TESORO SAVAGE VANCOUVER ENERGY PROJECT:

REVIEW OF DRAFT EIS

PRELIMINARY REPORT – AIR QUALITY

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I. BACKGROUND AND EXPERIENCE

I, Ranajit Sahu, have over 23 years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment; soils and groundwater remediation; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal Clean Air Act (CAA) and its Amendments, Clean Water Act (CWA), Toxic Substances Control Act (TSCA), Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) **,** Superfund Amendments and Reauthorization Act (SARA), Occupational Safefy and Health Act (OSHA), the National Environmental Policy Act (NEPA) as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

Specifically, I have over 20 years of air quality consulting experience, providing emissions calculations support including the calculation of potential-to-emit for various pollutants, permitting support, and related technical analyses for clients in all 50 U.S. states and abroad. My consulting experience includes dealing with the types of pollutants (such as volatile organic compounds, or "VOCs" and hazardous air pollutants or "HAPs") and sources similar to those at issue in this matter – for example fugitive emissions from storage tanks; fugitive and stack emissions from vapor capture and control systems from loading of liquids; and fugitive emissions from myriad types of components used in chemical plants, refineries, and bulk liquid terminal facilities.

I have a B.S., M.S., and Ph.D., in Mechanical Engineering, the first from the Indian Institute of Technology (Kharagpur, India) and the latter two from the California Institute of Technology (Caltech) in Pasadena, California. My research specialization was in the combustion of coal and, among other things, understanding air pollution aspects of coal combustion in power plants.

I have over 21 years of project management experience and have successfully managed and executed numerous projects in this time period. Projects include basic and applied research

projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

I have provided consulting services to numerous private sector, public sector, and public interest group clients. My major clients over the past twenty one years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including the U.S. Environmental Protection Agency ("EPA"), the states of New York, New Jersey, New Mexico, the U.S. Department. of Justice, California Department of Toxic Substances Control, and various municipalities. I have performed projects in 48 U.S. states, numerous local jurisdictions and internationally.

In addition to consulting, I have taught numerous courses at several Southern California universities.

I have and continue to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies.

II. COMMENTS ON AIR QUALITY AND RELATED ISSUES IN DRAFT EIS

Tesoro Savage Petroleum Terminal LLC (the Applicant) has submitted an Application for Site Certification (No. 2013-01) to the Washington State Energy Facility Site Evaluation Council (EFSEC) to construct and operate the Vancouver Energy Distribution Terminal Facility (proposed Facility or proposed Project) at the Port of Vancouver (Port) in Vancouver, Washington, located on the Columbia River.

The Comments set forth below concern only the Draft Environmental Impact Statement (EIS) and not the application itself or any other permit or certificate that may be necessary for the proposed Project.

A. Overview and Summary

The DEIS is deficient in a number of respects related to air quality and associated impacts. Because of these deficiencies, the air quality, toxic air pollution, and greenhouse gas emission calculations are either incorrect or unsupported. These failings undercut the DEIS's conclusions that air quality impacts are minor. The Comments below set forth the following basic deficiencies:

- Failure to analyze and disclose environmental impacts from transportation traffic including additional rail idling, marine anchorages, and resulting increased air emissions;
- Underestimation of air emissions from marine vessel loading;
- Failure to disclose and analyze toxic and other air pollutant emissions from locomotive idling at facility and along entirety of route, especially near population centers;

