimat River, and whether containment booms and oil recovery equipment can be deployed within the transit time of oil from Hunter Creek to the estuary (<24 hours).

1.55 Mitigation of Oil That Becomes Entrained in Sediments

Reference:

i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: “PAH levels may remain above sediment quality guidelines, unless remediated.” (p. 7-10). If oil is entrained in bed sediments, how will the extent (depth, distance, volume) of sediment contamination be measured and cleaned up? Overall, there are few details about how sediment contamination would be measured and dealt with. The residual oil in Prince William Sound, Alaska after the Exxon Valdez oil spill has persisted for more than 20 years. There is no discussion about the persistence of stranded oil in the Kitimat River that is not detected and, thus, not cleaned up.

Request: a) Please provide details on how sediments are remediated. Please provide information on how long it will take to remediate sediments, and on the extent (distance downstream) and depth of sediments remediation.

b) Please provide information on who makes the decision about the extent of remediation required.

1.56 Recovery of Fish and Fish Habitat

Reference: i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-25 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: The Application states that fish restocking would occur if mitigation is not effective and ecological effects of a spill occur. Restocking may not be the most suitable method for recovery of fish populations and the Application needs more details on fish habitat recovery (removal and/or cleaning of spawning substrates – i.e. gravel/cobble). A "Habitat Compensation Program" (reference i) is briefly mentioned, but the report has not been released. The importance of fish habitat recovery is paramount considering that not only did residual oil in Prince William Sound, Alaska after the EVOS persist for at least 20 years, but the actual clean-up operations, including dispersant use and high pressure washing of contaminated shorelines, further damaged fish habitat and, thus, the ecological effects were compounded. Given similarities in climate, damaged fish habitat from residual oil could be extensive.

Request: a) Please indicate when the "Habitat Compensation Program" will be completed and whether it will be reviewed before construction begins.

b) Please provide a literature review of past experience demonstrating whether habitat compensation is effective and covers the range of fish habitat, especially spawning and incubation habitats, that occur in sediments where residual oil can persist.

c) Please discuss how mitigation measures and clean-up may damage fish habitat and refer to lessons learned from the EVOS.

1.57 Objectives for Post-Spill Monitoring

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Should there be an oil spill into the Kitimat River, it is essential to initiate a thorough monitoring and assessment of impacts on fish and the fisheries that they sustain. This includes factors that affect the production and abundance of fish, including the health and abundance of prey (invertebrates and forage fish), access to suitable habitat for spawning, and water and sediment quality as they affect embryo development, growth, reproduction, and migration. Monitoring must also assess the quality of the fish as indicated by the occurrence of external lesions, the extent of parasite infections, and tainting by petroleum hydrocarbons. Damage to the local economy, including impacts on sports and native fisheries and tourism, and damage to First Nations cultural practices must also be assessed.

Request:
a) Please provide a clear definition of Enbridge's objectives for post-spill monitoring, including what would be measured to achieve those objectives, where it would be measured, and for how long.

b) Please provide an indication of whether monitoring would be weighted towards chemical measures of oil contamination or to an assessment of fish species presence/absence, abundance, productivity, and economic and cultural loss.

1.58 Management of Post-Spill Monitoring

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Plans for monitoring should be in place prior to a spill, with clear agreement among stakeholders about who will design, direct, and interpret the monitoring, how it will be done, and who will pay for it. The current proposal provides few useful details about post-spill monitoring.

Request:
a) Please provide information on local/federal/provincial agencies that are responsible for fisheries and environmental management and protection in the Kitimat watershed, and their anticipated role in post-spill monitoring.

b) Please provide information on existing contingency plans, remediation, oversight, monitoring, and enforcement plans by these agencies and compare them to the Enbridge plans for monitoring.

c) Please provide information on who would pay for creating and sustaining a monitoring and response capability.

d) Please indicate how the spatial and temporal scale for monitoring would be established following a spill.

e) Please indicate which agency or agencies would report and interpret monitoring data.

f) Please provide information on how monitoring data would be used to trigger action regarding additional remediation, additional monitoring, and who would make the decision whether additional remediation or additional monitoring is required.

g) Please provide information on how long post-spill monitoring would be sustained, and on the criteria or triggers that would be used to support a decision to cease monitoring.

