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Order of Appearances

Northern Gateway Panel 3

Kitimat River Valley

Mr. Drummond Cavers	Mr. Ray Doering	Mr. Jeffrey Green
Dr. Matthew Horn	Dr. Malcolm Stephenson	Dr. Elliott Taylor
Mr. Paul Anderson	Mr. Owen McHugh	

Introduction by Ms. Kathleen Shannon for Northern Gateway Pipelines 18328

Joint Review Panel (JRP) Chairperson Sheila Leggett asked each of the witnesses, this time reappearing on the Northern Gateway Project (NGP) Kitimat River Valley Panel, if they confirmed that they remain under oath. All said yes. Ms. Kathleen Shannon then introduced the panel members, and the personnel supporting the witnesses. She described their areas of expertise and corporate affiliations, as well as the evidence for which they are responsible, and their curricula vitae. Exhibit B210-6 lists all of the witnesses for each of the Northern Gateway Pipelines' witness panels, their titles and responsibilities, issues and the evidence each panel will speak to, including the Application. 18328

Examination by Ms. Elizabeth Graff for the Province of British Columbia 18454

Ms. Graff introduced herself and her two colleagues from the Ministry of Environment, Mr. Jim Hofweber and Mr. Graham Knox.

Data used for modeling spill scenarios

Ms. Graff began her questions by asking about the use of SIMAP in the ecological risk assessment. Dr. Horn explained that the history of the model, which was initially used for marine spills in the 1980s, has become used for freshwater spill modeling and damage assessment of rivers over the last few decades. Ms. Graff asked if the model could address characteristics of salmon rivers, and Dr. Horn indicated that river dimensions are incorporated into each analysis, allowing it to "take into account" a specific river. Ms. Graff asked whether SIMAP "is designed to provide an analysis of chronic effects or the delayed effects of acute exposures" and Dr. Horn answered that it was not used for either in this example, but was used "to determine the acute toxicological effects from a proposed hypothetical spill". 18457-18467

Ms. Graff asked about the range and selection of NGPs spill scenarios, seeking to understand how and why they selected the scenarios they did. She asked about stream flow calculations and Dr. Horn provided details related to the flow rates and indicated that the source of the data for each river "came from a variety of sources". 18469-18481

Sediment load as a factor in oil dispersal

Ms. Graff asked about other parameters related to the spill scenario calculations, including the lack of a range of sediment loads, indicating the importance of sediment because of the role it could play in transferring toxic elements to aquatic life. Dr. Horn indicated that parameters had to be prioritized, noting that in this case, "the two most important parameters are actually the volume of oil that is spilled and then the flow rates

of the river", continuing with an explanation as to the rationale for their calculations. 18483-18496

Ms. Graff continued with various questions around the spill scenarios, with the witnesses providing general details around the model used and calculations made. Ms. Graff asked about river flood stages, and Dr. Stephenson spoke again about high and low flow river conditions, noting "we modelled the deposition of oil onto shoreline soils, and the fate of that oil, the weathering of that oil on shoreline soils, if not recovered, and the potential accumulation of oil in vegetation and exposure of animals, wildlife that would be occupying or using that riverbank as well." Similar discussion continued. 18498-18512

Calling up Exhibit B132-2, Adobe 60-61, Ms. Graff asked for clarity around the conclusion that the remobilization of oil within the stream could "result in a net benefit". Dr. Stephenson described the scenario of oil initially being deposited in a spawning area, and later being remobilized by a flood event, causing it to be redeposited, at which point it would be "more dispersed, more spread out" and would have "had the benefit of additional weathering which will remove more of the… toxic components of the oil". 18514-18527

Ms. Graff asked about sinking oil, questioning whether the sunken oil in the Kalamazoo River was all a result of sedimentation, which Mr. McHugh confirmed. She then asked about the water quality reports used to determine sediment concentrations in the ecological risk assessment. Dr. Horn explained that some sources were found that characterized suspended solids for the Kimitat River, and that missing data was generated by augmenting what was available "using professional judgement based upon surrounding rivers and surrounding regions to fill in the gaps". Further discussion continued around suspended solids calculations and the role the solids play in dispersing oil in a river. 18529-18564

