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 KEN AMES

I, Ken Ames, 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.

3. Based on my professional experiences and training, I have developed an expertise in hydrogeology and the fate and transport of contaminants including petroleum hydrocarbons.

I. INTRODUCTION

4. I am a hydrogeologist and Washington State licensed Geologist No. 1280, focused on environmental and water resources issues, with over 20 years of consulting experience. I currently work with private and public sector clients throughout the United States and abroad and have managed numerous remedial investigations, involving soil, soil-vapor, and surface- and ground-water, as well as other extensive water-resources studies.

5. I have considerable experience in the assessment of the fate and transport of various contaminants, including petroleum hydrocarbons, trace metals, and chlorinated

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compounds. I also have considerable experience in environmental permitting, compliance management, and reclamation, as well as the selection of appropriate site remedies as part of which I have developed in-situ technologies that may be utilized in a variety of settings to cost-efficiently remediate groundwater for various contaminants.

6. While with the U.S. Geological Survey, Water Resources Division, I was Section Head for water quality investigations for the Washington District. In this role I was also responsible for the Washington District Field Services Unit and Water Quality Laboratory. I developed and conducted various surface and groundwater quality investigations for various Federal Agencies, including the Environmental Protection Agency, Department of Energy, Department of Defense, Bureau of Indian Affairs, Bureau of Land Management, and Bureau of Mines, as well as State and local agencies.

7. My work in metals in soils and streambed sediment studies resulted in changes to State of Washington regulatory statutes and for which I am a recognized expert in background concentrations of metals in soils and sediments.

8. I have authored and co-authored numerous U.S. Geological Survey reports and other publications in various journals, conference proceedings, and technical magazines.

9. I am also a member of various professional organizations and have received honorariums from different organizations, including the U.S. Geological Survey and the Academy of Sciences of Uzbekistan.

10. I have taught at the University of Delaware, lectured at San Diego State University, as well as at various conferences and proceedings, and I am currently conducting various training courses through the Environmental Training Institute.

11. A detailed resume is included as part of this document as Attachment A.

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II. DOCUMENTS RELIED UPON

12. In preparation of this testimony I have reviewed the following documents:

- Vancouver Energy Operations Facility Oil Handling Manual. Plan No. OP.05. Revision 00. June 26, 2015.
- Applicant Tesoro Savage Petroleum Terminal LLC, d/b/a Vancouver Energy (hereinafter, "TSPT" or the "Applicant") Comments on the Draft Environmental Impact Statement ("DEIS"). January 22, 2016.
- Appendix H.2. Joint Aquatic Resources Permit Application ("JARPA") Form. February, 2014.
- Hayward Baker Inc. Vancouver Energy Terminal Ground Improvement Design – Areas 300 & 400. April 15, 2015.
- TSPT Project Description Updates for Draft Environmental Impact Statement Development. May 27, 2015.
- CardnoEntrix. Tesoro Savage Vancouver Energy Distribution Facility Draft Environmental Impact Statement. November, 2015.
- Appendix C. Tesoro Savage Vancouver Energy Distribution Terminal Vancouver, Washington. Preliminary Stormwater Pollution Prevention Plan. August 29, 2013.
- Tesoro Savage Petroleum Terminal LLC. Preliminary Spill Prevention Control and Countermeasure Plan. January, 2014.
- BergerABAM. Tesoro Savage Vancouver Energy Distribution Facility Preliminary DEIS. July - September, 2014.
- City of Washougal. Tesoro Savage Vancouver Energy DEIS General Comments, January 2016.

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- Washington State Department of Natural Resources. RE: Tesoro Savage Vancouver Energy Terminal Draft Environmental Impact Statement. January 22, 2016.
- City of Spokane. RE: City of Spokane Comments to Tesoro-Savage DEIS. January 18, 2016.
- AECOM. June 2015 Semi-Annual Groundwater Monitoring Report. September 9, 2015.

III. TSPT ONSITE ANALYSIS OF POTENTIAL SURFACE AND GROUNDWATER CONTAMINATION

A. Background of Existing Onsite Contamination

13. The Vancouver Energy Terminal (the "Project") consists of just over 47 acres that are situated adjacent to the Columbia River, in Vancouver, Washington ("Site"). An Alcoa/Evergreen aluminum smelter that operated until 2000 was previously situated at the Site, which resulted in the release of various contaminants of concern ("COCs") to the soil and groundwater that included polychlorinated biphenyls ("PCBs"), polyaromatic hydrocarbons ("PAHs"), fluoride, cyanide, volatile organic compounds ("VOCs"), and selected Resource Conservation and Recovery Act ("RCRA") metals. This resulted in a number of regulatory orders to address and mitigate the risks to human health and environment posed by the release of the aforementioned COCs.