- Failure to disclose and analyze air emissions from loss of volatile fractions of crude oil out of rail cars along entirety of transit route (i.e., crude shrinkage);
- Failure to address fugitive emissions from crude oil storage tanks at facility;
- Improper and artificially-constrained spatial/geographic analysis for greenhouse gas emissions from and as a result of the project such that the Draft EIS does not consider all trips to and from the facility nor all potential destinations;
- Failure to assess the full geographic or spatial impact relative to potential export of crude by limiting it to only impacts that might occur within Washington state only or even smaller regions near the proposed facility;
- Failure to include the physical and chemical properties of all of the potential types of crude oil which will be handled, which, in turn affects air emissions estimates and permit calculations;
- Inconsistencies between possible maximum oil throughputs on an incoming (rail) and outgoing (marine vessel) basis likely resulting in inaccurate estimates of throughput and inaccurate estimates of air pollutant emissions;
- Failure to provide information allowing confirmation of type of rail cars to be used and potential failure to properly estimate emissions from rail cars if the applicant is unable to guarantee and enforce use of newer rail cars;
- Failure to analyze, discuss, or explain magnitude, frequency, and duration of loading of marine vessels directly from trains as opposed to from storage which will affect emissions of air pollutants at the facility;
- Failure to make underlying documents prepared by the applicant and relied upon by EFSEC available to public as component of development and review of draft EIS; and
- Incorrect air pollutant dispersion modeling because the modeling is based on incorrect or incomplete emissions analyses as outlined above.

B. Availability of Underlying Documents

During the site certification process, EFSEC functions as the Lead Agency responsible for complying with the procedural requirements of the Washington State Environmental Policy Act (SEPA; Washington Administrative Code [WAC] 197-11-938[1]). The Applicant prepared a Preliminary Draft Environmental Impact Statement ("EIS") for EFSEC review and EFSEC subsequently prepared the Draft EIS.

The public should be provided with a complete copy of the Preliminary Draft EIS along with the Draft EIS prepared by EFSEC. Changes, if any, made by the EFSEC should be made apparent to the public. While the EFSEC states (p. ES-1) that EFSEC and its consultant "extensively supplemented" Applicant provided information and analyses, that cannot be verified without access to the Preliminary Draft EIS. It appears that none of the air quality analysis changed from that provided by the Applicant in the preliminary draft EIS – per the note at the bottom of F-II in Appendix F. If so, it can be assumed that the ESFEC made no changes to the air quality analysis provided by the Applicant.

C. Failure to Fully Assess Geographic/Spatial Impact of Crude Shipments.

The Applicant is proposing to construct and operate a Facility that would receive an average of 360,000 barrels (bbl) of crude oil per day by rail, temporarily store the oil onsite, and then load the oil onto marine vessels for transport to existing refineries primarily located on the West Coast of the United States, including those in California, Washington, Alaska, and Hawaii. [p. ES-2].

Given that the crude oil will be transported to refineries in Hawaii and Alaska, the spatial domain of the analysis is inadequate since the air quality analysis presented in Appendix F considers emissions that only occur within the state of Washington.

More importantly, given that the domestic crude oil can now be exported – a development that post-dates the preparation of the Draft EIS – it is likely that the crude oil might be sent to more than just the "West Coast" refineries as noted in the Draft EIS. This is a significant enough development that it negates a basic assumption in the EIS – see Section 2.7.3, p. 2-73. Unless the operator can be restricted, it must be assumed that crude oil will likely be exported to beyond the four listed states. The analysis of environmental effects from the proposed Project must be expanded to address the potential for export of crude oil beyond the limited boundaries in the Draft EIS.

D. Sources and Properties of Crude Oil Not Adequately Disclosed or Analyzed.

The Draft EIS states that the Facility will handle crude oil primarily from mid-continent North American locations, including the Bakken formation that covers parts of North Dakota, Montana, and Saskatchewan, Canada. Depending on market conditions and the needs of the proposed Facility's customers, crude oil may also come from other North American formations, such as the Niobrara in Wyoming and Colorado and the Uinta in northeast Utah. [p. ES-4].

Given the potentially large universe of sources of crude oil, the Draft EIS should provide more detail on the properties of the different types of crude oil that the Facility will potentially handle. For each of the above general types of crude – e.g., Bakken or dilbit [p. ES-15 notes that these are the two most likely types of crude that will be handled at the Facility] – the Draft EIS should provide the full range, composition, and properties (such as true vapor pressures at a range of ambient temperatures, the vapor molecular weight, the liquid molecular weight, and the distillation curve) of the crude oil that can be sourced from that area.

