From: Zacharias, Mark ENV:EX
To: Morel, David P ENV:EX
Cc: Lewis, Cameron F ENV:EX
s.13

Page 002 to/à Page 005

Withheld pursuant to/removed as

s.13

From:	Zacharias, Mark ENV:EX
To:	Morel, David P ENV:EX
Subject:	Ltr Hon John Horgan 6Feb2018.pdf
Date:	Tuesday, February 6, 2018 16:33:32
Attachments:	Ltr Hon John Horgan 6Feb2018.pdf ATT00001.txt

A good summary of work to date and some of this could be used for the IP.

KINDER MORGAN CANADA

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February 6, 2018

The Honourable John Horgan
Premier of British Columbia
West Annex, Parliament Buildings
Victoria, British Columbia V8V 1X4

By electronic mail: premier@gov.bc.ca

Dear Premier:

I am writing regarding the announcement of January 30, 2018 from Honourable George Heyman, Minister of Environment and Climate Change Strategy regarding the Government of British Columbia's *"..... second phase of regulations to improve preparedness, response and recovery from potential spills"*. Although the Trans Mountain Expansion Project was not specifically mentioned, we question the intent and purpose of several measures introduced by the Minister, as well as the broader objectives of the Government of British Columbia.

We are of the view that further review, as contemplated by the Minister, beyond what has already been completed or planned, is unnecessary and is in fact in conflict with regulatory processes and protective measures that have been undertaken by the National Energy Board (NEB), the Government of Canada and the Government of British Columbia. If your review proceeds, as suggested, it should build on the extensive work undertaken by experts in the field of spill response and oil spill behavior, and it should be used to broaden understanding and learning, not as a tool to frustrate or delay our Project and investment generally in the energy sector in Canada. We understand that additional information from your government about the review will be forthcoming in the coming weeks.

The Trans Mountain Pipeline has been safely shipping crude oil and refined products in BC for 65 years. Diluted bitumen has been transported in our pipeline for 30 years. We take great pride and effort to ensure we operate safely and work with governments at all levels to ensure the legislation, regulation and policy overseeing the shipment of oil and oil products are world class. Trans Mountain, for example, was one of the first operators in North America to introduce real-time leak detection for pipelines. We were also instrumental in supporting the deployment of advanced digital navigation aids now used by BC Coast Pilots on the West Coast to enhance safety for all forms of large vessel commercial shipping.

After completing the required regulatory review process for the Trans Mountain Expansion Project, the Government of British Columbia granted its Environmental Certificate in January 2017. At the same time the Government of British Columbia also confirmed Trans Mountain has met the *"Requirements for British Columbia to Consider Support for Heavy Oil Pipelines"*; including world-leading practices for land oil spill prevention, response and recovery systems to manage and mitigate the risks of heavy oil pipelines. The satisfaction of British Columbia's Requirement 5 included that *"British Columbia receives a fair share of the fiscal and economic benefits.....that reflects the level, degree and nature of the risk borne by the province, the environment and taxpayer"* and the culmination of the commercial agreement between the Government of British Columbia and Trans Mountain. The Agreement ensures that over the 20-year term of the Agreement the Province of British Columbia will receive a minimum of $500 million and up to one billion dollars, depending on volumes moved and the parties' performance and respect of their obligations under the Agreement. This is a financial contribution that is incremental to the jobs, royalties, taxes and other economic benefits the Project's construction and operations will create. It is money targeted and designed to enhance British Columbia's environmental stewardship and protection. This unprecedented investment by Trans Mountain in British Columbia goes directly to the very principles of environmental responsibility that we share with your government.

Over the past five years, Trans Mountain and stakeholders participated in consultation initiatives that resulted in the new provincial spill response regulations that took effect last year. Trans Mountain has worked with the Government of British Columbia under its principle to avoid duplication among regulators. We expect this to continue. For the second phase of these consultations we have supplied Ministry staff and representatives with significant information regarding response times and geographic response plans. Regarding compensation, we note that Trans Mountain has a financial assurances plan that provides for coverage of one billion dollars (growing to $1.1 billion with the Project) for loss or damages from a spill including cleanup and remediation, and loss of non-use value of a public resource.