Discussion continued, with Ms. Graff asking about the information given on oil spills in flood events, asking if the oil ends up in a river's estuary in such a case. Dr. Horn explained that in spills, oil usually ends up along a river's shorelines or moving to a slow water point, where it eventually sinks. Further discussion continued, with Dr. Horn providing further details on the fate of oil in rivers and ashore.18566-18574

Ms. Graff asked why the risk assessment didn't account for a scenario where slope failure caused both proposed pipelines to fail. Mr. Cavers indicated that the NGP route had avoided deep seated slides, which are the mechanisms that could cause such a scenario, explaining that such a scenario would be very rare. 18576-18582

Adverse effects

Turning to assessment of chronic adverse effects, Ms. Graff called up Exhibit B80-3, Adobe 113, and asked what NGP means by "*the magnitude of the adverse environmental effect*". Dr. Stephenson mentioned the *Environmental Assessment Act* process which provides environmental components for consideration. He then explained that in the given context, the term refers to the effect of the chemical insult of a spill scenario, which is based on concentrations of hydrocarbons in the environment and its exposure or

ingestion by the key indicators evaluated in the risk assessment. Discussion on the topic continued and Dr. Stephenson provided further details about adverse effect estimations for aquatic organisms and wildlife. 18584-18602

Long term versus acute effects of exposure

Ms. Graff asked if duration of effects indicates the time toxic effects occur, or the time the environment remains impacted. Dr. Stephenson explained two scenarios, one being acute effects assessment, which is based on a 96 hour duration of exposure, and the other the chronic effects assessment, looking at 4 weeks after a spill and 1-2 years after a spill. Mr. Green called up Exhibits B3-20 and B3-21, referring to a section that discusses types and ranges of effects of exposure to hydrocarbons. 18604-18617

Noting a passage that states that consideration was given to either chronic effects or immediate effects of spills, Ms. Graff then asked if a risk assessment shouldn't consider both, in either an acute or long-term case. Dr. Stephenson referred to the Exxon Valdez spill and spoke about "extremely weak evidence" that return rates of fish were decreased as a result of early exposure to hydrocarbons. 18619-18632

Ms. Graff asked further questions about the use of SIMAP data, noting that NGP used it to predict chronic effects, yet SIMAP is not designed to address long-term exposure to pollutants. Dr. Horn spoke about a team-based approach to assessing effects of oil spills, and Ms. Graff responded, asking if NGP's approach is a standard approach to assessing chronic effects. Dr. Stephenson explained that assessing long-term effects of oil spills has rarely been modelled before, so he felt that they have "broken new ground", noting that oil spill concern has "traditionally" been based on acute effects. 18634-18642

Ms. Graff called up the ecological risk assessment, Exhibit B80-3 at page 114, and asked if a statement on the page implied that concentrations could cause adverse effects to fish eggs in gravel. Dr. Stephenson indicated that the Chickadee Creek was an example of a very small creek, which having a large amount of oil enter it, would result in "a very high potential for very high sediment deposition of oil", whereas they found that deposition in the larger rivers was "fairly light". 18644-18653

Spill effects on fish

Ms. Graff asked if one could infer that in some cases, a spill may result in above average concentrations, and thus cause deformities in fish embryos. Dr. Stephenson indicated that concentration levels will vary across areas, noting that their study found "average condition to be below concentrations that we would expect to cause harm", with some areas experiencing "adverse effects on the benthic habitat and potentially spawning areas", but "not a complete destruction of all habitat". 18655-18658

Referring to the bottom of the same page, Ms. Graff noted predictions of rapidly declining TPAH concentrations to "below effects thresholds", and asked if this prediction was reflected in the real life experience of the Marshall spill in Michigan. Dr. Stephenson couldn't speak to the Marshall spill, but pointed to a sentence on that page (114) that provides details pertaining to persistence of oil and effects in spawning shoals, noting that

previous studies have shown that within 4-8 weeks, “there is no significant residual toxicity of that oil to developing embryos”. 18660

Ms. Graff followed up, stating that her previous question was not about lab studies, but about whether such decreased concentration was observed in the Kalamazoo spill. Dr. Stephenson did not speak to the Kalamazoo spill, but noted “there are certainly environments where oil can be more persistent”. 18689-18690

