BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of: Application No. 2013-01 TESORO SAVAGE, LLC TESORO SAVAGE DISTRIBUTION TERMINAL	CASE NO. 15-001 SWORN PRE-FILED TESTIMONY OF ELLIOTT TAYLOR, Ph.D.

I, Elliott Taylor, state as follows:

1. I swear under the penalty of perjury of the laws of Washington and the United States that the following testimony is true and correct.

2. I am over eighteen years of age and am otherwise competent to testify in this case. My testimony is based upon my education, training, experience, professional qualifications, and understanding of the matters herein. Based on my professional experiences, training, and education, I have developed an expertise in oil spill and emergency planning, preparedness and response, and oil fate and behavior.

I. INTRODUCTION, EDUCATION AND PROFESSIONAL BACKGROUND, AND OTHER QUALIFICATIONS

3. My name is Elliott Taylor, and I am a Principal and Senior Scientist with Polaris Applied Sciences, Inc. I earned a Bachelor of Science degree in oceanography from Universidad Autónoma de Baja California, received graduate training at the Scripps Institute of Oceanography at the University of California San Diego, and earned a doctorate in oceanography from Texas A&M University. I have taught undergraduate and graduate level courses in geology and oceanography, and have taught courses world-wide on oil spill planning and preparedness. I have also conducted extensive field and laboratory research on beach and offshore sediment properties, oceanography, and oil fate

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and persistence. I am recognized as an oil spill expert by the International Maritime Organization (IMO), a United Nations specialized agency with responsibility for international shipping and prevention of marine pollution by ships, and the IMO has recommended me to lead multiple oil spill preparedness programs for several different sovereign governments. My CV is attached as Attachment A to my testimony.

4. I have more than 27 years of experience in preparing for and responding to major oil spills, with an emphasis on shoreline response. I have worked on more than a dozen oil spills, including the following: Exxon Valdez Alaska (1989 and follow-up through 2006), Barge 101 Alaska (1992), Greenhill blowout Louisiana (1992), New Carissa Oregon (1999), Transredes pipeline Bolivia (2000-2001), Johnson Creek Oregon (2004), SOTE Pipeline Ecuador (2004), Torm Mary Texas (2005), Barge PB20 Washington (2005), Selendang Ayu Alaska (2004), Kab 121 Well Gulf of Mexico (2007), the Deepwater Horizon Gulf of Mexico (2010-2014), Lemon Creek British Columbia (2014), and Poplar Pipeline Montana (2015). I have also been responsible for the preparation of more than 100 oil spill contingency plans for companies throughout the United States, Canada, Caribbean, South America, the Middle East, Africa, and Russia which describe in detail the procedures that would be used to control, contain, and recover oil if a spill were to occur. These oil spill contingency plans encompass the range from facility plans, to pipeline and shipping operations, to National Contingency Plans (NCP). My work with American Petroleum Institute (API), IOSC (International Oil Spill Conference), United States Coast Guard (USCG), and the IMO led to the development of an international guide and tools that are used for gauging oil spill preparedness and evaluating emergency response plans (*see* references and the ARPEL RETOSv2 application).

II. SCOPE OF ANALYSIS OF THE TERMINAL'S IMPACTS

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5. I am familiar with the Vancouver Energy Terminal Project. I have personally reviewed materials submitted for the Application for Site Certification, Applicant Tesoro Savage Petroleum Terminal LLC, d/b/a Vancouver Energy's (hereinafter, TSPT or the Applicant) Preliminary Draft Environmental Impact Statement (PDEIS) and the Energy Facility Site Evaluation Council's Draft Environmental Impact Statement (DEIS). I also worked with a team of Tesoro, TSPT, and Primary Response Contractor (PRC) personnel on a two-day tabletop exercise in January 2016 analyzing the spill response actions typical of the first 24-48 hours for worst-case discharges from the facility. The tabletop exercise comprised two scenarios: a spill of Bakken crude and a spill of dilbit (Canadian oil sands product).

6. In my work for the Applicant and for this testimony, specifically, I was asked to:

- Explain and evaluate the oil spill response planning requirements (federal and state) for the facility and associated transport systems (tank vessels and rail);
- Assess the fate and behavior for hypothetical spills of Bakken crude and dilbit with particular attention to the Columbia River; and
- Opine on the ability of the proposed response capabilities (TSPT, Tesoro, Mutual Aid, and Contracted PRCs) to mitigate hypothetical spill scenarios.

7. In addition to my education, experience, and knowledge gained from my work in spill response planning and actual spill response in Washington and Oregon, I have considered the following materials in writing my declaration: PDEIS, DEIS, the Comments Letter re: DEIS, regulations (i.e., Code of Federal Regulations, the Washington Administrative Code), etc.

III. ANALYSIS

A. <u>Regulatory Framework</u>

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8. While I have not quantified the probability of a spill event, in general, the likelihood of a major spill is low, given the control and prevention measures proposed and in place. Regardless of the low probability, oil spill contingency measures must be planned and in place to mitigate the potential effects of a release. The main applicable statutory and regulatory authorities governing spill response and spill prevention planning are codified in state and federal laws, including the following:

- Oil Pollution Act of 1990 (OPA)
- Washington State Oil and Hazardous Substance Spills Act (1991)
- U.S. Environmental Protection Agency's (EPA) Oil Pollution Prevention (SPCC) and Spill Contingency Plan requirements, 40 C.F.R. Part 112 and Subpart D
- EPA's Resource Conservation and Recovery Act Contingency Planning Requirements – 40 C.F.R. § 265, Part D
- USCG Facility Response Plan requirements, 33 C.F.R. § 154
- Washington State Department of Ecology (WDOE) Oil Spill Prevention and Contingency Planning requirements – WAC 173-180 (Part F) and -182
- WDOE Safe and Effective Pre-booming Thresholds, WAC 173-180-224
- WDOE Pre-loading Transfer Plan, WAC 173-180-230
- USCG and WDOE Facility Operations and Transfer Manual, 33 C.F.R. § 156 and WAC 173-180-400
- WDOE Oil Transfer Training and Certification program, WAC 173-180 Part E

9. Congress enacted the federal OPA after the Exxon Valdez oil spill in 1989. The OPA strengthened the prevention, planning, response, and restoration efforts associated with oil spills. The OPA established liability for parties responsible for spills, set technical requirements for vessels that carry oil and for facilities that store or transport oil, and established an oil spill liability trust fund.

10. The State of Washington adopted the Oil and Hazardous Substance Spills Act (OHSSA) in 1990, also in response to several major oil spills. OHSSA, as amended by the 1991 Oil Spill Prevention Act, requires plan holders to prepare for their worst case spill, as defined by the regulations, by conducting drills, pre-positioning equipment, and

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training personnel. The statute directs WDOE to develop rules for setting minimum standards of compliance for facilities and vessel contingency plans, and for primary response contractors, in order to better prepare and respond to oil spills in Washington State.

11. As described in more detail, below, the federal OPA and the state OHSSA establish a system of tiered local and regional planning levels for oil spill prevention, mitigation, and response. Additionally, these statutes and accompanying regulations create planning and spill response requirements for individual facilities.

i. Federal Planning Requirements and Structure

12. The National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300, commonly referred to as the NCP identifies the national priorities for spill response and provides the general framework for efficient, coordinated, and effective spill response action. The EPA publishes the NCP in consultation with the National Response Team (NRT), which consists of 16 federal agencies with focus on various aspects of emergency response to pollution incidents. The NCP establishes a tiered system of regional and local contingency plans, under the direction of the Federal On-Scene Coordinator (FOSC), including a Regional Contingency Plan (RCP) and Area Contingency Plans (ACP).

13. The RCP is modeled after the NCP and adds information specific to the region. Regional Response Teams (RRT) write the RCP. The RRT consists of designated representatives from key federal response and support agencies together with affected states.

14. ACPs provide response planning for sub-regional geographic areas. The NCP designates each Area and creates area committees which are comprised of personnel from federal and state agencies that coordinate response actions with tribal and local

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governments and with the private sector. These area committees, under the coordinated direction of FOSCs, are responsible for developing ACPs. Area committees are also required to work with the response community to develop procedures to consider the use of alternative response measures.