In July 2017 I wrote to you after you became Premier-Designate of British Columbia and had completed the Confidence and Supply Agreement between the BC Green Caucus and the BC New Democrat Caucus. That letter contained a comprehensive account of the NEB and the BC Environmental Assessment Office (BC EAO) regulatory processes that resulted in approval and associated conditions of our Expansion Project by Canada and British Columbia. I offered to meet with you at the time, to share with you further information and the invitation has, and continues to remain open.

As I have said here and elsewhere publicly, we respect your government's commitment to environmental protection and I can assure you we share that same commitment. Our commitment is evidenced by our past and current operations, and all of the activities underway resulting from the federal and provincial regulatory processes for the Project. In its report, the NEB devoted a specific chapter to the behavior of oil, including diluted bitumen and a thorough review of the extensive scientific studies, modelling and research on the subject. Diluted bitumen, its properties, transportation and cleanup of spills, has been and continues to be studied for many years by third parties in Canada and the US including the National Research Council and the Government of Canada (Environment and

Climate Change Canada, Department of Fisheries and Oceans and Natural Resources Canada). Trans Mountain collaborated with the Province of British Columbia and other stakeholders including Indigenous communities, for more than three years in the development of BC's new, world-leading land-based spill response regime that resulted in legislated changes in 2016.

Many of the areas outlined in the recent announcement by the Minister are already captured in the NEB and BC EAO certificates. For example, Condition 35 to the BC EAO addresses research on the fate and behaviour of bitumen specifically regarding the behaviour and recovery of heavy oils spilled in freshwater and marine aquatic environments, including research programs having the objective of providing spill responders with improved information on how to effectively respond to spills. All of which is being developed in consultation with the appropriate provincial and federal authorities and Indigenous communities. The research topics include physical and chemical properties of the oil and other products intended to be shipped from the Westridge Marine Terminal, product weathering, dispersion and oil/sediment interactions, product submergence, product behavior, cleanup and remediation options for sediments and shoreline.

In addition to the above, Trans Mountain is participating in efforts to further understand oil properties for the betterment of response. Current research initiatives include:

i. An independent, science-based multi-million dollar study, was commissioned by the Canadian Energy Pipeline Association (CEPA) and the Canadian Association of Petroleum Producers (CAPP). A Science Advisory Committee comprising of federal agencies and independent spill response experts was set up to provide feedback and guidance. The study is designed to evaluate and compare the physical and chemical properties of various types of crude oil that move in North America. Over 10 types of crude oil, including several diluted bitumen products are undergoing a battery of tests to determine how fresh and weathered the oils behave in various marine, estuarine, and freshwater settings, under different environmental conditions. The study is in progress and results will be publically available at the end of 2018. We will assess the findings to identify opportunities to improve spill response strategies.

ii. A joint industry project including the governments of British Columbia and Alberta to independently evaluate and review current inland spill response technologies focusing on diluted bitumen. The purpose of the Inland Spill Response Joint Industry Program was to conduct a comprehensive review of the current technology that exists for in-land spill response oil recovery; apply the existing technology to four scenarios; identify suitable technologies and to identify gaps in the existing current technology. The review focused on diluted bitumen (dilbit). The study was completed in 2017. The findings have led to improvements in our Emergency Management Program and response strategies, including, however not limited to, the development of a Sunken and Submerged Oil Plan. The plan includes methods to recover sunken oil.

iii. Support of the International Institute for Sustainable Development-Experimental Lakes Area Program. This unique industry and government collaborative Program is examining the fate and behavior of diluted bitumen and conventional heavy crude oil in a freshwater shoreline environment. Baseline chemical and biological information was collected in 2017 for a natural lake study site, using an actual Canadian lake. In 2018, a controlled spill of oil will be used to quantify the efficiency of immediate product recovery and further analysis of residual oil constituents. Potential impacts will be evaluated for 16 weeks. The information from this portion of the project will be used to determine if degradation is significantly different for diluted bitumen and conventional heavy crude oil, and if wave energy has a significant effect on oil degradation rates in the freshwater shoreline environment. The program will also compare clean-up methods for the oil spilled. Another larger project will be undertaken in 2019.