These are all critical properties for the analysis of air emissions and impacts as these properties all affect volatility of the product that will be transloaded at the proposed Project site. In turn, the more volatile the type of crude oil is, the more like it will result in emission of air pollutants both in transit and at the facility itself. For example, data on Bakken crudes show that this type of oil in particular, is highly volatile and a potentially large source of VOC pollutant emissions. For tar sands dilbit, the properties make those crudes less volatile but those types of crude are much more difficult to address in the event of a spill. Air quality impacts analysis cannot be properly conducted without a thorough assessment of the properties of the crude oil that can be handled at the Facility.

E. Rail Related Issues.

1. Facility capacity not accurately represented or analyzed.

The crude oil is proposed to be delivered to the Facility by rail in "unit trains" composed of up to 120 crude oil tank cars, each with a tank car capacity of 750 bbl. An average of four unit trains would arrive at the proposed Facility each day.

Occasionally, a fifth train may arrive within a 24-hour period. [p. ES-2]. Short-term impacts analysis should assume that five trains can arrive and be unloaded in a day. While the Draft EIS states that if a fifth train arrives, its unloading might extend to the next day, it is apparent that the facility can unload more than four trains but perhaps not as many as five. The effect on the surrounding area in a 24-hour period could be different depending upon whether as many as five trains are unloaded. This could also affect short-term storage at the facility and barge traffic. The actual limit on how much oil can be unloaded from the trains (i.e., size of pumps; number of pumps; etc.) in a 24-hour period should be provided in order to establish the maximum daily as well as the maximum hourly unloading capabilities. That maximum daily capacity should then be analyzed.

On an annual basis, the Draft EIS states that there will be a total of 2,920 one-way train-trips (1,460 round trips = 2*365) per year.[1] Based on these assumptions, the maximum throughput of crude oil at the proposed Facility per the Draft EIS is 131,400,000 bbl per year (120 cars/train*750 bbl/car*4 trains/day*365 days per year). However, on the marine side, the Draft EIS notes that the maximum throughput is 32,000 bbl/hr* 15 hours/day*365 days/year which equals 175,200,000 bbl/year. This is 33% greater than the maximum throughput on the incoming/rail estimate. Thus, just on this point alone, air emissions might be underestimated by 33%. In any case, there is a mis-match between the possible maximum throughputs estimated on an incoming and outgoing basis. This should be clarified and corrected if necessary.

2. Rail car requirements not clearly enforceable.

The Draft EIS notes that the rail cars to be used will be "sole purpose" crude oil cars. [p. ES-2] However there is no information regarding how this will be guaranteed or enforced or even whether it will be guaranteed or enforced. The Draft EIS states that BNSF is the likely rail transporter to the Facility. In order for the Draft EIS to rely on the "sole purpose" statement in its analysis, it must demonstrate that this will be enforced and BNSF providing confirmation that "sole purpose" rail cars will be used. If there is no guarantee or enforcement then the Draft EIS cannot rely on this fact and must analyze differing scenarios.

The Draft EIS also claims that all tank cars used to transport crude oil to the proposed Facility would be required to meet the new US Department of Transportation (DOT) Specification 117 tank car standards jointly issued by the Pipeline and Hazardous Materials Safety Administration

[1] The analysis does not consider any emissions from the empty rail cars that leave the facility back to the points of origin (or elsewhere). Since there is no mention of any rail car cleaning facilities at the proposed terminal, there will be residual crude oils in the empty rail cars that will emit air pollutants during transit. This error in analysis should be corrected in the Final EIS.

(PHMSA) and Federal Railway Administration (FRA) on May 1, 2015. Yet again, the Draft EIS fails to provide information on enforcement in practice. It is also not clear what will happen if an older design tank car arrives at the Facility. The Draft EIS does not discuss this contingency, which is quite likely since significant numbers of older design rail cars are still in use – even by BNSF. More fugitive emissions are possible from older-style rail cars, not only due to their propensity for spills in case there is an accident, but also during non-accidental travel given the manner of construction of the top hatch and components within.