15. ACPs provide detailed information on response procedures, priorities, and appropriate countermeasures by identifying response resources, cleanup strategies, and resources at risk within the area. These plans also identify appropriate spill response techniques (and appropriate conditions for their use), including: mechanical containment and recovery; dispersants and other chemical countermeasures; in-situ burning; shoreline cleanup; and natural removal.

16. Additionally, there are Local Emergency Response Plans that are part of the tiered response under the federal plan. Local emergency response plans are produced by Local Emergency Planning Committees (LEPCs). LEPCs have membership from government agencies, including local fire, police, emergency managers, industry, citizens, and other interested parties. These plans guide local efforts in responding to spills.

17. In addition to these regional plans, the OPA requires vessel and facility owners that handle oil as cargo to develop detailed plans to immediately respond to an oil spill. At the federal level, these plans must be approved by the USCG and the EPA for marine transfer-related facilities such as the Vancouver Energy Terminal. In their plans, facility owners have to document their agreements with oil spill response organizations (OSROs), and be tested regularly. These plans are known as Facility Response Plans (FRPs). The graphic (right) depicts the organizational structure of the oil spill contingency and response plans in the United States.

ii. State Requirements

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18. In addition to the federal planning framework, Washington's OHSSA, as amended and codified in RCW 90.56 and elsewhere, includes its own planning mechanism.

19. It is my expert opinion that the State of Washington's laws and regulations represent some of the most stringent requirements on spill prevention and response preparedness in the US and worldwide. The planning requirements defined in regulations for facilities, vessel, and rail (currently in public review) exceed response times and capabilities defined at the Federal level as well as for most states.

20. The North West Area Contingency Plan (NWACP) has been adopted as the state's Oil and Hazardous Substance Spill Prevention and Response Plan (or Statewide Master Plan) as required by statute (Chapter 90.56.060 RCW). The NWACP has been developed in consultation with multiple entities including the USCG, EPA, state agencies, local governments, tribal representatives, port districts, private facilities, environmental organizations, oil companies, shipping companies, containment and cleanup contractors, tow companies, and hazardous substance manufacturers. The NWACP identifies the responsibilities of state and local government, federal agencies, facility owners, and property owners whose land could be affected by a spill in the prevention, containment and cleanup of a worst case spill, and emergency response to the same. It also identifies actions necessary to reduce the likelihood of spills and establishes an incident command system for responding to oil and hazardous substances spill.

21. Washington statute and regulations also require companies and vessels that handle or transport crude oil or refined oil products as cargo to have a government-approved contingency plan for preventing and responding to spills. This plan must be a written document that describes how the plan holder will respond to an oil spill, train its personnel, and what equipment they will have access to in case of a spill. WDOE focuses

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on three major areas of these contingency plans: planning standards, a drill program, and primary response contractors.

22. Planning standards are used to prepare for a worst case spill situation. The planning standards include requirements for oil spill assessment, boom, recovery, storage, in-situ burn, dispersants, shoreline cleanup, aerial observation, and workboats. Contingency plans are required to describe how the plan holder will meet the planning standards given its unique location, facility, and operations. To meet the planning standards, plan holders must use PRCs, who have been approved by the State. To become a State-approved PRC, a contractor must be able to provide 24-hour per day contact for spill response and commit to begin mobilization efforts within one hour from notification of a spill.

23. Washington State's spill exercise, or drill, requirements are very similar to those found in the federal program. WDOE evaluates all drills and provides the plan holder with feedback on areas where its contingency plan is inadequate. In addition, WDOE shares lessons learned with all plan holders in the state and provides input to plan holders while they develop or update their plans.

iii. Implementation of Federal and State Planning Requirements in Vancouver, WA and Along the Columbia River

24. In the Northwest Area (defined as the coastal and inland zones of Idaho, Oregon, and Washington), the RRT and Area Planning Committee have joined together to accomplish all planning and preparedness activities and jointly publish the NWACP. The NWACP also incorporates the Statewide Master Plan required by the state's OHSSA. The NWACP undergoes regular review and updates. The 2016 version is available at: http://www.rrt10nwac.com/nwacp/.

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25. In addition to the main volume, the NWACP is made up of Geographic Response Plans (GRPs). GRPs are the strategic and tactical volumes of the NWACP and are site-specific plans for responding to oil spills in Washington, Oregon, and Idaho. The plans are tailored to a specific beach, shore, or water way. Each GRP has two primary objectives, which are to: pre-identify sensitive natural, cultural or significant economic resources; and give responders directions by prioritizing response strategies. The GRPs are developed to identify sensitive areas and resources in a geographic region that would be at risk from a spill in the area and the recommended strategies and tactics to mitigate impacts on those sensitive areas and resources if threatened by a spill. Facility or vessel response plans are required to address spill response priorities and protection strategies for a spill originating at their respective locations.

26. Given that Facility Response Plans (FRP) or Vessel Response Plans (VRP) must work in context of Area Plans, the GRPs are thus an integral part of the VRPs and FRPs. The strategies identified in a GRP serve as guidelines for responsible parties, federal and state agencies' coordinated efforts and are deployed during an oil spill. Each GRP has several chapters with a variety of information that is useful to responders, both in the initial hours and for longer periods of time if a response is sustained. Responders implement the directions listed in the GRP without delay while the responders also act to contain the oil and recovery it off the surface of the water. Over time, the GRP protection strategies are refined and supplemented based on field assessments and actual deployments (as part of spill response or exercises). The GRPs are available at: https://fortress.wa.gov/ecy/coastalatlas/storymaps/spills/spills_sm.html.

iv. Inspections

27. In addition to meeting regulatory compliance for spill prevention and response, the Vancouver Energy Terminal would be subject to regular inspections from

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federal and state agencies. The USCG, WDOE, and EPA each have the prerogative to visit and inspect the facility for compliance with regulatory matters. Furthermore, the Terminal will have its own inspection program, including inspections by external organizations. A summary of inspections is attached hereto as Attachment B.

B. Oil Types and Characteristics

28. In the United States, the EPA and USCG divide petroleum-based oils into five groups. *See* Attachment C.

29. The two major types of crude oil being considered for the Terminal are Bakken crude and crude oil products from the Canadian oil sands region. The Canadian Oil Sands Products (OSPs) include diluted bitumen products, or dilbits, such as Access Western Blend (AWB) and Cold Lake Blend (CLB) and light synthetic crude oils (synbits). The properties of these crude oils and comparison to other petroleum oils, and their likely fate and behavior relevant to the Vancouver Energy Terminal Project, are attached hereto as Attachment D.

30. Group 1 (non-persistent oils and refined products such as gasoline) tend to dissipate completely through evaporation within a few hours and do not normally form emulsions. Group 2 oils (such as Bakken crude) can lose up to 40% by volume through evaporation and some may form unstable to stable emulsions. Group 3 oils tend to lose less through evaporation and can form viscous emulsions. Group 4 oils (such as IFO 180 or Bunker B) are very persistent due to the minimal content of volatile hydrocarbons and their high viscosity, which preclude both evaporation and dispersion. Group 5 is meant to collectively classify oils with a density greater than that of freshwater.

31. Fate and transport are two phenomena that modify the properties and location of spilled oil, respectively. Many treatises are available that discuss the natural transport processes for spilled oil, generally associated with currents, turbulence, winds,

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and gravity (NRC, IPIECA, API, ITOPF)[1]. Once oil is spilled and exposed to the elements, it undergoes continuous compositional changes associated with weathering. Groups 2 through 5 oils can become denser as light-end hydrocarbons evaporate, and can potentially shift in behavior to a higher group. A spill to water will spread on the water surface and can be transported by currents as it continues to spread and fragment. Spills to land also will spread and move down slope, but the process is much slower compared to what happens in water. These transport processes are discussed in the DEIS, Ex-0051-PCE (DEIS, Chapter 4), and PDEIS, Ex-0004-PCE, (PDEIS, Appendices D and H of Oil Spill Contingency Plan).

32. As noted in the NW Area Planning Task Force 2014 report "Emerging Risks":

> [T]he characteristics of OSP, Oil Sands Products, and Bakken crude are well understood and fall within parameters that are currently addressed within the NWACP. While OSP does not pose any "new" spill threat, the focus on OSP has increased recognition that current fate and effects predictive modeling does not adequately address all aspects of the heavier Group 4 oils and more work in this area is warranted.