1.59 Delayed and Cumulative Effects

Reference:
i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Pink salmon were among the species of fish most affected by the EVOS. In addition to direct mortality of fish embryos in oil-contaminated spawning shoals, there was experimental evidence of low rates of survival of pink salmon at sea.[6] Salmon that survived exposure to oil under controlled conditions, and that appeared normal as juvenile fish, were tagged and released with tagged salmon that had not been exposed to oil during early development. Compared to the control group, 20 to 40% fewer exposed salmon returned to spawn, indicating that low level exposures to oil-derived PAH (about 5 to 19 µg/L total PAH) during embryonic development impaired some aspect of migration, swimming, feeding, or predator-avoidance ability of adult pink salmon. Given the similarity in physiology and life history among salmonids and other species of anadromous fish, the returns of anadromous species and the success of fisheries are likely to decrease in the years following a spill, corresponding to the expected number of years at sea for each species. Lower returns of spawning adults will also have reverberating effects of lower production in subsequent generations.

[6] Carls, M.G., and Rice, S.D. 2007. Fish embryo sensitivity and PAH toxicity In Envuironmental Impact of Polynuclear Aromatic Hydrocarbons. Edited by C. Anyakora. Research Signpost, Kerala, India. pp. 1-32.

Request:

a) Please provide information on plans to monitor oil and PAH concentrations in sediments, gravel and interstitial waters of spawning beds where various fish species deposit eggs.

b) Please provide information on the extent to which anadromous fish species (salmon, sea-run trout, eulachon, Pacific lamprey, etc.) will be monitored following an oil spill.

c) Please provide information on whether post-spill monitoring will include assessment of the emergence of fry from spawning beds, escapement of juveniles to the sea, and the return success of adults.

d) Please provide information on the availability of baseline information describing current rates of emergence of fry from spawning beds, escapement of juveniles to the sea, and the return success of adults.

e) Please provide information on plans to establish current baseline rates of emergence of fry from spawning beds, escapement of juveniles to the sea, and the return success of adults.

1.60 Other Delayed and Cumulative Effects

Reference:

i) Exhibit B 3-6 Volume 6A - Application dated May 2010, Section 11, p. 11-1 (A1T0F6)
ii) Exhibit B 19-29 Volume 6A Application Update December 2010 (A1W9C1)
iii) Exhibit B 3-20 Volume 7B - Application dated May 2010 (A1T0H0)
iv) Exhibit B 3-21 Volume 7B - Application dated May 2010 (A1T0H1)
v) Terms of Reference, Joint Review Panel Agreement (A1R4D5)

Preamble: Delayed effects can also result from an increased susceptibility to infection and disease, corresponding to impairment of immune function after exposure to PAH. Other environmental stressors, such as sudden changes or extremes of temperature, salinity, or oxygen concentration can also aggravate or potentiate toxicity. Some of these stressors can represent the cumulative impacts of a variety of human activities, including changes in annual run-off, flood patterns, and water quality due to forestry, agriculture, construction, or urban development, as well as fishing

pressure. While no one factor in itself may be harmful, their effects combined with an oil spill could have significant impacts.

Request: a) Please provide information on natural and human-caused stressors on the Kitimat River, including physical changes to terrestrial habitats adjacent to the river (e.g. forestry, agricultural, roads, urban or industrial development), alterations of stream or river channels, flow control structures, and sources and amounts of nutrients, effluents or chemical inputs to the river.

b) Please provide a review and analysis of the current impacts of natural and human-induced stressors on the Kitimat River ecosystem, and the resources most affected by these stressors.

c) Please provide an analysis of which of the current stressors are most likely to interact with and aggravate the impacts of oil on the Kitimat River ecosystem.

d) Please provide information on whether post-spill monitoring will include interactions between the impacts of spilled oil and other natural or human-induced stressors in the Kitimat River watershed.

e) Please provide information on the current rates of fish disease in the Kitimat River, including the prevalence and incidence of bacterial and viral diseases, parasite infestations, and external and internal signs of cancer.

f) Please provide information on plans for post oil-spill monitoring and assessment of the prevalence and incidence of diseases and pathology in fish from the Kitimat River.