Significant progress regarding Geographic Response Plans has been made as part of BC EAO Condition 33. In addition we have consulted and engaged with BC Ministry of Environment and Climate Change Strategy multiple times regarding geographic response planning, including sharing our plans. Feedback received from the Ministry was incorporated into the plan, and at the last meeting in October 2017, we received confirmation from Ministry staff on our approach to geographic response planning for the pipeline system. Consultation and input into the development of the plans, including the identification of sensitive, natural, cultural resources was conducted with local and regional governments, first responders and Indigenous communities. We are on schedule, as planned, to have them implemented by mid-2018 after final Indigenous consultation has been completed. In addition, in compliance with NEB Condition 117 there will be an update in 2018 on the enhancements already implemented in the Kinder Morgan's Emergency Management Program, and the related consultation with Indigenous communities and stakeholders.

After reviewing my letter to you of July 2017 and the substantial progress made with respect to both the federal and provincial conditions, I am struck by how many of the same issues raised in the Minister's announcement, especially those focusing on the Project and impact of bitumen based crudes (dilbit, heavy crude) along the pipeline and marine vessel routes, are already well underway. I am at a loss to understand what approach to investigation, further study, and environmental protection has not been undertaken or is not underway.

Trans Mountain has, and continues to respect all necessary and fair regulatory requirements for the Project. This Project has been deemed to be in the national interest and we are confident it can be built and operated in respect of communities and the environment.

The portion of your Minister's announcement suggesting the Province of British Columbia would consider attempting to place restrictions on diluted bitumen transportation is particularly troubling. Setting aside whether such a restriction is legal or within British Columbia's jurisdiction, we are extremely disappointed that we learned of the proposed restrictions only after the press release was issued. The implications of such a threat strike directly at the heart of our country's oil and natural gas producers, and producing provinces, energy customers in the Lower Mainland, Canada, USA and overseas, and the

men and women who earn a living supporting the energy industry in this country. As I am sure you are aware, provincial powers cannot be used to compromise the orderly development and efficient operation of interprovincial works or undertakings. The NEB recently applied this same principle to find certain City of Burnaby bylaws were constitutionally inapplicable or inoperative on the basis of unreasonable delay. To that end we have initiated a technical and legal review of whether the suggested provincial initiatives could apply lawfully to a federally regulated Project. This will of course be informed by the proposed regulations contained in the forthcoming intentions paper.

In conclusion Premier, I hope that you will consider the severity and consequence of the actions your Minister has proposed and that you will accept my offer to meet with you to discuss these and any other matters relating to the operations of our company in British Columbia. In the coming weeks, I will be meeting with shippers, investors, Indigenous communities, suppliers and contractors. Following my anticipated discussion with you, I hope to tell them that while your government's position with respect to our Project is clear, there is a predictable, reasonable and timely regulatory and permitting process in BC that will allow major, energy projects to proceed.

Yours truly,

TRANS MOUNTAIN PIPELINE ULC

Ian Anderson
President, Kinder Morgan Canada Limited

cc: Hon. Rachel Notley, Premier of Alberta
Hon. Jim Carr, Minister of Natural Resources

Regards, Mark
s.17,s.22

From:	Zacharias, Mark ENV:EX
To:	Morel, David P ENV:EX
Cc:	Lewis, Cameron F ENV:EX
Subject:	Fwd: Susan Allen"s MEOPAR Proposal: Dilbit Modelling
Date:	Wednesday, February 7, 2018 10:33:32
Attachments:	Allen_midoss-proposal-07nov17-2010.pdf ATT00001.htm

---

Another idea for a secretariat

Regards, Mark
s.17,s.22

Begin forwarded message:

From: Kate Moran <kmoran@uvic.ca>
Date: February 7, 2018 at 10:31:24 AM PST
To: "Mark ENV:EX Zacharias" <Mark.Zacharias@gov.bc.ca>
Cc: Jessica Stigant <jstigant@uvic.ca>, Kim Juniper <kjuniper@uvic.ca>, Natalia Gartley-ONC <oncsec@uvic.ca>
Subject: Fwd: Susan Allen's MEOPAR Proposal: Dilbit Modelling

Mark,

I chatted with Kim about what we discussed at dinner last week. Marine Environmental Protection, Observation, and Response (MEOPAR) is a National Centre of Excellence that funds research in this area, based at Dalhousie. ONC partners with MEOPAR by jointly funding research of mutual interest. They also support special studies and workshops. We jointly with MEOPAR just awarded funds to UBC to conduct research that will integrate dillbit into oceanographic models. One option for you to consider is for us (ONC) to utilize our MEOPAR partnership (they support the national network of Canadian researchers that includes oil spill response experts) to tap into this resource either as a specific review, workshop, or both.