33. Similarly, extensive work has been done to understand natural oil weathering processes, such as evaporation, dissolution, water uptake or emulsification, and consequent oil properties changes (e.g., Fingas, 2011; NRC, 2003)[2]. Together, transport and weathering result in ultimate fate of spilled oil, whether that is as vapors to the atmosphere (evaporation), stranded on river banks, degraded to asphalts (such as

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[1] National Research Council, (NRC) 2003, Oil in the Sea III: Inputs, Fates and Effects; IPIECA/IOGP, 2015. Oil spills: inland response. IOGP Report 514, 36p.; IPIECA/OGP, 2015. Contingency planning for oil spills on water. OGP Report 519, 60p.; API 2015, Fact Sheet 3, Fate of Oil and Weathering (Oil Spill Prevention); ITOPF (Accessed May 2016) http://www.itopf.com/knowledge-resources/documents-guides/fate-of-oil-spills/weathering/

[2] Fingas, M., 2011. Oil Spill Science and Technology; National Research Council (NRC) 2003, Oil in the Sea III: Inputs, Fates and Effects

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through photo-oxidation), or biodegraded to simple compounds. Many of these are described in the application and are modeled through trajectory and weathering models (ex., the National Oceanic and Atmosphere Administration's (NOAA) GNOME and ADIOS2). More complex use of these or other models, not used for the DEIS, are those that combine these natural phenomena with assumed oil spill response countermeasures that can be expected to limit movement and modify variables in the weathering models.

34. Weathering processes include evaporation, dissolution, emulsification, sedimentation, microbial degradation, and photo-oxidation. Weathering changes the oil's physical and chemical properties. Fresh oil is more volatile, contains more water-soluble components, floats, is not very viscous, and more readily disperses from the source. Weathered oil initially loses volatile components, which are also the most water-soluble components, and the oil becomes more viscous and more likely to form more coherent slicks as opposed to spreading out in a thin film. Over time, weathering continues to change the composition of oil until it degrades in the environment, leaving behind only small quantities of residue (e.g., tar balls). Some of the oil (especially heavier oil) may mix with water and emulsify. Emulsions can be unstable (break down naturally and quickly once agitation or mixing ceases) to stable. Stable emulsions are more resistant to rapid weathering and more difficult to collect or treat relative to non-emulsified oil.

35. Although low probability, a spill from the facility or rail line is more likely to occur on land where typically oil will move slowly, without the aid of wind or water currents. A spill on land will migrate downslope and, depending on oil viscosity and soil permeability, a portion may infiltrate into the ground. For oil reaching a river or wetland, a portion of that oil can be expected to strand on the shoreline or bank and some may infiltrate into sediments, depending on oil volume and viscosity and sediment grain sizes (pore space). In addition to the limiting factor of pore space, presence of ground water and

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even water saturated soils tables will limit oil penetration. Where exposed, sunlight may photo-oxidize stranded oil as well as biological degradation.

36. The DEIS indicates that on sandy beaches oil can penetrate up to two meters (Mosbech 2002). In the Mosbech citation, there is no scientific evidence presented regarding this depth of penetration or the types of oils considered. Crude oils generally do not penetrate deeply into fine sediments. Very light oils, such as a Bakken crude, are able to penetrate meters in sand and coarser sediments given their low viscosity when fresh. As the crude oil weathers the viscosity of the residue increases and therefore is not able to penetrate into pore spaces as easily. Other conventional crude oils and dilbits have initially higher viscosities and will penetrate less into sands and coarser sediment compared to a Bakken crude. For medium crude oils, penetration into sand is usually on the order of centimeters.

i. Fate and Behavior of Bakken Crudes

37. Bakken crude oils are very light and relatively volatile crudes, classed as a Group 2 oil. Bulk properties of Bakken crudes fall into conventional light crudes (API gravity between 37 to 46) (Attachment C). A specific concern with Bakken crude is the flammability of the unweathered crude and associated air hazards. Air monitoring and sampling during a study conducted with a controlled release of Bakken crude at Ohmsett (2014)[3] showed:

- No Lower Explosive Limit exceedances above 10%. A maximum of 4.7% was observed at the location of release after 4 minutes.
- Hydrogen sulfide was detected at a maximum concentration of 0.2 ppm. One minute averages were normally below 0.04 ppm.
- Maximum verifiable Volatile Organic Compound (VOC) concentration of 138 ppm (west side of tank located within 5 feet of study area). The highest

[3] EPA, Bakken Shale Crude Oil Spill Evaluation Pilot Study (April 2015)

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verifiable one minute average was 67 ppm. Both were recorded within 5 minutes of the release.

- A maximum benzene concentration of 5500 ppbv was detected using an UltraRAE located 5 feet above the release point, during the release.
- A maximum benzene concentration of 2700 ppbv was detected in a Tedlar bag sample collected 5 feet above the release point, during the release.
- Charcoal tube results suggested a possible maximum concentration for an 8 hour TWA of 75.1 ppbv benzene.
- The Trace Atmospheric Gas Analyzer detected a maximum benzene concentration of 550 ppbv in downwind locations.
- About six hours after the initial release, verifiable VOC readings (1-minute average) were all below 5 ppm.

38. A significant portion of Bakken oil will naturally evaporate when exposed to air. If reaching water, spreading will be relatively fast relative to most other crudes and a portion of the hydrocarbon can be expected to dissolve into the water column. A portion also may naturally disperse into the water column provided mixing energy or turbulence. The fast spreading means that it may be challenging to boom if it has spread but then dissipation of product on water progresses faster through the natural weathering process. An example of how quickly Bakken crude naturally dissipates is provided by a couple of case studies.

39. A spill of 750-800 bbls of Bakken crude into the Mississippi River from a barge in February 2014 showed the oil spread quickly to form a light, milky sheen[4]. Pockets of oil were trapped within a barge fleet downstream and cleanup was limited to the immediate vicinity of the spill site and decontamination around the barge fleet. The total oil recovered was 2.3 bbl illustrating how quickly this light crude oil naturally

[4] NOAA presentation by Gulf of Mexico SSCs, February 2014. Bakken Crude Oil Spill, Barge E2MS 303, Lower Mississippi River, http://www.nrt.org/production/NRT/RRT3.nsf/Resources/May2014_pdf/$File/Bakken_Crude_Spill_E2MS303_Revised.pdf (accessed April 2016)

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dissipates. The spill resulted in closure of the river for 65 miles downstream for 2 days. No fish kills or oiled wildlife were reported.

40. In the case of the 2015 Poplar Pipeline release into the Yellowstone River, dissolved and dispersed Bakken oil reached a water intake 14 feet below surface, forcing the intake and treatment plant to shut down. Spill responders evacuated remaining oil in the pipeline between valves and recovered oil trapped under the ice immediately over the location of the pipeline crossing. Non-recoverable sheens were identified to a maximum downstream distance of 73 miles in the first few days following the release. As in the Mississippi spill case, natural evaporation and dispersion accounted for most of the light crude oil loss. No oiled wildlife impacts were observed or reported.

41. EPA water sampling during the Poplar Pipeline response showed[5]:

- The ice cover appears to have prevented the light, volatile components from evaporating, and provided the right conditions for benzene and other VOCs to dissolve into the water instead.
- Initial water sample results collected 2 days post-release showed that dissolved concentrations of benzene in the public water supply exceeded the drinking water standard of 5 parts per billion.
- Within one week of the initial release(23 January), MT DEQ confirmed the municipal water delivery system met the federal Safe Drinking Water Act standards
- Water sampling data from 5 and 10 days post-initial release (22 January and 27 January), at the water treatment detected toluene but only at the lower quantitative capability of the instrument (therefore reported as an estimated value); between 27 January and 23 February BTEX results were not detectable.
- On 14 March 2015, the ice on the Yellowstone River upstream of the spill site began to break at a very rapid rate. At that time the city shut down its water intake. VOC levels jumped from non-detect up to >200 ppb over the course of the day. By 17 March VOCs were at normal levels and normal operations were resumed for drinking water intake.