EFFECTS OF HYDROCARBONS ON THE BIOPHYSICAL ENVIRONMENT

1.61 Approach to Assessing Effects of Hydrocarbon on Biophysical Environment

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.1, p. 8-1 to 8-3 and Table 8.1 (A1T0I9)

Preamble: In Volume 8C of the risk assessment (RA), the treatment of the possible effects of oil or diluent (called condensate in much of the RA) spills is incomplete, with only very general references given, and without a focus

on the area of the proposed project, e.g. Kitimat Arm and Kitimat River. There has been much work done and published on the effects of petrogenic PAHs on marine fish and invertebrates from northern temperate waters, but little of that work is referenced in the RA. These works should be considered in the RA. Without this information, assessing the risks, and determining the potential for mitigating risks, is not possible.

The RA fails to display a clear understanding of the toxicology of oil-derived compounds, especially PAHs. The RA should describe how certain PAHs are known to cause cancer, both in fish as well as humans, and should also describe the wide complexity of structures associated with this class of organic compounds. The RA should review the differences in metabolism of PAHs between fish, crustacea, and molluscs, which has implications both for biological effects as well as transfer though the food chain.

The RA purports to, in Table 8.1, "provide a brief overview of documented effects of hydrocarbons on marine biota". The table, however, is inadequate for the task, leaving out many important effects, and thus initially minimizing the apparent risk of spilled hydrocarbons to the flora and fauna of the region. Further, while the RA states that the assessment was conducted by focusing on key components of the ecosystem and vulnerable species and life history stages, it does not include information on the process used for identification of these key components and species.

Request: a) Please update and expand Table 8.1 by providing information concerning a number of other effects which are known or likely to occur in the event of an oil or condensate spill. At a minimum the following information should be included:

i. For invertebrates, provide information from the peer-reviewed literature, because the citations listed here consist of a two page handout from the US Fish and Wildlife Service and a general textbook on ecotoxicology. Examples which

should have been examined by the authors of this RA include Neff et al (1976)[7] Barata et al (2005),[8] Jensen and Carroll (2010),[9] and many more.

ii. For fish, include information concerning the effects of very low levels of dissolved petrogenic polycyclic aromatic hydrocarbons (PAHs) on the developing fish heart, and include information on other routes of exposure that can cause injury, including direct contact, ingestion of oiled prey, and uptake across gills and integument.

iii. For marine mammals, provide information on studies showing that effects have been seen in cetacean populations for almost two decades following the EVOS.

iv. For terrestrial wildlife, please advise what studies have been conducted to determine whether the consumption of oiled prey as a significant route of exposure is of concern, and what such studies have concluded. If no such studies have been conducted, why not?

b) Please provide a narrative as well as a graphic description of the process used to identify key ecosystem components, vulnerable and sensitive species and life history stages, and explain how the reliance on evaluating risk to this limited group of indicators will provide a reliable risk assessment for the ecosystems that will be affected by the Project.

[7] Neff JM, Anderson JW, Cox BA, Laughlin RB, Rossi SS, Tatem HE. 1976. Effects of petroleum on survival, respiration, and growth of marine animals. Proceedings, Sources, Effects and Sinks of Hydrocarbons in the Aquatic Environment, Washington, DC, August 9–11, pp 515–539.

[8] Barata C, Calbet A, Saiz E, Ortiz L, Bayona JM (2005) Predicting single and mixture toxicity of petrogenic polycyclic aromatic hydrocarbons to the copepod Oithona davisae. Environ Toxicol Chem 24:2992–2999

[9] Jensen L.K., Carroll JL (2010) Experimental studies of reproduction and feeding for two Arctic dwelling Calanus species exposed to crude oil. Aquatic Biology 10:261-271.