B. Soils

14. Historical operations at the Site resulted in a release of various COCs through a variety of pathways, including the storage of various wastes in piles and landfills, leaking underground storage tanks, leaking transformers, unlined sludge ponds, scrap metal recycling, smelting operations, and other fabrication processes. As a result, COCs in soils at the Site included but are not limited to, petroleum hydrocarbons, PCBs,

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cyanide, fluoride, chlorinated solvents, and metals in the soils. Under Consent Decree number 09-2-00247-2 and enforcement order 4931 with the Washington State Department of Ecology ("Ecology"), Alcoa and Evergreen completed a remediation and facility decommissioning effort to cleanup levels established by the Consent Decree. Environmental restrictive covenants remain, as part of the Consent Decree, with impacted soils described below for the five areas where construction is planned as part of the development of the Project.

C. Groundwater

15. Groundwater at the Site was affected by the historical operations as well, and contaminated groundwater is still present at portions of the Site, including in the area of the East Landfill, the former North/North 2 Landfill, and at the shoreline area. However, based on the discussion in the DEIS, the effects from the groundwater to the Columbia River appear to be insignificant and, given the local hydrogeology, there does not appear to be good communication between the shallow water bearing units and the underlying aquifer. Therefore, potential threats to either the Columbia River or the Troutdale Aquifer appear to not be significant. Furthermore, as part of the Final Supplemental Cleanup Action Plan, Monitored Natural Attenuation has been employed until groundwater cleanup standards are achieved. This strongly suggests movement of the contaminants in the shallow groundwater is not significant.

D. Capped and Covered Landfill Areas

16. There are three capped areas within the Site that lie in areas where construction is proposed, along with two areas of landfilled material. These include the following areas and associated COCs:

- Vanexco Cap – PCB impacted soil, with no impact to groundwater; Deed Restriction.

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- Spent Pot Liner ("SPL") Cap – Former NPL site, with 47,500 cubic yards of SPL and reclaimed alumina insulation. There are a number of COCs, including cyanide, associated with this material in the soil at the Site, with fluoride detected in the groundwater at concentrations as great as 27,500 micrograms per liter (µg/l); Deed Restriction.
- Ingot Cap – Material consists of about 14,000 tons of brick, concrete, and contaminated soil, with PCBs as the primary COC, with no COCs detected in the groundwater below this area; Deed Restriction.
- East Landfill – Approximately 38,000 cubic yards of contaminated material from the North/North 2 Landfill, along with material from the South Bank area were placed in the East Landfill in 2003. The variety of materials deposited in the landfill has resulted in a number of COCs present in the soil, such as lead, cyanide, fluoride, and PCBs. VOCs, including trichloroethane ("TCE"), are also present in the groundwater below this area and, as a result, the groundwater is monitored for natural attenuation on a quarterly basis.
- North/North 2 landfill - the remaining landfill was covered with about one foot of sand. It is likely that various COCs remain in the soils, including PCBs and PAHs, along with VOCs in the shallow groundwater below that is estimated to be between 15- and 25-feet below ground surface.

E. <u>Columbia River Sediments</u>

17. The Site lies within the Washington State Water Resources Inventory Area 28, which is on Ecology's 303(d) list of impaired water bodies for temperature, sediment bioassay, fecal coliform, dissolved oxygen, and PCBs. However, there are no listed 303(d) parameters for the Site. Furthermore, the Port of Vancouver, as part of their

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ongoing berth dredging activities, conducted sediment sampling in 2013 at berths 13 and 14 and did not detect any COCs at concentrations that exceeded the Sediment Evaluation Framework toxicity screening levels; chromium and nickel at berth 14 were detected at concentrations above the screening levels initially, then below when the samples were re-analyzed.

F. Analysis of Onsite Proposed Construction Activities

18. The analysis of onsite proposed construction activities focused on the use of jet grouting in Area 400 and the removal of selected pilings that could result in the disturbance of any pre-existing contamination at the Site.

i. Jet Grout

19. Any jet grouting planned as part of construction efforts will be limited to an area associated with the placement of the pipeline out to berth 13, as shown in drawing number HB-14 (Hayward Baker Inc., Vancouver Energy Terminal Ground Improvement Design – Areas 300 & 400. April 15, 2015). Based on available information, there is no known significant pre-existing contamination in the area shown on Howard Baker drawing number HB-14. The placement of jet grout columns will begin immediately above the ordinary high water mark and extend landward, with each column having a diameter of 6 feet and extending to a depth of 78-feet below ground surface (bgs). The top of the Troutdale Aquifer has been found to be about 125-feet bgs in the southern area of the Site, near the Columbia River, which is nearly 50-feet below the lowest depth of the planned jet grout columns. The jet-grouting process involves the mixture of soils and grout in-situ which limits the mixture almost exclusively to the area where the drill is advanced. Furthermore, this process is akin to the placement of a slurry wall, which has become a commonly used and effective tool to act as a hydraulic barrier to prevent groundwater contamination from migrating downgradient. Therefore, the placement of jet