[5] EPA Region 8, Pollution Report #12 (FINAL), available at https://www.epaosc.org/site/sitrep_profile.aspx?site_id=9708&counter=23045; Bridger Pipeline Release, Water Treatment Plant Analytical Data Summary (Feb. 2015), https://www.epaosc.org/sites/9708/files/WTP%20Analytical%20Summary%2002-24-15.pdf.

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42. Given the low viscosity of Bakken crude, a spill may penetrate into and migrate through sand, mixed sediment, or boulder/riprap bank materials but is not retained effectively by the open pore space. On impermeable or clay surfaces, Bakken crude will simply spread. In porous materials, the crude would infiltrate and spread until reaching relatively impermeable soils or water, where it may continue to spread, diffuse, and undergo gradual degradation.

43. The lessons learned from research and spills reveal that Bakken crude oils quickly dissipate in flowing water but can be expected to persist longer if it infiltrates into soils. The rapid loss of volatile light ends in the first hours of a response presents safety concerns where oil is concentrated so that controls must be put in place to protect personnel from inhalation risks and to avoid accidental fire and explosion. As a very light crude oil, Bakken crude has a much shorter half-life in the environment relative to most other crude oils and its fate and behavior is similar to other Group 2 oils that have been transported and in use for many years.

ii. Fate and Behavior of Oil Sands Crudes

44. A major concern expressed with oil sands crude products is the inference that these OSPs are bitumen. Although these products are created from bitumen, the crude oil products such as dilbit are quite different from the raw bitumen. The generalized use of the term "bitumen" in place of the actual oil sand products is misleading as the properties and behavior of a raw bitumen are not the same as the for OSPs. For example, sections 4.5.3, 4.5.4, and 4.5.5 of the DEIS mischaracterize the densities of oil that the facility will handle because it improperly characterizes some oil types as "heavy" without reference to their actual density. That error is problematic for two reasons. First, these sections analyze impacts of oils the project does not propose receiving. The project does not propose receiving oil with a density of 1.01 g/cm^3. Therefore, the analysis in this section

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of the DEIS improperly considers oils of that density, and their impacts. The DEIS indicates that heavy oils have a density of 1.01 g/cm^3 and sink, and then draws conclusions regarding project impacts based on oils of that density with an assumption that those oils sink. However, the Terminal products all have a density of <1 g/cm^3 and therefore will not sink unless other processes are invoked.

45. The natural evaporation of light end hydrocarbons from a dilbit will lead to a heavier (denser) residue; however, it is important to note that experiments done on natural weathering show there is no phase separation of diluent and bitumen but instead the homogeneous blend has properties unique to the oil blend itself. The fresh and evaporated oils remained as homogeneous mixtures of soluble components. Meso-scale experiments conducted on natural weathering of OSPs in tanks and flumes showed that of the dilbits tested, most did not reach densities exceeding that of freshwater and none exceeded that of normal seawater (*see* Attachment E). The tank and flume experiment results show natural evaporation for two of the major export dilbits, AWB and CLB, in comparison to freshwater (1 g/cm^3) and seawater (1.03 g/cm^3) densities. AWB and CLB (under moderate agitation) approached freshwater density after approximately six days of weathering (SLRoss, 2012; WPW, 2013; King et al 2014)[6], further supporting the case that the crude oils proposed for handling at Terminal will not sink if spilled into water.

46. The Terminal oils have API of 15–45. Many oils with an API less than 22.3 API may be classified as "heavy" because of their density—but unless their API is

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[6] Witt O'Briens; Polaris Applied Sciences; Western Canada Marine Response Corporation, A Study of Fate and Behavior of Diluted Bitumen oils on Marine waters; Dilbit Experiments – Gainford, Alberta; Transmountain Pipeline ULC: 2013; p. 163.
King, T.L.; Robinson, B.; Boufadel, M.; and Lee, K. , 2014. Flume tank studies to elucidate the fate and behavior of diluted bitumen spilled at sea. Marine Pollution Bulletin 2014 83 (1). p32-37
SL Ross Environmental Research Limited. Meso-scale Weathering of Cold Lake Bitumen/Condensate Blend; Ottawa, Canada, 2012 Report prepared for Enbridge Northern Gateway. Filed with the National Energy Board, February 6, 2013

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equal to or less than 10, they do not sink in fresh water without invoking some other processes. Under appropriate conditions, floating oil may become fragmented and undergo vertical mixing and dispersion. Given sufficient energy and suspended particulates, the dispersed oil droplets may interact with suspended fine sediments (fines). The combined oil and sediment or organic matter, often referred to as OMA or OPA (oil mineral aggregates/oil particulate aggregates), may remain suspended in the water column or settle to the river bed depending on the aggregate density, water density, and local turbulence.

47. Effective OPA formation works best when sufficient energy is available to form small oil droplets; however, the more viscous nature of dilbit resists natural dispersion and the oil tends to break into fragments rather than disperse. Recent tests showed that dilbit-derived OMA was not readily identifiable in wave tank tests at various sediment concentrations and that non-"chemically" dispersed dilbit resists sinking[7].

48. The DEIS statement oversimplifies the OPA process and thereby drastically overestimates the amount of oil that would sink, and thus the impacts of the sunken or submerged oil. While oil weathering combined with suspended sediment interaction can lead to a portion of dilbit oil becoming submerged or sunken in the case of a spill, most oil will still float. In the case of the Kalamazoo River spill, a worst-case actual spill of dilbit into fresh water, most of the dilbit was recovered from the water surface. An estimated 15-18% of the spilled oil that entered the Kalamazoo River ended up attached to bottom sediments, of which a significant portion was released through agitation (poling, sparging) (Enbridge, 2013[8]; Dollhopf et al, 2014[9]).

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[7] Laughlin, C., Law, B., Zions, V., King, T., Robinson, B., and Wu, Y., 2016. The dynamics of diluted bitumen derived oil-mineral aggregates, Part 1. Canadian Technical Report of Fisheries and Aquatics Sciences.

[8] Enbridge, 2013. Enbridge Line 6B Response,

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49. In a review of OPA formation mechanisms, lab studies, the Kalamazoo case, and conditions prevalent in the Fraser River, researchers conclude that OPA formation is unlikely under most conditions characteristic of the lower Fraser River given that suspended sediment concentrations and energy levels of the study area are less than those in which OPA is observed to happen (Hospital et al., 2016)[10]. The same is expected to be true for the Columbia River, which tends to carry less sediment than the Fraser River. For cases of spills into flood plains in which sediment/organic matter interaction can be expected to be higher than within the river channel, or at contact points with shorelines, OPA formation may be a more significant process in terms of oil fate than conditions such as in the Columbia River.

50. In addition, the DEIS applies the same analysis to dense oils' capacity to sink with no acknowledgement or reference to the fact that water bodies have variable density. For example, estuaries have higher water density than freshwater riverine water; as a result, dense oils must be heavier in order to sink in an estuary environment compared to a riverine setting. Over the course of a 10-day weathering study of two dilbit products (AWB and CLB), no sinking was observed for oils exposed to various wind and wave conditions in estuarine water with salinities of approximately 15 ppt or in flume studies

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http://response.enbridgeus.com/response/main.aspx?id=12783 (accessed Sept. 2013)

[9] Dollhopf, R. J.; Fitzpatrick, F. A.; Kimble, J. W.; Capone, D. M.; Graan, T. P.; Zelt, R. B.; Johnson, R., 2014. Response to Heavy, Non-Floating Oil Spilled in a Great Lakes River Environment: A Multiple-Lines-Of-Evidence Approach for Submerged Oil Assessment and Recovery. In Proceedings of the International Oil Spill Conference Proceeding, Savannah, GA, 2014 pp. 434-448

[10] Hospital, Aurelien et al. Tetra Tech EBA, Vancouver, British Columbia, Canada.,2016. Stochastic Spill Modeling in Support of the Ecological Risk Assessment (ERA) of Hypothetical Pipeline Diluted Bitumen Spills in the Lower Fraser River as Part of the Trans Mountain Expansion Project, Proceedings of the 39th AMOP Technical Seminar on Environmental Contamination and Response, June 7-9 2016, Halifax Nova Scotia

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with seawater at 35 ppt (CRREL and SLRoss 2015; King et al 2014; SLRoss, 2012; Taylor et al., 2014; WPW 2013)[11].