1.62 Exposure Through Air

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.2, p. 8-5 (A1T0I9)

Preamble: The RA downplays the seriousness of exposure to volatile organic compounds (VOCs) after a release of diluted bitumen or condensate, with statements like the last paragraph in this section, which begins "Most VOCs have relatively low toxicity...". Contrary to this, the website of the company (DNV) contracted to conduct this risk assessment for Northern Gateway, contains a link to a concept for a new type of oil tanker (http://www.dnv.com/press_area/press_releases/2010/Amajorsteptowardsthenewenvironmentalerafortankershipping.asp) that they believe will cause "less harm to the environment" because it will "eliminate entirely the venting of cargo vapours (VOCs)". No quantitative information is provided on the VOCs that would be released as part of the ongoing operations of the proposed project, or on the levels and risks of VOCs that would be released in the event of spills of either the diluted bitumen or the condensate.

Request:

a) Please provide information on the specific VOCs and their amounts that are projected to be released into the air masses of Upper Kitimat Arm in the course of normal operations of the project, and include information for both the condensate as well as the diluted bitumen.

b) Please provide information on the specific VOCs and their amounts that are projected to be released into the air masses of Upper Kitimat Arm in the event of spills of either condensate or the diluted bitumen.

c) Please provide recent toxicological information on the effects of prolonged inhalation of VOCs on the health of humans and air-breathing biota, as well as the effects of acute inhalation of very high levels of VOCs in humans and biota.

1.63 Effects of Hydrocarbons on Plankton

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.4, p. 8-6 to 8.7 (A1T0I9)

Preamble: The subsection on plankton says that on the one hand, plankton may be at high risk because of their inability to move away from spills, and their proximity to the water surface. On the other hand, the RA suggests that there is little information on the effects of oil or hydrocarbons on plankton. However, there is a considerable amount of recent information on the effects of petroleum on temperate and sub-Arctic plankton, especially on copepods and other zooplankton, which does not appear to have been considered during the RA. Further, in the event of a significant spill near the proposed terminal, the narrowness of the channel raises the probability that the entire channel would be affected, potentially cutting off recruitment of planktonic species from other areas for an unknown period of time.

Requests: a) Was existing recent information on the effects of oil and hydrocarbons on plankton considered? If yes, please provide reference and synthesis of that information. If no, why not?

b) Was the specific case of a significant spill near the proposed terminal considered? If yes, please provide information about the impacts of such a spill. If no, why not?

1.64 Effects of Hydrocarbons on Marine Vegetation

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.5, pp. 8-7 to 8.12 (A1T0I9)

Preamble: This section purports to be about marine vegetation, but also includes discussion of benthic and infaunal communities associated with, for example, eelgrass habitat. Information should be provided showing that disturbances of these communities have persisted much longer than the 6 years described in the RA. Sites in Buzzards Bay, Massachusetts oiled

over 40 years ago, still show impacts to infaunal organisms in low energy, soft substrate, sheltered habitats.[10]

Request: a) Were the long term effects of an oil spill in sheltered habitats such as Minette Bay and the Kitimat River estuary considered in light of the available literature, especially recent studies in Buzzards Bay, Massachusetts? If no, why not?

1.65 Effects of Hydrocarbons on Marine Invertebrates

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.6.2, pp. 8-18 to 8-19 (A1T0I9)

Preamble: Here, the RA uses a general textbook and a 2-page handout from the US Fish and Wildlife Service to make broad statements about a range of biological effects of oil on invertebrates. This section also states that subtidal invertebrates "are not expected to be vulnerable to direct effects of oiling". This section also notes that oil from the EVOS remained "at least" until 1996 in the sediments below and among the mats of mussel byssus, cobbles, and fine sediments. This section also states that "it is unlikely that condensate will reach the shoreline."

It is the responsibility of the project proponents to provide a systematic assessment of possible effects, especially in the region of concern, in order to determine if, and how, effects of spills can be mitigated.