F. Transportation Traffic Issues Not Adequately Analyzed.

Section 6.2.2 of the Executive Summary [p. ES-9] states that the cumulative impact of rail congestion including the rail demands as a result of the Facility and other cumulative projects is significant since it can exceed capacity in some areas. Thus, rail congestion is anticipated. While the Draft EIS discusses several potential adverse impacts due to rail traffic increase and resultant congestion, it does not discuss additional air emissions from the idling locomotives. This omission should be rectified.

Section 6.2.3 of the Executive Summary [p. ES-10] notes that cumulative vessel trips on the Columbia river could be as high as 5,405 due to deep-draft, far exceeding the 2013 or any historical annual vessel traffic. Thus, this is a significant increase. To the extent that such large traffic increases cause vessels to idle at or near respective ports or in transit on the river, air emissions increases are likely. The Draft EIS does not provided any such analysis. To the extent that this increased volume of vessel traffic might require additional anchorages – beyond the eleven existing anchorages noted in Table 2-12, p. 2-72 - along the river or near the Port of Vancouver or elsewhere along the river, that too is not addressed in the Draft EIS.

G. Details of Transload Operation and Capacity.

1. Direct loading v. storage not adequately disclosed or analyzed.

The Draft EIS provides that once a loaded unit train arrives at the proposed Facility, the crude oil would be unloaded from the railcars and either pumped directly to marine vessels at modified berths on the Columbia River or pumped through a network of transfer pipelines to a storage area containing six aboveground storage tanks. The Draft EIS fails to disclose how the decision is made to unload directly to the marine vessel, bypassing the storage tanks or to unload to the storage tanks first, and does not discuss implications for that decision as it obviously affects the amount of time volatile crude oil is on site and stored. This in turn affects environmental impacts as well as possible permitting issues at the Facility itself.. Oil storage tanks are a source of air pollutant emissions (see below). How long oil is stored and how much and how frequently oil levels in tanks increases and decreases will have an effect on emissions. Further the more times oil is moved around and handled, the more likely fugitive emissions will result. The Draft EIS must disclose how, when, and how frequently oil will be stored as opposed to loaded directly on marine vessels and the difference in environmental impacts as a result.

2. Vessel and loading capacity not accurately represented or analyzed.

The Draft EIS states that approximately 80 percent of the marine vessels expected to call at the proposed Facility would be in the 46 million deadweight tons (MDWT) size range. [p. 2-29 states that these are the typical Handymax class of vessels and can load 319,925 bbl of crude oil. See also p. 2-68.] Smaller numbers of the marine vessels in the 105 and 165 MDWT size ranges (approximately 15 percent and 5 percent, respectively) may also call at the proposed Facility. Typical operations would involve the arrival, loading, and departure of one vessel in each 24-hour period, which equates to approximately 365 vessel calls per year.

This means that, on average, each Handymax marine vessel, because it can only handle 319,925 bbl, will load less than the 360,000 bbl of crude oil that will arrive daily at the Facility. Given this, it is likely that more of the larger vessels will be needed than the Handymax class vessels assumed in the Draft EIS or there will be periods of time during which oil is stored and in fact would build up over time if 4 to 5 trains are calling at the facility daily. I also note [per p. 2-50] that the Draft EIS provides for a maximum transfer rate to vessels of 32,000 bbl/hr. Even assuming a 15-hour transfer time over a 24-hour period [per p. 2-49] in which a vessel arrives, is loaded, and then leaves – the quantity loaded would be 32,000 x 15 = 480,000 bbl, which is considerably larger than the Handymax capacity. It is also much greater than the 360,000 bbl daily average loading rate considered in the analysis. Thus, the air quality (and likely many of the other impact analyses) are underestimated both for marine vessel loading end of the operation and likely for storage emissions. The analysis should be based on the 480,000 bbl daily value.