Returning to a previous passage in the same exhibit that refers to interference with reproductive capacity of fish, Ms. Graff asked for clarity around what portion of the reproductive capacity would be lost. Dr. Stephenson spoke about effects being dependent on the life stage of fish at the time of a spill, while also reiterating his earlier comments about a spill not affecting all areas of a river, indicating that an entire fish population of a river would not be likely to be affected by a spill. 18692

The discussion continued with Ms. Graff seeking agreement that significant ecological effects could result years after a spill from “multiple year-classes of species being affected”. Mr. Green responded by speaking about the “fundamental problem of trying to predict the outcome of a spill scenario in terms of scope, magnitude, duration and frequency.” He continued by pointing to Exhibit B3-20, page 65, where NGP points out that in cases of acute toxicity “*the population could take several generations to recover without the overlap in cohorts common to other salmonids.*” He also spoke about the importance of pipeline design in terms of reducing risk of failure and response mechanisms. Mr. Doering added his thoughts on mitigation measures related to design, construction and operations. 18702-18717

Addressing other effects of spills

Discussion turned to the organization of the Ecological and Human Health Risk Assessment. Ms. Graff asked why the report focuses on toxic effects of a spill, without addressing the full range of consequences. Mr. Green spoke about the general organization of the assessment and spoke about the intent to “get at very site-specific exposure scenarios and then make predictions about what that might mean to sensitive fish species”. 18721-18728

Ms. Graff continued with questions about whether the assessment had addressed certain effects of spills, such as oiling of fish scales, and secondary environmental effects such as loss of prey. The witnesses provided general examples of such effects being addressed. 18721-18730

Calling up Exhibit B80-3, Adobe 7, Ms. Graff noted that fish aren’t considered a food source for grizzly bears in the assessment, and asked for clarification of this. Dr. Stephenson explained that bears’ exposure to oil through salmon was “deemed to be inconsequential” and that he thought bears would be more likely to be exposed to oil by walking on shorelines and sediment that were oiled. 18750-18755

Moving to page 115, Ms. Graff asked the witnesses to reconcile seemingly contradictory statements about the expected duration of effects of a spill, with what is described in the

executive summary. Dr. Stephenson spoke about the high degree of variability in the effects of a spill, adding that what is found in the executive summary is brief and less detailed than what is found elsewhere in the assessment. 18757-18770

Referring back to the same page, Ms. Graff noted the statement, *"The effects of a hydrocarbon spill would be reversible with recovery taking place over time"* asking if this would be true for endangered species. Mr. Green spoke about high-risk or small populations being susceptible to extirpation, and the importance of protecting spawning grounds. 18772-18791

Following Mr. Green's answer, Mr. Graff asked if he could agree that NGP can't guarantee spill effects would be reversible in every case for every species. Mr. Green agreed, but stated the unlikeliness of an event causing irreversible damage. 18793

Spill response activities

Ms. Graff identified that the risk assessment is based on unmitigated spills, but noted that in many cases, reference is given to reduced effects because of spill response activities. She asked what strategies could be used to remove toxic components of oil from water columns or sediment. Mr. McHugh spoke about the importance of limiting oil reaching a river, as well as the development of longer-term remediation plans. 18801-18810
Taking Dr. Horn to Volume 92, Ms. Graff asked for details of how NGP would plan to remove oil from the river within 48 hours of a spill to prevent adverse effects, as he had stated at paragraph 13995. Dr. Horn talked about the entire response plan being "focused on limiting the amount of oil that gets into the river and removing surface oil". Discussion moved to the challenges of entrained or dissolved oil in a water column. 18812-18837

Condensate spills

Ms. Graff asked what mitigation measures would be used in the event of a condensate spill. Dr. Taylor answered that the same response procedures would apply, such as stopping the spill as soon as possible, and isolating sensitivities, noting that the majority of it would evaporate. Discussion on recovery of condensate continued. 18839-18854

Ms. Graff asked the witnesses to comment on the difficulty of "responding to a spill before significant portions of rivers are oiled". Mr. McHugh reiterated Mr. Langen's earlier objections that the subject had already been adequately addressed at Prince George. He spoke about the importance of source control and having access along the right-of-way. Mr. Cavers added comments about diversion structures and Dr. Taylor added his thoughts about avoiding spills and having "world-class response capabilities". 18870-18878