Natalia set up a call for us to discuss further on the 19th. Happy to talk sooner if necessary.

Best,
Kate

MIDOSS Research Plan

Our research will provide innovative and valuable advances to three questions:

- **How** will a Dilbit spill behave in a large estuary such as the Salish Sea?
- **What** coastal areas in the Salish Sea are most likely to be impacted by (a) a Dilbit spill (b) an oil barge spill (c) a spill from a ship not carrying fuel as its cargo?
- **How** can oil spill risk be effectively represented (e.g., mapped) to support planning to minimize coastal impacts?

There are many marine oil spill models in use today (comprehensive reviews include Huang 1983, Spaulding 1988, ASCE 1996, and Reed et al. 1999). Despite the significant progress that has been made during the past four decades, our ability to predict the fate and behaviour of a spill is still very limited, especially for the fate and transport of non-conventional oil products such as Dilbit. Considering that Alberta Oil Sands pipeline expansions such as Trans Mountain propose to transport increasing quantities of Dilbit destined for tanker export, there is a need to better model not only the trajectories but also the weathering processes of these non-conventional products.

Oil spilled on water undergoes a series of weathering processes that change its physical and chemical properties. The type of oil and environmental conditions determine the rate of weathering. Diluted bitumen is oil sands bitumen diluted either by condensate (Dilbit) or synthetic crude oil (Synbit). Once spilled, Dilbit and Synbit behave differently from conventional crude oil. Dilbit may return to the properties of the starting bitumen as the volatile components evaporate. In contrast, spilled Synbit weathers to a heavier oil, with intermediate properties between weathered synthetic crude and bitumen (Fingas, 2015).

Marine oil spills can cause severe and long-lasting consequences to coastal communities, including injury and loss to marine species and ecosystems as well as impacts on human health, community well-being, and the economy. Myriad interacting biophysical and social factors influence how oil spill events impact coastal communities (Chang et al. 2014). For example, while direct contact with spilled oil, inhalation of associated vapours, or consumption of contaminated seafood can cause immediate illness, there is also some evidence that exposure to oil spill toxins can cause long-term health consequences such as cancers, birth defects, and neurological damage (Aguilera et al. 2010). Oil spill disasters often cause substantial and enduring psychological stress to communities, compounded by the tensions and conflicts associated with inflows of cleanup and recovery money (Mayer et al. 2015). Coastal industries such as fisheries, aquaculture, and tourism are often harmed both directly by contamination (e.g., Exxon Valdez spill, Peterson et al. 2003) and indirectly by damage to brand and reputation (Chang et al. 2014).

We will address each of these questions by advancing the science of the following project areas.

1. Modelling the near surface currents in an estuarine setting with strong wind and tidal forcing
2. Modelling Dilbit weathering in an estuarine setting
3. Understanding risk information needs and risk communication strategies of diverse decision-making groups

In addition, using the expertise of the three research groups and incorporating the improvements above as they become available, we will (4) build a coupled oil spill prediction system and risk exposure product for the Salish Sea.

1. Modelling the near surface currents in an estuarine setting with strong wind and tidal forcing

Background Accurate, high-resolution hydrodynamic fields are essential in order to make accurate oil spill predictions in a complex, coastal setting. The hydrodynamics for this project will be provided by two state-of-the-art, regional ocean circulation models: SalishSeaCast, a 0.5 km resolution Nucleus for European Modelling of the Ocean (NEMO) configuration for the Salish Sea developed as part of IP1.2 (Soontiens et al. 2016 and Soontiens & Allen, 2017), and a higher resolution configuration of the Finite Volume Community Ocean Model (FVCOM) for Burrard Inlet and the Fraser River estuary under development by the Department of Fisheries and Oceans Canada (DFO). Both are free-surface models based on the primitive equations, but NEMO is a finite-difference, curvilinear grid model well-suited for strongly-stratified water while FVCOM is a finite volume, unstructured grid model well-suited for complex coastlines, narrow passages, and shoreline wetting and drying.