H. Air Quality Impacts Are Not "Minor."

In the Draft EIS, all air quality impacts are generally noted as "minor" with a few also characterized as "moderate." However, the basis for making such characterizations is not clear. The Draft EIS must disclose the differences in characterization and the bases for those differences.

1. Table ES-2 and Appendix F fail to address numerous issues surrounding air pollutant emissions related to the rail transport of crude to the facility.

The only impact due to rail transport noted in Table ES-2 is due to vehicle idling at crossings. As noted earlier, the cumulative analysis in the Draft EIS states that rail capacity, on a cumulative basis, could be significant – causing congestion. This appears inconsistent with the "minor" impacts noted due to vehicle idling at crossings.

In addition, idling emissions from locomotives themselves are not addressed at all either within the facility or along the entirety of the route. There are likely to be significant emissions of air toxics that will be emitted due to train switching and/or idling near population centers such as the Tri-Cities or Spokane areas in Washington. Of course this will also occur at all other population centers through which the crude trains must travel in order to get to the proposed terminal.

The Draft EIS fails to disclose, address, or analyze the VOC emissions from the volatile crude oil during transit. This analysis should include the entire rail route from the starting point of the

crude to the Facility. The spatial domain for all locomotive emissions should be the entire train route from its source to the facility since emissions during train transit affects air quality along the entire route. This includes not just emissions from the locomotives, but also any fugitive VOC emissions lost from the volatile crude during transit by rail (also known as "crude shrinkage," which has been estimated to be as high as 3% for Bakken crudes) and re-entrained particulate emissions along the track. In particular, these emissions should be estimated for all populations affected along the rail route. If properly analyzed, for example at the 3% VOC emission loss level known for some Bakken crudes, the emissions could be quite significant. If a single train of 120 cars, with 750 bbl/car lost 3% of product due to the volatile crude vaporizing (or "shrinking"), a single train could emit 2700 bbl or around 450 tons of VOC pollutants along its route. Further, it is likely those emissions will in fact be concentrated in urban or more-populated areas where trains are required to slow or sit for some period of time. The Draft EIS makes no effort to estimate and disclose those air pollutant emissions.

2. Table ES-2 and Appendix F fail to fully consider and assess potential air pollutant emissions from marine vessel loading.

Also relative to Table ES-2, Air Quality, the air quality impacts due to vessel emissions at the Facility and in the vessel corridor in the river are not, as claimed in the Draft EIS, likely to be minor. This is because the analysis is incomplete. While the majority of the displaced vapors are likely to be captured and fed to the marine vapor control units, MVCUs, as noted in the Draft EIS [p. 2-49 and 2-50], not all of the vapors will be captured. Up to 5% of the vapors can be assumed to escape, depending upon details of the emissions capture and barge loading operations. This is a potentially significant mass of VOC vapors that will be emitted directly as fugitive emissions from each vessel during loading. Impacts from these emissions cannot be assumed to be minor.

Page 4 of Appendix F lists various "stationary combustion" sources, but also includes non-combustion sources such as fugitive (VOC) emissions from product handling components and storage tanks. This appears inconsistent or at least is confusing. Conspicuously, the previously-mentioned fugitive emissions from marine vessel loading, which are part of the stationary source and thus subject to permitting, are omitted from the list of sources noted on p. 4, Section 3. This source of emissions is also not discussed in Table 2 of Appendix F. Thus, it appears that the preliminary draft EIS, this Draft EIS, and all permitting documents assume that 100% of the VOCs from marine vessel loading will be captured. This is an assumption that is neither correct nor supported. Thus, this Draft EIS deficient; in addition, any permit application submitted by the applicant is likely deficient as well. Finally, the Draft EIS also fails to consider the increased emissions from the vessels due to additional congestion at the Facility, at anchorages, or on the river. As discussed above, it is likely the Draft EIS appears to be inaccurate or underestimating the amount of marine vessel loading that will occur at the facility when operating at full rail capacity. It is important for that to be corrected and for the EIS to examine the likelihood and impact of more than one marine vessel calling at the facility at a time and emissions from waiting vessels.