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grout columns should actually act to prevent the migration of any COCs from the Site to the Columbia River.

ii. Removal of Pilings

20. The removal of selected pilings will be performed whenever possible using vibratory extraction, resulting in a single, slow, and continuous motion to minimize sediment disturbance and excessive turbidity. If a pile is not able to be removed in this manner, then it will be cut and/or pushed into the sediment using agency-approved best management practices.

21. Given the lack of any significant contamination in Columbia River sediments at the Site, coupled with the approach to remove the pilings described above using best management practices to minimize disturbance, there is little to no risk of disturbing any pre-existing contamination, as a result of this effort. Furthermore, given the recent characterization of sediments in the areas where any pilings could be removed, additional sediment characterization prior to removal should not be required.

IV. ANALYSIS OF ONSITE OPERATIONS

22. It is highly unlikely that normal daily operations of the Project will disturb any pre-existing contamination at the Site in the soil or shallow groundwater, thereby creating an undue risk to human health and the environment. Furthermore, the employment of an industrial stormwater pollution prevention plan ("SWPPP") and a Spill Prevention Control and Countermeasures ("SPCC") plan coupled with a final version of the Operation Facility Oil Spill Contingency Plan ("OFOSCP"), along with other plans required by the Federal Government and the State of Washington, and associated stored and maintained requisite equipment, as well as trained personnel, will ensure that, should a spill occur at the facility, proper response measures will be taken to ensure safety and minimize undue harm to the environment.

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23. Other experts are addressing the likelihood of an on-site spill. Consideration was given to a theoretical spill of crude that would cover the entire Site, just over 47 acres with crude oil to a depth of one inch, which would be equivalent to a spill of approximately 1.25 million gallons. In this scenario, there is the potential for crude oil to infiltrate to the underlying soils in areas that do not have an impervious surface, as well as potentially migrate downgradient toward the Columbia River. However, in both scenarios, the soil has the ability to adsorb significant quantities of the petroleum product to mitigate migration to both the underlying shallow groundwater and Columbia River. Furthermore, the placement of stormwater controls, as part of the industrial SWPPP, should deter and contain much of the surface migration of the petroleum product across the Site, as the elements of the OFOSCP are employed. Finally, existing groundwater monitoring wells at the Site would have been sealed and capped at the surface, which will prevent such wells from acting as conduits to the underlying groundwater.

V. OFF-SITE RAIL RELATED IMPACTS

24. I was also asked to evaluate concerns and comments expressed by several parties related to the potential impact of a spill from a rail incident in the proximity of a well-head protection zone or a shallow aquifer. My testimony does not assess or rely on the probability of those events occurring in those areas. In his testimony, Dr. Christopher Barkan evaluates the estimated petroleum crude oil derailment rate, the estimated conditional probability of release given a derailment event, and the estimated conditional probability of quantity released given a release event, on the BNSF line from Newman Lake to Vancouver. Three spill categories were used, with the associated volumes and intervals in years between probable events at any location along the route, given for rail cars that meet current DOT-117 specifications:

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- Medium Spill - 30,000 gallons (equivalent to approximately one car), once per 9,000 years
- Large Spill - 92,000 gallons (three cars), once per 42,500 years

Effective Worst Case Discharge ("EWCD") - 840,000 gallons (28 cars), once per 7,883,000 years.

25. While Dr. Barkan addressed the probability of these events, my analysis assumes they have occurred and assesses the impact of these events on groundwater. Specifically, I consider all three scenarios as part of my analysis to determine the volume of soil required to absorb the spilled petroleum product, given general assumptions regarding the petroleum product that could potentially spill and the geologic characteristics of the unsaturated zone through which it could migrate. Based on the OFOSCP, products anticipated to be transported to the Site, include but are not limited to:

- Bakken (ND and MT) - average density of 813 kilograms per cubic meter (kg/m^3)
- WCS (Canada) – density of 932 kg/m^3

26. Overall, the range in density of all anticipated products lies within the values given above. As a result, the denser product that would have the lowest anticipated non-mobile, residual concentration in the soil was used to provide the most conservative scenario, along with the anticipation of any spill that might occur within the well-head protection zones and aquifers utilized by the Cities of Spokane and Washougal. Based on Brost and DeVaull[1] calculations of non-mobile, residual concentrations of various petroleum products in different types of soil (Cres), a range was found for compounds that resemble the densities specified for the Bakken and WCS crude oil; Cres of as high as

[1] Brost, E.J., and DeVaull, G.E., 2000, Non-aqueous phase liquid (NAPL) mobility limits in soil: American Petroleum Institute, Soil and Groundwater Research Bulletin no. 9, 9 p.