51. A spill of dilbits to land or in contact with the river banks or shorelines would have very limited penetration into sand but could penetrate into pebble and coarser materials (Harper 2015; CRREL and SLRoss 2015)[12]. Retention would be expected to be greater for dilbit than Bakken should it penetrate into coarse riverbanks. Coastal and Ocean Resources (2013)[13] estimated dilbit penetration and retention on different substrates, assuming that weathered dilbit will: (1) have <1 cm of penetration in sands, < 5 cm in pebbles, and < 10 cm in cobbles (Harper & Kory (1995)); (2) retention of 300 L/m^3 for sand, 200 L/m^3 for pebble and 100 L/m^3 for cobbles (Harper & Kory (1995)); and (3) a layer of weathered oil above the sediments of 1 cm for rock, sand, pebbles and cobbles. These assumptions for a weathered dilbit are derived from extrapolating the Bunker C results, which may reasonably reflect weathered dilbit behavior but are not representative of fresh dilbit. CRREL and SLRoss (2015) found oils sands products penetrated to approximately 18 – 20 cm in gravel, but less than 10cm in sand, and only a few centimeters into mixed soil.

52. Extensive ongoing and recent research and the limited experience from OSP spills reveal that dilbit properties are likely to change quickly during the first days should a spill occur. Similar to many medium to light crudes, the rapid loss of volatile

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[11] CRREL/SLRoss, 2015. Investigation of the Behaviour of Diluted Bitumen and Heavy Conventional Crude Oil Spills. Final Report prepared for the American Petroleum Institute. 125pp plus appendices.
Taylor, E., Challenger, G., Rios, J., Morris, J., McCarthy, M.W., and C. Brown. 2014. Dilbit Crude Oil Weathering on Brackish Water: Meso-scale Tests of Behavior and Spill Countermeasures. Proceedings of the Thirty-Seventh AMOP Technical Seminar. Environment Canada, pp. 317 – 337

[12] Harper, John et al., Coastal Ocean and Resources, Sidney, British Columbia, Canada. Retention and Penetration of Diluted Bitumen Products in Coastal Sediments. Proceedings of the 39th AMOP Technical Seminar on Environmental Contamination and Response, June 7-9 2016, Halifax Nova Scotia;

[13] Coastal and Ocean Resources, 2013. Procedures for Estimating Oil Retention in Spill Modeling. Report prepared for Trans Mountain Pipeline

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light ends in the first hours of a response presents safety concerns where oil is concentrated so that controls must be put in place to protect personnel from inhalation risks and to avoid accidental fire and explosion. Relative to Bakken crude, dilbits have a longer half-life in the environment; however, the concern of sinking dilbit is seriously overstated as multiple lines of evidence show that most, if not all dilbit, will remain floating on water for days or longer.

iii. Trajectory and Mass Balance Analysis

a. Oil Movement and Trajectory

53. The trajectory analysis in the DEIS was completed based on a 48-hour worst-case spill condition[14]. The results of the analysis indicate that the geographic area of potential impact from an incident originating in Vancouver, Washington, within 48 hours of release is the Lower Columbia River from RM 105 (45°38'4.19"N, 122°42'10.55"W) to RM 47 (46° 8'40.52"N, 123°17'46.39"W), or approximately 58 river miles downstream from the terminal. In accordance with the requirements of WAC 173-182, and WAC 173-182-315 in particular, the worst-case discharge scenario is an unabated release over 48 hours of all the volume of oil in the largest tank on shore and it does not take into consideration any source control measures, which would be among the normal first steps in a spill situation, or containment (un-emptied tank, secondary containment). The trajectory also does not take into account any additional response containment or downstream boom operations that may divert oil to river bank collection points.

54. In the unlikely event of a spill that originates from a tank vessel or rail car into the Columbia River or offshore, currents and winds combined with natural spreading would transport oil generally down current. Current speeds vary depending on the river discharge and cross section, upstream or downstream winds, and tides at least upstream to

[14] DEIS, App. D.4; id., App. H.

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the Bonneville Dam. Personnel familiar with the TSPT location noted that the estimated current speed in the vicinity of the Facility dock is usually on the order of 1 to 3 knots and, in flood flows, may exceed 5 knots at the dock face[15]. Modeled current flow data for the project area from the NOAA Northwest River Forecast Center (Portland, Oregon) indicates that the monthly average current velocity ranged from 0.7 to 1.8 knots. The average current velocity used for the trajectories is 1.2 knots and provides a reasonable representative condition for transport and movement of the leading edge of an assumed oil slick.

55. Portions of a spill into the river, or nearshore, can be expected to reach shorelines, which is why GRPs are defined to minimize oiling and to protect priority areas. Oil that contacts the shoreline or river banks and vegetation may be stranded there, generally retarding the downstream movement along the banks.

b. Fate and Weathering

56. For the purpose of illustrating the fate and weathering of the two oil types considered for the proposed Terminal (Bakken crude and OSPs), a series of weathering models were completed using the NOAA ADIOS application, a tool that is internationally accepted and applied extensively in the US and worldwide. The spill scenarios illustrated assume the following conditions:

- Assumed spill volume to water: 2500 bbl (maximum most probable for a vessel)
- Current speed: 1 kt
- Wind speed: 5kts
- Wind direction: NW
- Water temperature: 47F

[15] DEIS, App. D.3; id., App. K; id. § 1.1.2.

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57. ADIOS modeling results show volume losses, primarily through evaporation, and changes in viscosity and density of the remaining oil (attached hereto as Attachment F). The most significant weathering changes for both crude oil types in the first 24 hours are similar to many other crude oils. More than 33% of the Bakken crude has evaporated compared to 24% for the CLB dilbit. In that first day, densities reach 890 (Bakken) and 979 Mg/m^3 (CLB), both of which would remain floating on the fresh water unless entrained through turbulence. If and where entrained, the oil would tend to resurface through natural buoyancy. Oil viscosity, which is a key factor for oil spreading and for skimmer and pump operations, increases minimally to 33 cSt in the first 24 hours for Bakken crude whereas a much more pronounced increase to over 3000 cSt occurs for dilbit.

58. Context for the general behaviors of Bakken and dilbit crudes are compared relative to common major oil types in Attachment G (modified from Polaris 2013[16]). Both crude oil types fall within the range of existing oil groups. The fate, behavior, effects, and countermeasures of these two oil types are all encompassed within the broad understanding and experience of oil spill response preparedness.

C. Oil Spill Response Capabilities

59. Conservative emergency and spill contingency planning will address the range of products that may be handled at the Terminal. The potentially higher content of lighter, volatile components in Bakken crude are not significantly different from handling other light crude oils or jet fuel. Similarly, handling a potentially heavier crude oil, such as OSPs, would entail countermeasures typically used and required for response to some ship bunker fuels, such as an IFO 180. Effective spill response countermeasures and controls

[16] Polaris Applied Sciences, Inc., 2013. A Comparison of the Properties of Diluted Bitumen Crudes with other Oils (accessed June 2014) http://www.crrc.unh.edu/sites/crrc.unh.edu/files/comparison_bitumen_other_oils_polaris_2014.pdf

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have one key objective: to minimize impacts related to the spill and the response. The fundamental strategies for achieving this objective are to limit spreading of the spill so that the footprint is minimized and to protect priority sensitive areas. These two fundamental strategies are effectively represented by the GRPs. The DEIS did not consider the spill response strategies in the GRPs that are activated in the event of a spill. These strategies include booming to contain oil and protect specific sensitive resources, and cleanup measures to recover oil and treat river banks.