Accurate surface, ocean boundary, and river forcing are critical for hydrodynamic prediction. Atmospheric forcing will be provided by ECCC's 2.5 km resolution High Resolution Deterministic Prediction System (HRDPS). ECCC produces 48 hour operational HRDPS forecasts every 6 hours, which are archived back to 2007. Several options exist for forcing the Juan de Fuca Strait ocean boundary, the most accurate of which are currently the DFO NE Pacific Ocean barotropic tidal model and the LiveOcean configuration of the Regional Ocean Modeling System for the Vancouver Island and Washington shelves operated by the University of Washington Coastal Modeling Group. Rivers in SalishSeaCast are currently forced by a 2011 Salish Sea watershed climatology and continuous observations from an ECCC Fraser River flow gauge.

SalishSeaCast is currently operational at 0.5 km resolution, but finer resolution and higher accuracy are needed in the areas identified as high incident (DNV 2013) and exposure (EBA 2013) risk by multiple studies during the Trans Mountain safety review process. In addition to the increased resolution provided by the FVCOM configurations under development in Burrard Inlet and the Fraser River estuary, a nested subdomain has been implemented using Adaptive Grid Refinement in Fortran to increase the resolution of SalishSeaCast by a factor of three in the Haro Strait and Gulf Islands region, the highest incident and exposure risk region outside of the Port of Vancouver (DNV 2013; EBA 2013).

Ocean Networks Canada (ONC) data in the Salish Sea has been, and will continue to be used extensively for evaluation. This includes CODAR surface currents, ferry measurements of near surface salinity, turbidity and temperature, and node measurements of deep salinity, temperature and currents.

Tasks

- Continue developing SalishSeaCast including
  - evaluate and improve the near-surface velocity fields, evaluate the model sensitivity to perturbations and initial conditions
  - determine the relative importance of wind, rivers, and tides for the near-surface velocity fields throughout the domain as the time-scales for wind events and oil spill responses are similar
  - integrate velocity predictions into the SalishSeaCast operational dissemination system
- Implement an operational framework for the FVCOM configuration, beginning with a 2-D barotropic model and proceeding to a fully 3-D baroclinic model, using SalishSeaCast to force the open boundaries. This component will be done by the Ocean Physics and Modelling group (DFO)
- Integrate the FVCOM results as boundary conditions to SalishSeaCast in Burrard Inlet and the Fraser River, thus coupling the two models into a single operational framework.

2. Modelling Dilbit weathering in an estuarine setting

Background The MOHID oil spill model is a Lagrangian transport module of the MOHID 3-D Water Modeling System that simulates oil spreading, evaporation, emulsification, dispersion, sedimentation, dissolution, oil-beaching, removal techniques, and chemical dispersion (Fernandes et al. 2013). The model has been recently improved with: biodegradation based on the coupled pseudo-components and first-order biodegradation algorithms, natural dispersion based on the modified Weber number, and oil-shoreline interactions that consider beaching probability on different shoreline types (Li 2017).

To better simulate the fate/transport of Dilbit, a number of MOHID weathering algorithms will be modified. The size distribution of oil droplets, which aggregate as a result of natural dispersion caused by wave actions, is one of the most important parameters determining the fate of spilled oil. To improve MOHID's ability to predict Dilbit droplet size distributions, the newly implemented Modified Weber Number Algorithm will be calibrated with experimental data (Zhao et al. 2014) generated by the DFO Centre for Offshore Oil, Gas and Energy Research (COOGER) for two types of Dilbit. While many oil spill models, including the OSCAR model, use empirical wave equations rather than wave model predictions to calculate vertical turbulent diffusion, we will evaluate the sensitivity of simulated oil trajectories and fate/behaviour in MOHID to both approaches.

Existing and ongoing experimental Dilbit biodegradation data will be collected from COOGER and analyzed to determine the first order decay constant for various Dilbit hydrocarbon groups. These rate constants, together with other physical and chemical properties of Dilbit, will be combined into a new MOHID oil properties database which will enable the model to be set up rapidly in the event of an emergency. The amount of spilled oil that dissolves in water, though less than 1%, is an important control on the toxic impacts to marine organisms. Therefore, the MOHID model's dissolution algorithm will be evaluated and calibrated using recent COOGER Dilbit dissolution experiments at different initial thicknesses.