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150,000 mg/kg for products with a similar density to Bakken crude to 7,700 mg/kg for products similar to the denser WCS crude, in a medium sand. A lower value for Cres of 5,143 mg/kg was given for petroleum products that have a similar density to WCS crude that spill in course gravel. So, the conservative Cres value of 5,000 mg/kg was used to calculate the volume of soil required to immobilize crude oil spilled in the well-head protection areas or above the aquifers in Spokane and Washougal, given the three spill scenarios listed above. There are a number of factors that determine the lateral extent of any oil spill at the surface, so to perform the calculations related to approximate anticipated depth given the three spill scenarios, the assumption is that an affected area for a spill would be one acre (100-feet on each side of the rail and 200-feet along the rail from the center-point of the spill) for one car, 2.2 acres for three cars, and 17.2 acres for twenty-eight cars. The resulting volumes of petroleum-contaminated soils and anticipated depth of the migration through the vadose zone are given in Table 1. The migration of any Light Non-Aqueous Phase Liquid ("LNAPL") product through the Vadose zone will require a considerable amount of time (i.e., several days) to reach the approximate anticipated depth, which can be mitigated through an immediate and appropriate spill response.

Table 1. – Volume of Petroleum-Contaminated Soils and Anticipated Depth of Migration of free product in the Vadose Zone for a Medium, Large, and Extreme Worst Case Spill

Spill Type	Approximate Volume of Soil (Cubic Yards)	Approximate Anticipated Depth (feet)
Medium	10,000	7
Large	30,000	9.2
EWCD	280,000	11

27. As a result of the analysis above, even with an EWCD spill that is permitted to remain in place for a sufficient amount of time to reach the depths identified in Table 1, it is not likely that any significant quantity of free petroleum product will reach

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the unconfined water table in the Spokane Valley, where depths to water in the area of the rail line are generally 50- to 100-feet bgs. Although the water table in the unconfined water-bearing unit is considerably shallower in the City of Washougal, the amount of free-petroleum product to reach the water table as a result of even a large or EWCD spill type should be negligible, especially with an immediate and appropriate response to the spill.

28. The above analysis does not take into consideration the potential of impact that might occur in the longer-term due to dissolution of various COCs from the free petroleum product, upon interaction with water at the surface or within the Vadose Zone. However, it is anticipated, as required by Federal and State laws, that there would be an immediate response to any of the spills described above at all locations along the BNSF route through Washington, which would include the removal of petroleum-contaminated soils that would minimize any longer-term dissolution and transport of COCs to the underlying groundwater.

29. Should a spill occur at any location near the Columbia River, the same scenarios described above, with a spill extending potentially 100-feet from the center-point of the rail was assumed. As a result, the majority, if not all of the spill, may be contained to an area of approximately one acre for a single car, with vertical migration over-time into the Vadose Zone. Again, the same response and actions described above for a spill anywhere along the BNSF rail line would be anticipated to mitigate the transport of any free petroleum product to either the shallow groundwater or toward the Columbia River.

VI. OVERALL CONCLUSIONS REGARDING DEGREE OF IMPACT FROM PROJECT RELATED TO RELEASE OF HAZARDOUS MATERIALS

30. Based on all of the above and with a reasonable degree of scientific certainty, construction and normal operation of the Project would not likely result in a

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significant release of contamination nor, as a result, adverse effects to human health or the environment. Furthermore, it is apparent that should a spill occur, the proper plans and response mechanisms, as required by law, would be in place to appropriately and immediately mitigate any acute or longer-term issues.

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

Attachment A: Curriculum Vitae of Ken Ames

[*Signature on Following Page*]

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DATED this 12th day of May, 2016.

Ken Ames, Declarant

STATE OF Washington)
)
COUNTY OF King)

Ken Ames, 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 12th day of April, 2016

LINDA K. BROWN NOTARY PUBLIC COMMISSION EXPIRES 3-13-19 STATE OF WASHINGTON

NOTARY PUBLIC in and for the State of: Washington

Residing at: Lynnwood

My Commission Expires: 3.13.19

Printed Name of Notary: LINDA K. BROWN

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