60. A major response consideration for both oil types is the safety and health risks associated with evaporation of hydrocarbon light ends from a spill. As noted in Hayward et al. (2016)[17]:

> Response to spills of these crude oils involves two weathering timeframes: the initial flammability phase when light ends of the oils are present and fires could occur, during which the deployment of traditional spill response options would be pre-empted by first responder (fire fighter) actions; and the second, longer-term phase of responding to the oil on-water. For purposes of this CERA, pollution responders could become actively engaged in the initial 4–6 h after first responders (e.g., fire fighters) would have arrived on scene and might still be dealing with flammability risks. Recent incidents have resulted in significant fires involving Bakken oil, which has been known to re-ignite. Flammability is also a concern with freshly-spilled dilbit oil. During this emergency phase, public safety actions would take precedence over pollution response actions. The behavior of the oil will begin to change due to weathering after the initial 4–6 h.

i. Spill Response Capabilities and Equipment Needed for Bakken Crude

61. The primary concern for handling and addressing a spill of Bakken crude is the high volatility of the crude oil with respect to most other crudes. The range of its

[17] Hayward Walker, A., Stern, C., Scholz, D., Nielsen, E., Csulak, F. and Gaudiosi, R. 2016. Consensus Ecological Risk Assessment of Potential Transportation-related Bakken and Dilbit Crude Oil Spills in the Delaware Bay Watershed, USA. J. Mar. Sci. Eng. 2016, 4, 23

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physical and chemical properties would need to be characterized such that appropriate spill response countermeasures and safety considerations can be integrated into the spill response strategies. The Pipeline and Hazardous Materials Safety Administration (PHMSA) and Federal Railroad Administration issued a supplementary safety advisory, Safety Advisory 2013-07, on November 20, 2013, to emphasize the importance of proper characterization, classification, and selection of a packing group for Class 3 materials (flammable liquids, including petroleum crude oil), and to reinforce the need to follow the federal hazardous materials regulations for safety and security planning.

ii. Spill Response Capabilities and Equipment Needed for Heavy Crudes

62. Concerns have been raised over the adequacy of spill response countermeasures to respond to spills of crude oils derived from Alberta oil sands and "dilbits." Specifically, the potential for these oils to submerge or sink faster than other crude oils and the sufficiency of current spill response planning and regulations to address risks specific to dilbits and other OSPs. However, the current regulatory and planning system includes robust provisions for the full range of all oil types, including those that would address risks specific to dilbits and heavier oil derived from Alberta oil sands.

63. Alberta crude oil products delivered to the Terminal may encompass a range of characteristics. Dilbits are blended oils, have specific gravities less than 1, and do not sink in fresh or saltwater unless very weathered and/or are combined with sediment. Immediate response to these spills on water would be similar to conventional response to most persistent oil spills to water: boom for containment, redirection, and concentration for skimmer recovery. Experience and tests of oil spill response techniques with dilbits has shown that the equipment currently maintained by PRCs/OSROs are very

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suitable for response to a dilbit spill to water. Practical experience with containing dilbit was gained during response to the Marshall spill (Enbridge, 2013)[18]. Containment on land encompassed berms and sorbent barriers. On water containment entailed multiple boom lines. These barriers helped to minimize oil movement and to concentrate oil for collection.

64. CRREL and SLRoss (2015)[19] reported that their meso-scale flume testing results indicated that the diluted bitumen products may not form as stable emulsions as some heavy conventional oils. The high viscosities that occur after days of weathering will require specialized heavy oil skimmers and oil handling systems be used in a spill response, not dissimilar to those used for weathered bunker spills. These heavy oil response packages will be effective on both oil types but may be needed somewhat earlier in the response operation in the case of diluted bitumen spills.

65. Tests with dilbits on brackish water showed skimmers effectively recovered the crude from the water surface for up to 8 days of weathering in open tanks (WPW, 2013; Taylor et al. 2014)[20]. Skimmer efficiencies generally ranged from near 70% to over 95% with weathered oil recovery rates ranging from approximately 1 to 3 m^3/hr. Skimmer manufacturers at the Gainford trials noted that the equipment, oleophilic brush systems set up for heavy oil collection, may have benefited from a different approach

[18] Enbridge, 2013. Enbridge Line 6B Response, http://response.enbridgeus.com/response/main.aspx?id=12783 (accessed Sept. 2013)

[19] CRREL and SLRoss, 2015. Investigation of the Behavior of Diluted Bitumen and Heavy Conventional Crude Oil Spills. Report to the American Petroleum Institute, February 2015, 162pp.

[20] Taylor, E., Challenger, G., Rios, J., Morris, J., McCarthy, M.W., and C. Brown. 2014. Dilbit Crude Oil Weathering on Brackish Water: Meso-scale Tests of Behavior and Spill Countermeasures. Proceedings of the Thirty-Seventh AMOP Technical Seminar. Environment Canada, pp. 317 – 337.
Witt O'Briens, Polaris Applied Sciences, and Western Canada Marine Response Corporation. 2013. A study of fate and behavior of diluted bitumen oils on marine waters; Dilbit Experiments, Gainford, Alberta. (WPW 2013)

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initially, such as using oleophilic disks and even weir skimmers with suitable pumps during the first days of the trials.

66. An OSP (Albian Heavy syncrude) spill occurred in 2007 from a pipeline damaged by a backhoe operator, Part of the on-land spill reached Burrard Inlet, Burnaby, B.C. Approximately 15,000 m of shoreline were affected by the spill. A five-year environmental impact assessment study after the spill indicated that spill response operations were effective at removing oil from the environment and in limiting the short- and long-term effects of the spill[21]. Oil was recovered by skimming and booming, as well as by flushing and removal from the affected shorelines. Though shoreline intertidal zones were oiled, most marine sediments had only a small increase in measured polycyclic aromatic hydrocarbons (PAH) concentrations, with 20 of 78 monitored sites exceeding water quality guidelines. Levels of extractable hydrocarbons and PAHs for surface water quality requirements were met in 2007. Subtidal marine sediments were monitored through 2011, with most samples having levels of PAHs below the water quality requirements. Those subtidal sediment samples that did exceed the maximum regulated PAH levels appeared to be caused by sources other than the spill. Based on these observations, only trace amounts or less of oil from the 2007 spill appear to have remained in the marine harbor sediments.

67. In general, the risk of submerged or sunken oil applies to some degree to many crude oils and heavier processed oils. All crude oils, like many refined products, will weather as light ends evaporate. Depending on the originating oil and local conditions, a few crude oils may weather to a point where portions of the weathered oil

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[21] Stantec Consulting Ltd., Summary of Clean up and Effects of the 2007 Spill of Oil from the Trans Mountain Pipeline to Burrard Inlet (2012), http://www.transmountain.com/uploads/pages/1374960812-2012-Summary-2007-Spill-Clean-Up---Effects-REV2.pdf

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submerge or sink. Other weathered oils that would normally remain floating may submerge or sink if sufficient sediment is mixed with oil.

68. As with other heavy oils, options for locating, containing and recovering non-floating oil would need to be included in oil spill response plans. Generally, however, standard spill countermeasures used for crudes such as Alaska's North Slope, or for intermediate fuel oils and bunkers, are also applicable for OSPs, particularly early in the response. As oil sands crudes weather and interact with sediment, a portion of a spill can become neutrally to negatively buoyant. That a portion of the crude may submerge or sink is not limited to OSPs. Case histories have revealed that spills of light crudes and bunkers have also resulted in a portion of the spill becoming submerged or sinking (API 2016)[22]. Containment of the submerged to sunken portions of the oil included natural collection points (pools, basins) for sunken oil and geotextile barriers for submerged oil.

69. The NW Area Plan recognizes the importance of understanding the potential behavior of oils handled and has specified best practices for cases in which oil does not remain floating, as noted in the 2014 NW Area Plan Section 3420.2:

- Recovering oil in fast- moving water is difficult, as oil tends to flow under containment booms and skimmer efficiency is greatly reduced, necessitating more rapid responses further downstream. In these situations, the USCG recommends installing underflow dams, overflow dams, sorbent barriers, or a combination of these techniques.
- Develop detection strategies potentially using sonar, divers/cameras, ROV/camera, aircraft, photo bathymetry, diaper drops, dragnet, snare drops, and side-scan sonar.
- Containment strategies consist of using bubble curtains, water jets, surface-to-bottom nets/screens, silt curtain, and natural collection sites.
- Recovery strategies consist of using diver directed oil recovery operations, remotely operated vehicles, dredges, vacuum systems, integrated video mapping systems, nets, sorbents, bioremediation and pre-spill surveys.

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[22] API 2016. Sunken Oil Detection and Recovery, API Technical Report 1154-1; API 2016, Sunken Oil Detection and Recovery Operational Guide, API Technical Report 1154-2

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- Consider expanding the ICS Structure to include Oil Detection Groups, Sinking Oil Recovery Groups, and Sinking Oil Divisions.