Impacts of spill response efforts

Based on a net environmental benefit analysis, Ms. Graff asked for agreement that in-river response strategy would likely result in unacceptable damage to critical habitat. Mr. McHugh didn't agree and Ms. Graff clarified that she interpreted NGP's evidence to show that sensitivity species are present at all times in the rivers in question. Discussion continued and Ms. Graff asked about circumstances where NGP has identified no active

response as the strategy for dealing with a spill, which Mr. McHugh called "natural attenuation". Discussion continued around the implications of this strategy, and general objections to the question. 18883

Discussion proceeded around response priorities, and where oil presents the most risk to aquatic life, with similar responses to those previous, from the witnesses. 18899

Bringing up Exhibit B132-2, Adobe 31, Ms. Graff noted the assessment doesn't assess secondary effects of a spill, and asked why consideration wasn't given to disturbances caused by clean-up efforts or combined effects. Dr. Stephenson again stated that the Ecological and Human Health Risk Assessment had a specific purpose and was not intended to repeat the environmental assessment. He commented that flood plains are "naturally subject to regular disturbance", and would quickly recover from clean-up activities. Ms. Graff inquired further about impacts of response efforts. 18908-18933

Discussion moved to clarifying NGP's statements about regeneration of shoreline plants following a spill in Exhibit B80-3, Adobe 114, with Mr. Green talking about different plants requiring different response approaches, pointing to a section on the subject in Exhibit B3-20, Adobe 55, and other witnesses speaking of the general recovery capabilities of plants following exposure to oil. 18935-18951

Assessment findings and implications for response management plans

Ms. Graff then asked about conservative assumptions used in the assessment, asking if refinement would be done using more realistic assumptions for design and management decisions. Dr. Stephenson indicated that NGP felt it had reached appropriate conclusions in the assessment for management purposes. 18961

Calling up Exhibit 80-2, Adobe 24, Ms. Graff noted that risk assessment results will be used for pipeline design, emergency response plans and site rehabilitation. She questioned what the value of modeling is given that it is considered unrealistic because of conservative estimates being used. Mr. Green spoke about the intention to be as realistic as possible in the assessment and mentioned the rarity of using such a realistic approach in pipeline proposals. Mr. McHugh added his thoughts. 18982

Examination by Ms. Cheryl Brown of Douglas Channel Watch 19004

Protection of the Onion Lake Aquifer Lack of information for detailed engineering

In the last panel, NGP talked about the difficulty of cleaning up groundwater.

Ms. Brown asked what the impact of a spill could have on the aquifer at Onion Lake Flats and whether or not NGP will be looking at the impact of a spill on the aquifer and the impact of the Kitimat River as a result of that spill.

Mr. Carruthers admitted that the Onion Lakes Flats is within the Kitimat River watershed and the report did not deal with Onion Lake Flats. 19065

Mr. Anderson, summarized NGP's position with, "In our response to [your IR 2.10(a)] we say that during detailed design and engineering we would look to see if any additional design features were required for the pipeline over the aquifer." 19087

Avalanche hazards limiting site access during an spill event

Ms. Brown asked whether or not avalanche hazards could limit access to a site in the event of spill. [Exhibit 83-10] Mr. Cavers responded that critical [response] routes would be examined from an ongoing avalanche control perspective. 19089

Threats from third-party damage

Referring to Exhibit 83-8 Ms. Brown asked for clarification of third party damage. Mr. Cavers explained that in this case third-party is activities related logging. Ms. Brown asked whether this included debris flows that occurred as a result of logging in previous times. Mr. Cavers and Mr. Doering explained how NGP has designed for debris flows.

Restricting access for recreation and hunting

Ms. Brown asked if there would be a restriction to the recreational access or hunters as a result of access management? Mr. Anderson responded that some areas may have restricted access and other areas may have enhanced access. This will be developed in consultation with interested parties. 19132

Examination by Ms. Jennifer Griffith of the Haisla Nation 19142

Expansion of the tank terminal capacity by 88 percent

[Exhibit 182-2] Mr. Doering confirmed that NGP has increased the working capacity of the tank terminal by 88 percent, sixteen tanks for oil, three tanks for condensate; that any one of the 19 tanks could be used for oil; and that no additional tanks would be required for an expanded output of 850,000 barrels per day (bpd) of oil and 275,000 bpd of condensate. Mr. Doering added there are four anticipated oil commodities – two synthetic oil blends and two diluted bitumen blends. 19144