Requests: a) Was a more thorough literature review conducted and considered than is suggested in the RA? If not, why not? Has the possibility that diluted bitumen might sink, especially if it is mixed with sand or mud after reaching the shoreline, and then leaves the shoreline and sinks on an outgoing tide, been considered? If yes, please provide information on the effects from diluted bitumen that sinks. If no, what are the reasons for not making such a consideration?

b) Have recently published accounts of EVOS oil remaining in mussel beds, along with recent estimates that it will take 3 decades for oil

[10] Environ. Sci. Technol., 2002, 36 (22), pp 4754–4760; http://video.nytimes.com/video/2010/07/18/science/1247468416166/lessons-from-an-old-oil-spill.html

in these strata to decline to background, or pre-spill, levels[11] been considered in the RA? If yes, please provide information on the effects of oil persisting in mussel beds. If no, what are the reasons for not making such a consideration?

1.66 Effects of Condensate on Marine Invertebrates

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.6.3, pp. 8-18 to 8-19 (A1T0I9)

Preamble: The RA states that is unlikely a spill of condensate would reach the shoreline, but acknowledges that condensate would rapidly become entrained in the water column. Given the narrowness of Kitimat Arm, in the event of a major spill of condensate near the terminal, condensate could reach the shoreline.

Request: a) Has the possibility of condensate reaching the shoreline been considered. If no, why not?

b) Has the effect of condensate that reaches the shoreline been considered? If no, why not?

c) Has the possibility that a great deal of any spilled condensate will rapidly entrain into the water column, where it cannot be contained or cleaned up, been considered? If no, why not?

d) Has the long term effect of condensate entrained in the water column been considered? If no, why not?

1.67 Effects of Hydrocarbons on Fish, Fish Habitat and Marine Fisheries Management

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.7, pp. 8-21 to 8-38 and Table 8.3 (A1T0I9)

[11] Carls MG, Babcock MM, Harris PM, Irvine GV, Cusick JA, Rice SD, 2001. Persistence of oiling in mussel beds after the Exxon Valdez oil spill. Mar Environ Res. 2001. 51:167-90.

Preamble: Here the RA states that egg and larval stages are generally the most vulnerable because they inhabit the upper water column and cannot swim away. This is a gross oversimplification of the diverse life history strategies of fishes. Some fish have adhesive eggs, deposited either along the shoreline, or sometimes at depth. Some fish larvae stay at depth, while others stay near the surface. Eulachon are of very high importance for the Haisla Nation, but are absent from Table 8.3 in the OWA and CCAA. The RA states that only a few species of flatfish, such as English sole, are found at moderate to shallow depths. It is noted that while eulachon spawn in rivers, the larvae immediately move to nearshore marine and estuarine habitats, where they rear and feed for several weeks, and it is also noted here that there is a distinct non-migratory population of Pacific herring in upper Kitimat Arm, that does not appear to mix with other populations.

In discussing the potential effects of spilled bitumen or condensate on fish, fish habitat, and fisheries, this section omits a growing body of work showing that extremely low levels of petrogenic PAHs cause severe defects in fish larvae, by targeting the developing heart.[12] We now know that very low concentrations (low parts per billion) of low molecular weight PAHs dissolved in water cause cardiac arrhythmia, heart malformations, and loss of vascular circulation in fish embryos, and these effects lead to the suite of larval deformations seen in fish exposed to oil or oil-derived compounds. These same compounds are associated with bitumen derived from the Alberta oil sands,[13] and are suspected of impacting

[12] Incardona, J.P., T.K. Collier, and N. L. Scholz. 2004. Defects in cardiac function precede morphological abnormalities in fish embryos exposed to polycyclic aromatic hydrocarbons. Toxicol. Appl. Pharmacol. 196:191-205.

Incardona, J.P., M.G. Carls, H. Teraoka, C.A. Sloan, T.K. Collier, and N.L. Scholz. 2005. Aryl hydrocarbon receptor-independent toxicity of weathered crude oil during fish development. Environmental Health Perspectives 113:1755-1762.