Tasks

- Calibrate the droplet size distribution algorithm using COOGER data and evaluate the sensitivity to empirical vs. modelled wave fields
- Determine decay constants for Dilbit hydrocarbon groups from COOGER data and assemble database to facilitate rapid model deployment during emergencies
- Calibrate the dissolution algorithm using recent Dilbit dissolution experiments done by COOGER

3. Understanding risk information needs and risk communication strategies of diverse decision-making groups

Background Many types of organizations and professionals – ranging from oil spill cleanup companies to ship pilots, local government emergency managers, and environmental non-governmental organizations (NGOs) – have a potential role to play in reducing marine oil spill risks and require effective risk information to support this role. This research will investigate risk information needs and effective risk communication strategies for diverse stakeholders, focusing on professionals making decisions for the benefit of communities, rather than on information needs of the general public. It specifically examines: (i) the types of decisions that would be informed by oil spill risk information, (ii) the required information content (e.g., spatial resolution, temporal range, uncertainty), and (iii) effectiveness of different modes of information communication (e.g., static maps, dynamic maps, interactive applications). Findings from the risk communication literature emphasize that in order to design effective risk information tools, it is critical to take into account how complex and uncertain information is cognitively processed, and to evaluate effectiveness empirically (Bostrom et al. 2015).

Furthermore, it is important to consider a broader range of decision and communication needs than tactical and operational spill response planning, for which traditional methods such as scenario analysis have largely been designed (Leschine et al. 2015).

Tasks

- First, in consultation with the circulation and oil spill modeling groups, several oil spill risk information tools will be mocked up and populated with hypothetical data. This portfolio of illustrative tools will be designed to capture variations in spatio-temporal representation, uncertainty representation, mapping content, and interactivity. Collaboration with the modeling groups will ensure that the illustrative tools reflect the anticipated capabilities and eventual outputs of their models.
- Second, two panels of 5-10 professionals each from different relevant organizations (e.g., shipping industry, emergency managers, environmental NGOs) will be recruited and interviewed regarding types of decisions that could be informed by oil spill risk information. The first panel will consist of professionals from the Salish Sea region of British Columbia, and are expected to have little direct experience with major oil spill events. The second panel will consist of corresponding professionals from other regions (e.g., U.S. Gulf Coast) who have had such direct experience. The interviews will provide data on decisions that could be informed by oil spill maps, as well as on differences across professional groups and across experience groups.
- The third task will engage the panel of local professionals in a structured workshop setting to evaluate the portfolio of illustrative tools against the types of decisions elicited in the interviews. Results will be used in the development of the Coupled Oil Spill Prediction System and representation of results from the stochastic simulations, described below.

4. A coupled oil spill prediction system and risk exposure product for the Salish Sea.

Coupling oil spill prediction system We will develop our oil spill prediction system by coupling a suite of state-of-the-art models (Figure 1). In addition to the HRDPS, SalishSeaCast, FVCOM, and MOHID models described above, we will use a WaveWatchIII configuration developed for the Salish Sea as part of the Prediction Core activities for Cycle II. The HRDPS, SalishSeaCast/FVCOM, and WaveWatchIII models will provide the respective atmospheric, hydrodynamic, and sea state forcing fields in order to drive the MOHID model. Previous systems have been developed for the Salish Sea using the OSCAR spill model coupled to HRDPS-SalishSeaCast (Niu et al 2016) and a suite of proprietary models developed by EBA TetraTech (H3D-SPILLCALC, EBA 2013). The system will be capable of forecasting spill trajectories up to 48 hours into the future, the maximum HRDPS lead time.

Determining exposure risk Deterministic simulations are vital for tracking individual spills as they occur (e.g., Deepwater Horizon), however for predicting the behavior of hypothetical spills, stochastic methods account for a wider range of spill conditions. Stochastic spill simulations generally use a defined spill location and quantity, but vary the hydrodynamic and atmospheric forcing conditions statistically within a predefined range (e.g., Niu et al 2016; EBA 2013), often using Monte Carlo methods (e.g., Barker 2011). The results of these simulations are generally presented as spatial probability distributions for both areal spill extents and shoreline oiling. The EBA TetraTech study using H3D-SPILLCALC found that nearly 70% of oil released during a 16,500 m^3 spill along the ship track between Vancouver and Victoria would end up on shorelines within 15 days, affecting a range of approximately 100 to 400 km of shoreline (EBA 2013).