Mr. Doering confirmed that the four commodity groups are conventional light and heavy oil, synthetic oil, bitumen blended with condensate and bitumen blended with synthetic oil. 19376-19381

ESA – expected changes due to increased tank terminal capacity

Mr. Green asked if the current ESA contemplates the new layout and design. Ms. Griffithhe questions, "the answer is Northern Gateway doesn't know?" Mr. Green responded, "while some number may change slightly, the overall conclusion of the significance of the effects would not change."19201

Ms. Griffith asked a second set of questions regarding new height of tanks and Mr. Doering responded that "there may…be greater excavation at one end of the site and a greater amount of fill at the other end of the site, so [the change] is not necessarily less excavation or resulting higher base elevation of tanks. 19205

Changes to toll rates as a result of capital costs from changes to tank terminal

Ms. Griffith asked a serious of questions about the level of cost estimates. Mr. Doering confirmed that the cost estimate currently contained in the application is "unclassified", and not Class 4 or 5. 19211

Ms. Griffith sought understanding on the range of certainty for a Class 5 cost estimates from minus 20 percent to minus 50 percent on the low end and plus 30 to plus 100 percent on the high end. Mr. Doering agreed and added, "As an unclassified estimate we don't actually put an uncertainty range on the numbers." 19240

Ms. Griffith asked, "We know that cost will go up as a result of the increase in tanks but we don't know whether the current estimate might go up more than 25 percent since there's no Class 3 cost estimate, is that correct?" Mr. Doering: "That's why we're doing a Class 3 estimate – which depends on what's happening in the construction industry, [so therefore] we want to do a Class 3 estimate as close as possible to the time of construction. 19255

Ms. Griffith asked, "If the construction costs are actually 25 percent higher than currently estimated, could it have ripple effects throughout the application that go as far as the economic case?" This questions was shut down because the Class 3 cost estimate was canvassed in Prince George.

Small leak detection – presence of oil sheen on water

Ms. Griffith asked for clarification between Exhibit B80-3 and B132-2 which stated, "..highly unlikely that a small leak occurring for an extended period would result in a larger volume released to a watercourse." 19297

Mr. Stephenson explained that oil from a small leak would reach the river slowly (because the oil would have to flow through the soil) and it would be detected very quickly because the presence of the sheen. 19289

Mr. Anderson agreed that a sheen of oil on the water would require someone to be there, either by over flights or other monitoring activities. Ms. Griffith asked, "[…] how often the Upper Kitimat would be flown?" Mr. McHugh responded, "either biweekly or weekly [and] there's a meteorological component [in terms] of scheduling flights." 19305

Ms. Griffith was unsuccessful in linking "small leak detection" with the theoretical leak detectability level for a 2 hour alarm. 19309

EHHRA- Ecological Human Health Risk Assessment

Dr. Horn confirmed that many data parameters form the underlying basis that is utilized by the model. 19322

Data points for velocity

Ms. Griffith asked about the calculation of the velocities in Exhibit B80-4, page 77. Mr. Horn went into detail about the methodology for measuring the velocity of the Kitimat River. 19331

Ms. Griffith asked about Dr. Horn's comment to Mr. Overstall [Transcript Volume 97, line 21224] where he said, "there were a couple more data points for the Kitimat River than the Morice. Mr Horn confirmed that the phrase "couple more data points" is referring to decades of data in one location. 19390

Dr. Horn explained the use of the Jobson relationship in the model, the use of the 3D model taking into account islands and complex channels, and temperature of the water. 19405

Receptor Species

Dr. Horn clarified that the model assumed that any receptor could be at any location. 19421

Representative flow

Dr. Horn stated that he believed that they modelled the river at a representative high flow and representative low flow case, which encompasses a good portion of the season. 19449

Hyporheic flow

Ms. Griffith and Dr. Horn discussed 3D modelling (19454) including BF hydro modelling and Super-critical or trans-critical flow (19466).

Dr. Horn confirmed that topographically induced hyporheic flow is found in the Kitimat River, and their SIMAP modelling did not simulate hyporheic flow in the acute phase. Although all of the oil that did make its way to the sediment for the chronic phase of the assessment was considered to be incorporated by hyporheic flows. Regarding the SIMAP model not indentifying the depth to which the spilled oil could be expected to penetrate the riverbed sediments as a result of hyporheic flow, Dr. Horn responded that one cannot specifically model all of the hyporheic flows at every point down the river without a great deal of information. 19473

Increased PAH concentrations increasing toxicity.