Incardona, J.P., H.L. Day, T.K. Collier, and N.L. Scholz. 2006. Developmental toxicity of 4-ring polycyclic aromatic hydrocarbons in zebrafish is differentially dependent on Ah receptor isoforms and hepatic cytochrome P450 1A metabolism. Toxicology and Applied Pharmacology, 217:308-321.

Carls, M.G., L. Holland, M. Larsen, T.K. Collier, N.L. Scholz, and J.P. Incardona. 2008. Fish embryos are damaged by dissolved PAHs, not oil particles. Aquatic Toxicol. 88:121-127.

[13] Kelly, E.N., J.W. Short, D.W. Schindler, P.V. Hodson, M. Ma,A.K. Kwan, and B.L. Fortin. 2009. Oil sand development contributes polycyclic aromatic compounds to the Athabasca River and its tributaries. Proc. Natl. Acad. Sci.106: 22346-22351.

human health in people living downstream of the Alberta oil sands development activities.

This section also states that the Kitimat River has a low probability of being affected by any spills of bitumen or condensate.

Regarding rockfish, this section states that only small number of adults in a spill area might die, then goes on to state that “rockfish was the only fish found dead in large numbers following the EVOS”.

In the subsection concerning commercial fisheries, tainting is defined as the presence of abnormal odour or flavor, and the statement is made that wild fish are rarely tainted, and if so, for only a short period of time (one to two months).

Requests:

a) Please identify all the potential exposure pathways for spilled oil or condensate to affect fish and other species, and provide a complete description of these pathways for exposure and injury.

b) Please provide information concerning eulachon in Table 8.3, including their spawning habitats.

c) Has information that many flatfish species, especially young and juveniles, live in shallower waters been considered, and if so, how? If such information has not been considered, why not?

d) Has information showing that pelagic fish species can show evidence of exposure to oil at sites located several hundred miles away from a spill been considered, and if so, how? If such information has not been considered, why not?

e) Has the information on nearshore habitat use by larval eulachon been used to consider the potential severe impacts of spilled oil or condensate on this species, if any spills were to occur while these larvae inhabit nearshore habitats? If this analysis has not been done, why not?

f) Has the susceptibility of the distinct population of herring in Kitimat Arm been considered, especially in the event of a significant spill in

the area of the proposed marine terminal, and if so, how? If such information has not been considered, why not?

g) Has the intertidal spawning strategy of herring been considered as a risk factor for this species in the event of oil or condensate spills and if so, how? If such information has not been considered, why not?

h) Has information been collected and incorporated concerning the mortalities of pink salmon eggs and larvae following the EVOS, and if so, how was it used in the RA? If not, why not?

i) Please provide more information on species, timing, and locations of FSC fisheries in this region, and incorporate this information into the RA.

j) Has recent scientific literature concerning the cardiotoxic nature of petrogenic hydrocarbons to larval fish been reviewed and used in this RA? If such information has not been considered, why not?

k) Have the cardiotoxic effects of petrogenic hydrocarbons on fish that spawn in freshwater, such as salmon and eulachon been considered, and if so, how? If such information has not been considered, why not?

l) Have the strong up-channel winds that are common in Kitimat Arm been considered as a factor that could push spilled bitumen or condensate into the lower Kitimat River? If no, why not?

m) How have the impacts of the EVOS on herring been considered in assessing risks to Pacific herring from the proposed Project? Most notably, it is generally agreed that there has been a large and long-lasting impact to Pacific herring in Prince William Sound following the EVOS, such that a once thriving and highly valuable commercial fishery has been virtually shut down for over two decades.

n) How has the high mortality of rockfish following the EVOS been considered in assessing risk to this species assemblage? If such information has not been considered, why not?

o) Please provide information describing how fish harvested from an oiled area are considered by some agencies, such as the US Food and Drug Administration, to be adulterated, even in the absence of tainting.

p) Please provide information on the extent of and costs associated with the testing that is required before allowing areas to be opened for harvest following an oil spill.

q) Have the potential economic and social impacts of long-term closures and onerous testing requirements been considered? If not, why not? Please review and consider information from a study showing that caged salmon were shown to be tainted for seven months following the T/V Braer spill.[14] Please explain whether this study supports a conclusion that that wild fish could be tainted for a significantly longer period of time than one to two months.

r) Please provide a review and synthesis of the scientific peer-reviewed literature concerning the potential effects of condensate and condensate constituents on fish and their habitats, that goes beyond the non-peer reviewed book published more than a decade ago which appears to have been largely relied on in the RA (Patin, 1999).