In order to evaluate the exposure risk for specific regions of the Salish Sea, we will perform stochastic simulations using the oil spill prediction system to generate probability distributions for multiple types of oil spilled under a variety of different conditions. In addition to using random dates and times during our existing hindcast record to stochastically vary atmospheric and hydrodynamic forcing conditions

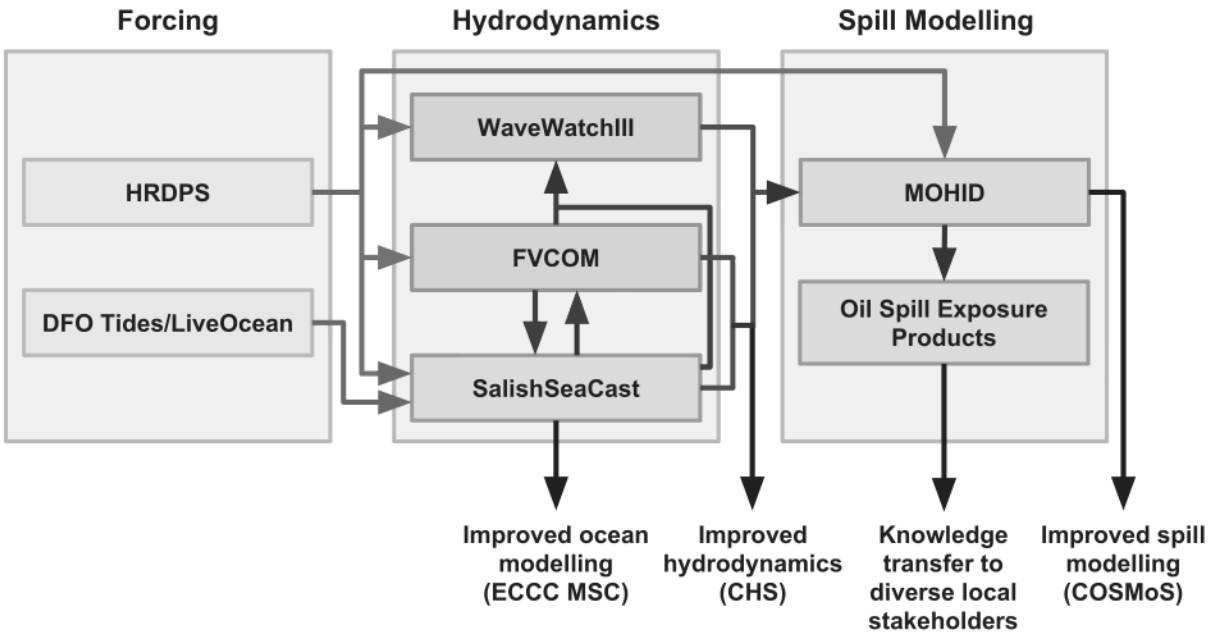

Figure 1: Outline of MODISS. Yellow boxes denote upstream products already in production, red boxes denote MEOPAR partner products, blue boxes denote products to be developed under the present project. Yellow arrows represent upstream forcing, red arrows represent hydrodynamic coupling, blue arrows drive the oil spill model and stochastic simulations, and black arrows are deliverables to partners and stakeholders. MSC=Meterological Service of Canada, CHS=Canadian Hydrographic Service

as done in previous studies, we intend to vary spill location and size stochastically as well, selecting the locations based on ship density track data provided by collaborator Canessa and by Chang's IP 1.9. We also will evaluate how the differences in chemical and weathering properties between different types of oil, including Dilbit, affect the exposure risk.

Communicating risk to stakeholders and end-users An essential component of this study will be to communicate the exposure risk determined during the stochastic simulations to our diverse local stakeholders using the Oil Spill Exposure Products (Figure 1) developed in Part 3 described above.

Tasks

- Couple MOHID into the SalishSeaCast operational framework
- Use it to produce daily spill forecast simulations at stochastic locations as both an end-user product and a development tool.
- Evaluate the system by hindcasting a series of documented spills (from collaborator O'Hara) that have a occurred throughout the HRDPS forcing record.
- Develop a stochastic modelling framework, specifically the Monte Carlo methods for varying spill location, and the high-performance computing workflow to facilitate computational demand. We estimate that 1/5 of Allen's present Compute Canada allocation will allow 20,000 simulations/month.
- Integrate the stochastic simulations into oil spill risk exposure products for stakeholders.