Ms. Griffith summarized that in the EHHRA, the modelling of acute and chronic toxicity of spilled oil to fish focused on the toxicity of PAHs. Ms. Griffith asked, "Do you agree that the potential effects from PAHs on fish would increase with increasing concentrations of PAHs in the spilled oil?" Dr. Horn replied, "It is one factor, yes". Asked whether increasing PAHs would decrease toxicity, Dr Horn replied, "I think it's unlikely, but.…it's just one factor." 19487

Dr. Stephenson confirmed that in the EHHRA modelling the total PAHs (TPAH) concentrations in the diluted bitumen, synthetic oil and condensate were measured by NGP at 1,653 milligrams per kilogram. [Exhibit B80-2 pages 65 to 73]

PAH levels used in modelling and no restrictions of PAHs through tariff

Ms. Griffith referred to the chart on page 75 which listed the TPAHs in a number of crude oil products ranging from 1,093 to 10,639 milligrams per kilogram. She noted that

NGP has identified representative products that are at the lower end of this range as a representative of what would shipped in the pipeline.

Ms. Griffith if NGP will be shipping products with potentially higher TPAHs in its pipeline. Mr. Anderson replied, "We do not have restrictions on total PAHs currently…". He also confirmed that it's currently not NGP intention to have in place restrictions through its tariff that would prevent the shipping of Alberta sweet mixed blend. 19500

As well, Mr. Anderson confirmed, "Our tariff […] would not affect shipping of [anthracene, flouranthene and pyrene]. 19514

Effects of six-fold higher concentrations than what used in the modelling

Ms. Griffith asked, "So the highest concentration of PAHs that could be shipped through the pipeline is over six-fold higher than the concentration used in the modelling for NGP's EHHRA?" 19516

Dr. Stephenson agreed but clarified that there are many factors regarding the questions of toxicity of oil. He said, "Increases in the total PAH concentration ranges that you've talked about would have an influence on the overall toxicity of the mixture but it wouldn't change our conclusions that a large oil spill will have significant affects on the ecology of the river." 19519

Ms. Griffith asked, "…would the higher PAH levels suggest a higher likelihood for chronic effects?" Dr. Stephenson responded, "Not necessarily". NGP evaluated chronic effects using two models. The narcosis model which looks at the entire suite of hydrocarbons and the toxicity threshold which was based on total PAH that used a threshold value of 1 microgram per litre (mg/L) of total PAH. He explained that 1mg/L is a lower edge of the toxicity threshold (the range is between 1 and 100 mg/L). NGP had a "great difficulty" seeing hydrocarbon concentrations in the hyporheic zone that would reach 1mg/L and the lowest range at which we see mortality beginning would be 5 mg/L. He concluded, "we're quite comfortable that that minor difference between hydrocarbons and their total PAH suite would result in numerical changes in the analysis but in terms of changing our broad conclusions, I wouldn't see any change in our conclusion."

Chronic effects using shoreline soil and river sediment modelling

Ms. Griffith referred to Exhibit B80-12, page 3 and summarized that the primary input for the shoreline model and river sediment model the amount of oil stranded or deposited on the basis of the SIMAP model. She asked if there were additional or secondary inputs. 19531

Dr. Stephenson responded that they assumed there would be preliminary removal of visible oil and the maximum residual hydrocarbon concentration would be no more than 1 kilogram of oil per square metre. The other major modifier (input) would the composition of the hydrocarbon itself by pseudo-components.

Ms. Griffith pointed out that on page 5, three primary processes are listed. One of them is described as "dissolution and downward transport of individual COPC (chemicals of potential concern) stranded in shoreline soil to the river environment." She asked, what happens when it re-enters the river environment? 19535

Disregard of downward transport of residual oil

Dr. Stephenson clarified that the small fraction which would be transported downwards did not re-enter the river in our modelling environment. "It was disregarded." He continued, "that did not actually link back into the river model. We were looking at the fate of oil on the shoreline soils and forecasting what conditions of residual hydrocarbons in shoreline soils would be… after the initial spill. […] most of the oil would evaporate or remain in situ. The downward transport was a minor component and we did not mathematically redirect those fractions that went down and back into the river." 19539