1.68 Effects of Hydrocarbons on Marine Birds

Reference: i) Exhibit B3-40 Volume 8C – Application dated May 2010, Section 8.85, p. 8-51 (A1T0J0)

Preamble: This section states that part of a bird monitoring protocol could be to "determine contaminant levels (e.g. PAHs) in preferred prey species (e.g. non-lethal sampling of liver tissue from captured birds)".

[14] http://response.restoration.noaa.gov/book_shelf/963_seafood2.pdf.

Requests: a) Please provide information showing how bird livers can be sampled non-lethally.

b) Please provide a rationale for how analysis of bird liver for PAHs can provide useful information about exposure of the bird's prey.

1.69 Mitigation Measures

Reference: i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.5.4, pp. 8-11 (A1T0I9)

ii) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.6.4, pp. 8-20 (A1T0I9)

iii) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.8.4, pp. 8-50 (A1T0J0)

Preamble: These sections state that booming will be used to protect sensitive shoreline areas and skimmers and sorbents will be used to reduce the amounts of hydrocarbons in the environment, in the event of spills of diluted bitumen or condensate (even though other parts of the RA state that spilled condensate is not likely to reach the shore).

Requests: a) Have the wave intensities in this specific geographic region been estimated and/or measured? If so please provide information on how those intensities have been considered in combination with the many published assessments of reduced boom efficacy in high winds and waves. See for example boom recommendations from the State of Alaska, USEPA, and NOAA.

b) If the wave intensities have not been estimated and/or measured, please explain why NGP anticipates booming will be effective, given the many published assessments of reduced boom efficacy in high winds and waves.

c) Similarly, please provide information on how skimming operations will be affected by wind and waves typical of Upper Kitimat Arm.

d) Please provide information to clarify whether or not booming strategies will be used in the event of a condensate spill, and if so,

provide information on how to make them effective, especially in the event of up-channel winds during a condensate spill.

1.70 Follow-up and Monitoring

Reference:
i) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.5.5, pp. 8-11 to 8-12 (A1T0I9)
ii) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.6.5, p. 8-20 (A1T0I9)
iii) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.7.5, p. 8-38 (A1T0I9)
iv) Exhibit B3-39 Volume 8C – Application dated May 2010, Section 8.8.5, p. 8-51 (A1T0J0)
v) Exhibit B3-42 Volume 8C – Application dated May 2010, Section 11.4, p. 11-29 (A1T0J2)

Preamble: The discussions of follow-up and monitoring are generally worded to indicate that these efforts will be focused on determining how long it takes for conditions to return to 'normal' following spills or other releases of contaminants, for example "to determine the success of the response measures and the recovery of marine vegetation" (reference i), "until hydrocarbon concentrations have returned to baseline levels" (reference ii), "Monitoring would typically continue until specific ends are achieved and residual hydrocarbons reach acceptable background levels" (reference iii), "until it is confirmed that baseline conditions are restored" (reference v).

Requests:
a) Please advise how a determination that baseline conditions have been restored will be made, given the lack of baseline studies on most marine species in Kitimat Arm.

b) Please specify what offers or discussions have been held with the Haisla Nation on the geographic, ecological and temporal scales of monitoring that would be needed to assess the complex ecology in this region, both before, during, and after construction of the Project.

c) Please provide information on the commitment that has been, or will be, made by NGP, to support such monitoring over the long time period which will be needed for an effective monitoring program, to include extensive monitoring prior to initiation of any project, and monitoring for the lifetime operation of the Project.