70. These and additional strategies and tactics, along with contractors that can provide diving services, would be considered as resources to be included in a spill plan for cases in which a portion of a spill may potentially submerge or sink. The API Reports provide a field guide and manual for detection, containment and recovery of submerged and sunken oil. The dilbit scenario details captured in the TSPT 2016 spill tabletop exercise documentation provides a list of the contractors and sources of services for the possibility of submerged oil, including Global Diving for sonar, side scan, and diving; Fred Divine for diving and vacuum systems; T&T Marine and Hicky Marine for dredging, Manson Marine for silt curtains, and Gravity Environmental for vessels and sonar[23].

iii. Facility

a. <u>Familiarity with Applicant's Spill Response Capabilities in the Vicinity of the Facility</u>

71. I reviewed the draft Oil Spill Contingency Plan (OSCP) for Vancouver Energy Terminal and collaborated with the team that developed the tabletop exercise in January 2016. Spill Response Exercise Report, Ex-0001-PCE (Revised Application for Site Certification ("ASC"), Appendix B6). I am familiar with OSR contractors along the Columbia River and the Maritime Fire and Safety Association (MFSA) Umbrella Plan. Chapter 4 of the DEIS fails to adequately recognize planning and regulatory measures in place to respond to significant events (such as spill planning, GRPs, etc.). While the opening sections of Chapter 4 describe these measures, the DEIS then essentially ignores them when describing the level of impact from an incident. This omission is significant. These spill response measures are known to be effective. For example, as confirmed in the

[23] Ex-0001-PCE (Revised Application for Site Certification ("Revised ASC"), Appendix B6).

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January 2016 Tesoro tabletop assessment of spill response actions and capabilities to a worst-case discharge, the proposed equipment and personnel response times meet and/or exceed timelines to mobilize equipment to address GRPs in a timely manner given likely oil trajectories[24].

b. Applicant's Primary Spill Responders

72. TSPT has identified Clean Rivers Cooperative (CRC), Global, Marine Spill Response Corporation (MSRC), in addition to the personnel and spill response resources that are proposed for staging at the facility, to provide for a cascaded response that meets and exceeds the high standards set by the State of Washington and the NW Area Plan for spill response.

73. The June 2015 version of the OSCP would be updated for operations to reflect final OSR equipment on site, formalized contract agreements for primary response contractors, oiled wildlife care, and incident management team personnel, and to reflect the 2015 version of re-defined GRPs for the Columbia River. It is important to recognize that OSCPs are plans that undergo review and updates on a regular basis, as a best practice and as required by regulation. The January 2016 tabletop exercise illustrated perfectly the new information available and used for spill response actions, including the 2015 updated GRPs for the Lower Columbia River, contacts for notification GRPs, and available equipment. The VE OSCP for operations would include the information from the January 2016 tabletop exercise[25]: GRP priorities listed in Incident Command System (ICS) forms 232 and 232A, operational assignments (ICS 204s and/or 210s), and the detailed spill response action plans for waste management and disposal, shoreline assessment, wildlife, sampling, recovered oil and water, and decontamination.

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[24] Spill Response Exercise Report, Ex-0001-PCE (Revised ASC, Appendix B6)
[25] Spill Response Exercise Report, Ex-0001-PCE (Revised ASC, Appendix B6)

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74. As noted in the Comments letter, the DEIS fails to mention the Western Resource Response List (WRRL)[26]. The WRRL includes caches from multiple public agencies and private entities within the rail and vessel corridor and was the foundation for the resources listed in the tabletop documentation. Ex-0001-PCE (Revised ASC, Appendix B6). The WDOE website furthermore illustrates to locations of the PRC equipment listed, showing extensive coverage along the Columbia River (attached hereto as Attachment H).

75. In an analysis of the resources that are available for response to a worst-case discharge (WCD) from the facility, the two contracted PRCs (CRC and MSCR) provide the following levels of equipment available at the staging sites for the WCD (Port of Vancouver-WA, St. Helens-OR, and Longview-WA) upon activation, complementing the equipment summary provided in the DEIS. Ex-0051-PCE (DEIS, Appendix D.4 attached hereto as Attachment I).

76. As noted in the analysis, the sole deficit shown is with respect to temporary oil storage. The only storage considered in the exercise was mobile storage available from PRCs as portable tanks, bladders, or a dedicated barge. Additional storage is available from the on-land storage capacity of tanks at the terminal, storage tanks in Portland, available rail cars, and additional contracted barge storage capacity.

77. The Applicant also has committed to stage additional response equipment as described in section 5.1.9.2 of the PDEIS, including:

- In Pasco, 5,000 feet of river boom and associated anchor systems, and one Current Buster number 2 on reel in a conex with blower and hydraulic power unit (HPU) system installed.
- In Vancouver, 5,000 feet of river boom and associated anchor systems, and one Current Buster number 2 on reel in a conex with blower and HPU system installed (Haugstad 2013).

[26] WDOE Comments re DEIS, 2015

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78. The PRC resources would be used to implement GRP strategies applicable within the 48 hour planning window[27]. The list includes those sites listed in the NWACP GRP October 2015 listing for the Lower Columbia River and is augmented with additional sensitive sites known to the response organization. Culturally sensitive areas that may require protection would be in addition to those listed but are not included in public documents.

79. As explained in more detail in revisions to the OSCP, Ex-0001-PCE (Revised ASC, Appendix B4) and the Spill Response Exercise Report, Ex-0001-PCE (Revised ASC, Appendix B6), during a tabletop exercise to determine the adequacy of response action resources, TSPT and contractors were able to locate, allocate, and deploy more than adequate response equipment and trained personnel in accordance with application spill planning standards. The results of this exercise to test the adequacy of proper execution of the response actions (along with pre-booming and secondary booming) show that a spill response would be rapid and with extensive resources to contain and recover spilled oil and to protect sensitive aquatic resources.

iv. Vessel

a. Familiarity with Applicant's Spill Response Capabilities in the Marine Vessel Corridor

80. Tank vessels are envisioned to transport crude oil from the Terminal to markets in the US and abroad. Tank vessels operating on the Lower Columbia River fall under federal (USCG) and state (Washington and Oregon) regulations for spill preparedness and response. The Testimony of Dennis O'Mara describes the navigation risks for vessel on the Columbia River and provides a quantitative risk analysis for potential vessel-source spills. As with any tank vessel presently operating on the lower

[27] App B4c - OSCP revisions Jan 2016 DEIS letter, pg. 22-40.

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Columbia River, tank vessels that would call upon the Terminal must have an approved oil spill contingency plan and pre-contracted arrangements for spill response.

b. Applicant's Primary Spill Responders

81. Section 4.5.2.1 of the DEIS states that "[t]he response to a crude oil spill in the vessel corridor would primarily be the responsibility of the USCG, Ecology, ODEQ, and CRC. The vessel owner would also respond through activation of the VRP. The RP(s) would be obligated to fund the response and pay for damages." This statement mischaracterizes responsibility for response to a crude oil spill. The vessel operator and the product owner are primarily responsible for response to a spill from their vessel and of their product, respectively[28]. The Responsible Party (RP) initiates response by making notifications to its PRC (or direct to MFSA, if covered under that plan). The MFSA Incident Commander is the initial representative of the Responsible Party for immediate spill response if the vessel is covered under that umbrella plan[29]. Alternatively, a representative for the RP is assigned as the Incident Commander. The Incident Commander works in Unified Command with federal and state On-Scene Coordinators to direct the response. All tank vessels are required to have approved VRPs that identify the contracted capability to provide response to average, maximum, and worst-case spills within stipulated timeframes. Umbrella plans, such as that provided through the MFSA, provide the immediate response capability to meet the response times and capabilities for covered vessels. If the RP is unable or unwilling to undertake the response, command may be assumed by the USCG or the State.

82. The Applicant's role in providing primary spill response assets for a vessel-based spill may unfold in one of several ways:

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[28] MFSA Letter to WA EFSEC at 8 (Jan. 22, 2016)
[29] *Id*. at 6.