Research Deliverables

- Year One: Stakeholder Workshop
- Year Two: Coupled Oil Spill Model System producing ocean output for CHS
- Year Three: Publications submitted on projects 1-3
- Year Three: Oil Spill Risk Product presented at Stakeholder Workshop

From:	Zacharias, Mark ENV:EX
To:	Lewis, Cameron F ENV:EX
Cc:	Morel, David P ENV:EX; Vander Steen, Benjamin ENV:EX; Brach, Pader W ENV:EX; Gaber, Leon ENV:EX; Poss, Angie ENV:EX; Coccola, Carley ENV:EX
Subject:	Re: Dm request
Date:	Thursday, February 8, 2018 07:23:46

Thanks everyone. Please don't put hours into this exercise. These are just anticipated questions that might come up today so 2-3 bullets each is fine.

Regards, Mark
s.17,s.22

On Feb 7, 2018, at 8:56 PM, Lewis, Cameron F ENV:EX <Cameron.Lewis@gov.bc.ca> wrote:

> Hello Mark,
>
> Ben is doing some research tonight. He has a few points on your #2 question already (see down below – added under your questions), but answering #1 and #3 by 11 am may be tough.
>
> Is it ok to engage MEM? They will be the ones that had led BC oversight at the hearings.
>
> ---
>
> **From:** Vander Steen, Benjamin ENV:EX
> **Sent:** Wednesday, February 7, 2018 8:45 PM
> **To:** Lewis, Cameron F ENV:EX; Coccola, Carley ENV:EX; Zahynacz, Matt ENV:EX; Broadbent, Sean ENV:EX; Brach, Pader W ENV:EX; Poss, Angie ENV:EX; Gaber, Leon ENV:EX
> **Subject:** RE: Dm request
>
> Good starting point for reading…
> NEB report on TMX: https://apps.neb-one.gc.ca/REGDOCS/File/Download/2969681
> NEB report on NGP: https://apps.neb-one.gc.ca/REGDOCS/File/Download/2396478
>
> I've started putting some content below on q #2. Questions #1 and #3 are going to be difficult to answer.
>
> For #1 – NGP and TMX said they "may" do a lot of things, but they didn't always firmly commit. For #3 – We haven't really done a jurisdiction scan on this specifically, also, there's a # of things we'll find that TMX surpasses Canadian requirements on (so it isn't just a matter of comparing regulatory requirements against regulatory requirements).
>
> I'm going to review relevant content in these two reports and start pulling relevant points out. I'll send an update on where I'm at ~10.

-----Original Message-----
From: Lewis, Cameron F ENV:EX
Sent: Wednesday, February 7, 2018 7:24 PM
To: Vander Steen, Benjamin ENV:EX; Coccola, Carley ENV:EX; Zahynacz, Matt ENV:EX; Broadbent, Sean ENV:EX; Brach, Pader W ENV:EX; Poss, Angie ENV:EX; Gaber, Leon ENV:EX
Subject: Dm request

Hello all

I just got a text from Mark.

He has asked for bullets on the below by 11 am tomorrow.

Need to figure out who might have this info and split the work up.

Ben, i will call you

Matt, could you call me on cell this evening please? 250-213-6882

Thanks!

1. Differences between what Northern Gateway proposed for spill prevention and response versus TMX

2. What spill prevention and response technologies could TMX adopt to improve outcomes (in addition to what they have already proposed)

- <!--[if !supportLists]-->• <!--[endif]-->Land-based: performance response times – commitments to meet a suite of response milestones following a spill within set timeframes;
- <!--[if !supportLists]-->• <!--[endif]-->Land-based: external pipeline leak detection (e.g., as outlined on PDF page 75 in NEB's final report on NGP);
- <!--[if !supportLists]-->• <!--[endif]-->Land-based: response equipment stationed at control points downstream along waterways that intersect with pipeline;
- <!--[if !supportLists]-->• <!--[endif]-->Land-based: publicly available geographic response plans (they're doing good work here now, but not sure they plan to have them be public)

3. What best practices are globally and whether TMX are using them.

Page 021 to/à Page 060

Withheld pursuant to/removed as

s.13

From:	Vander Steen, Benjamin ENV:EX
To:	Zacharias, Mark ENV:EX; Morel, David P ENV:EX
Subject:	Advice to DM
Date:	Friday, February 9, 2018 17:14:27
Attachments:	Advice to DM.docx

As requested here is the document we discussed today. My apologies for the delay, I wrote the email ages ago and forgot to press the send button.

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Withheld pursuant to/removed as

s.12;s.13

Page 063 to/à Page 149

Withheld pursuant to/removed as

s.13