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- At the terminal (during loading) – to the extent safe and effective, all transfer operations would be pre-boomed. If safe and effective pre-booming thresholds are exceeded (DEIS, Apps. D.3 and K), OSR resources would be on standby for immediate deployment if the need were to arise. Thresholds above which pre-booming would not be performed are:
  - Water current speed > 1.5 knots will be the effective threshold value
  - Wave heights > 2 to 2.5 feet will be the safe and effective threshold value
  - Sustained wind speed greater than 30 knots (~35 mph)
  - Low visibility resulting from fog, heavy precipitation, or snow at the dock and/or boom deployment vessel
- If pre-booming thresholds are exceeded but conditions allow for safe operations (DEIS, Apps. D.3 and L), boom and skiffs would be placed on standby for immediate deployment in case of a spill.
- The terminal must have the capability to initiate the deployment of four times the largest vessel (4 x 900 = 3600 feet) or 2,000 feet of boom, whichever is less, within 3 hours. The Terminal has 3,000 feet and skiffs to immediate boom deployment. DEIS, App. D.4; id. § 7.1.8.
- While underway or at anchor – a spill originating from the vessel underway or at anchor would trigger the vessel response plan, which in most cases is the MFSA OSRP for the initial 24 hrs. TSPT OSR assets may be mobilized, upon request, to augment a tiered response capability for the vessel response.

83. The DEIS observes that the current MFSA spill contingency plan is not designed to address spills greater than 300,000 bbl and is primarily focused on addressing spills of refined petroleum products[30]. The typical capacity of the handymax class vessels, which would be expected to usually transport the crude oil from Vancouver Energy, is not much more than 300,000 bbl (at 319,925 bbl). Moreover, when the facility is approved, MFSA will amend its Contingency Plan and add any additional equipment necessary to meet the additional commodity types and quantities. Facility vessels would not be loaded in an amount that exceeds the MFSA spill contingency plan volumes. *See* WAC 173-182, Section C.

[30] DEIS, App. D.15.

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84. The MFSA Plan and response system includes recovery equipment that can handle light ends as well as heavier products that float[31]. MFSA's Primary Response Contractor (Clean Rivers Cooperative, CRC) has also exercised responses to products that may sink, such as asphalt. The Plan's associated response equipment capacities currently exceed Washington and Oregon Department of Environmental Quality planning standards.

v. Rail

a. Applicant's Primary Spill Responders

85. As with vessels, the primary responder for a rail spill is the railroad operator as the RP, working in collaboration with federal and state designated On-Scene Coordinators through a Unified Command structure. In the unlikely event of a rail spill, the railway operator's oil spill contingency plan would be triggered, mobilizing the contracted spill response capability of its PRCs. For example, Burlington Northern Santa Fe (BNSF) maintains caches of spill response equipment at five locations along the Columbia River. These caches contain boom, skimmers, portable tanks for temporary storage, and ancillary equipment, tools, and resources. Caches are maintained in trailers for towed transport over land, one on a flatbed rail car, and another packaged to be transported by helicopter.

86. In addition to its own oil spill response caches, BNSF rail has contracts with the same two PRCs as the Terminal: MSRC and CRC along the Columbia River, as well as Clean Harbors, Global Diving & Salvage, and National Response Corp. Environmental Services.

b. Spill Response Capabilities and Plan Efficacy

[31] MFSA Letter 22 January 2016, pg 2.

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87. The Applicant's role in providing primary spill response assets for a rail-based spill may unfold in one of several ways:

- A spill within the Terminal would have limited movement given design of site drainage, impermeable catchments, and secondary containment.
- Terminal personnel and equipment provide a first response capability to augment the rail response.
- TSPT OSR assets may be mobilized, upon request, to augment a tiered response capability for a rail response at other locations.

88. A rail transport spill is unlikely given the precautions adopted for crude oil transport. Nonetheless, there is public debate over the realistic maximum scenario for spill planning purposes should a spill occur, [32].

89. In its report, the Washington Utilities and Transportation Commission (WUTC)[33] found a reasonable worst-case spill for planning purposes may encompass 1 to 3.5 million gallons (approximately 24,000 to 83,000 bbl), which is substantially less that the worst-case discharges defined for the terminal or a vessel. Draft regulations for oil transport by rail, however, identify the WCD as the full volume of oil transported in rail cars plus fuel and other oils of the train. Chapter 173-186 WAC, "Oil Spill Contingency Plan – Railroad Rulemaking." The latter WCD is unrealistic.

vi. The Oil Spill Response Capacity along the Columbia River Greatly Exceed Requirements

90. Based on my expertise and understanding of the proposed operations, the prevention measures proposed, and the emergency planning already developed for the

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[32] *See* WUTC, Rail Safety Rulemaking Related to ESHB 1449, Docket TR-151079, Oil Train Safety Rulemaking (Jan. 2015); Samantha Wohlfeil, Railroads Required to Plan for a Worst-Case Oil train Spill in Washington State, Emergency Management (May 18, 2015), http://www.emergencymgmt.com/disaster/Railroads-Required-Plan-Worst-Case-Oil-Train-Spill-Washington.html. By way of example,

[33] WUTC, Rail Safety Rulemaking Related to ESHB 1449, Docket TR-151079, Oil Train Safety Rulemaking (Jan. 2015).

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DEIS review, the Project has identified the measures and means that protect the environment and that can adequately clean up an oil spill in the Columbia River in the unlikely event that it should happen. Compliance with the stringent planning requirements defined and enforced by WDOE, in addition to Oregon and federal requirements ensures that the most protective measures adopted in the US are met.

91. In my opinion, the professional response resources under contract to the facility, rail operators, and tank vessels are strategically located and appropriate to respond to and minimize the adverse effects of spills for these potential sources. PRCs and the Project have identified areas for additional resources to be identified.

92. Present response capabilities along the Columbia River are in place to address spills of oils ranging from Group 1 light-end volatile products, such as gasoline, to Group 4 and 5 heavy-end products, such as asphalt. The crude oil products proposed for transport and handing for this Project, Bakken crude and OSPs, have fresh and weathered oil characteristics that are encompassed by oil Groups 1 through 5. Spill response plans are in place locally and regionally to address the range of oil types that are being transported in the region and the Project has identified additional initiatives to augment awareness and emergency response planning. Ex-0001-PCE (Revised ASC, Section 1.4.1).

93. The project has identified through its worst-case spill tabletop that it has the capability to deliver, within 6 hours, 158,616 barrels per day of skimming capacity, 51,364 bbls of temporary storage, and 135,842 feet of boom through its professional spill response contractors[34]. The resources available in the relatively short timeframe greatly surpasses planning standards and provide the means to contain and intercept oil, collect and remove oil, protect sensitive areas, and mitigate the possible adverse effects from the

[34] Spill Response Exercise Report, Ex-0001-PCE (Revised ASC, Appendix B6)

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unlikely case of a major spill. Furthermore, specialized services are identified and in place for the possibility that a portion of an oil spill may submerge or sink.

IV. EXHIBITS

94. The following documents are attached to my testimony for reference:

Attachment A: Elliott Taylor CV

Attachment B: Summary of Inspections

Attachment C: EPA and USCG Defined Petroleum-Based Oil Groups

Attachment D: Ranges of Physical Properties for Example Oil Types

Attachment E: Tank and Flume Experimental Results for Changes in Weathered Oil Density

Attachment F: ADIOS Modeling Results for Bakken and Dilbit Scenarios

Attachment G: Summary of Fate and Behavior and Potential Adverse Effects on Environment for Major Oil Types

Attachment H: WDOE Map of PRC Equipment

Attachment I: Ex-0051-PCE (DEIS, Appendix D.4, Section 7.1.8 Excerpts)

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DATED this 13th day of May, 2016.

Elliott Taylor, Declarant

STATE OF WA)
)
COUNTY OF Kitsap)

Elliott Taylor, being duly sworn upon oath, deposes and says: The foregoing testimony is true, correct and complete to the best of my knowledge, information and belief and is given subject to the laws of perjury in the State of Washington.

GIVEN under my hand and official seal this 13th day of May, 2016

Ludivina B. Garvin

NOTARY PUBLIC in and for the State of: WA

Residing at: Port Orchard WA

My Commission Expires: 11/25/2019

Printed Name of Notary: Ludivina B. Garvin

Notary Public
State of Washington
LUDIVINA B GARVIN
My Appointment Expires Nov 25, 2019

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