3. Table ES-2 wholly fails to consider or address air pollutant emissions that are likely from crude oil storage tanks.

Table ES-2 does not address the expected emissions of VOCs from the storage tanks (using the latest calculation methodologies such as those based on DIAL[2] and similar studies) and numerous other sources of air emissions, mostly fugitive in nature, from the Facility. There will be VOC and air toxic emissions from the storage tanks at the facility as well as from the many components associated with crude oil movement within the facility. While these might be addressed in the permitting or other documents, for the sake of presenting a complete picture of all construction and operational emissions due to the proposed facility, the Draft EIS should identify all sources and activities of emissions of all air pollutants. As written, the air quality discussion in Table ES-2 is misleading.

4. Greenhouse gas emissions are artificially constrained and inadequately addressed in the Draft EIS.

Similar to the situation with rail, vessel emissions should include emissions from vessels for the entire trip from the Facility to its destination. While criteria pollutant emissions and air toxic emissions from vessels can be limited to when vessels are in reasonable proximity to the actual West Coast of the U.S. and its population centers, emissions of greenhouse gases (such as carbon dioxide, which results from burning any fuel including in the rail locomotives and the marine propulsion engines) should be included for the entire voyage of the vessels – such as to Alaska, Hawaii, or other more distant destinations. Here the spatial domain used in the analysis is of critical importance. Since greenhouse gas emissions are invariably associated with any transport of crude – both by rail as noted above and by the marine vessels – omitting a portion of the transit will incorrectly reduce the greenhouse gas emission calculations as well.

Currently, the Draft EIS only includes greenhouse gas emissions for the Facility from within Washington state [p. 9; p. 21] – for both train and vessel emissions. This is arbitrary and of course results in underestimation of greenhouse gas emissions resulting from the operation of the facility. Trains do not magically appear at the Washington state line nor do vessels magically disappear upon leaving the Washington state nautical boundary – thus estimated emissions of greenhouse gases have been artificially constrained and minimized by design. Moreover, the DEIS admits that for oil transportation, it uses only inbound train and outbound vessel emissions.

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[2] For background on the most recent calculation methodologies for storage tank emissions, see EPA Critical Review of DIAL Emission Test Date for BP Petroleum Texas City, TX. November 2010. Available at http://www.epa.gov/airtoxics/bp_dial_review_report_12-3-10.pdf.

TCEQ Presentation DIAL Project. 2007. Available at https://www.tceq.texas.gov/assets/public/implementation/air/am/committees/pmt_set/20100407/20100407-Nettles.pdf.

Robinson, R., National Physical Laboratory "The Application of DIAL for Pollutant Emissions Monitoring." January 2015 presentation. Available at http://www.h-gac.com/taq/airquality/raqpac/documents/2015/Jan%2015/DIAL%20%202015%20Houston%20Meeting%20January%20(sent%20version).pdf.

[p. 3.2-30 (Tables 3.2-12 and -13)]. This method incorrectly reduces by half the transportation emissions; trains that arrive in Vancouver must depart Vancouver, emitting greenhouse gases in both directions. The same is true of course for inbound and outbound vessels. These are fatal flaws in the DEIS that must be corrected.

Even with the fundamental errors discussed above, the DEIS's calculations show an enormous greenhouse gas contribution—0.9 percent of the entire emissions from the United States—from this single project. [p. 5-48]. When added to the lifecycle emissions calculations, the DEIS finds a "12.3 percent increase over the life-cycle GHG emissions of the 2005 US average crude oil mix." [p. 5-49]. In addition, the Draft EIS does not estimate incremental greenhouse gas emissions that would not otherwise be refined and therefore not used as products such as gasoline – but for the ability of this proposed terminal to facilitate additional production.

5. The dispersion modeling in the Draft EIS is plainly not correct given the significant errors and omissions outlined above.

Finally, the portion of Appendix F that addresses dispersion modeling is incorrect because the emissions analysis is incorrect or omits significant sources of emissions (as described above). It is therefore premature to comment in detail on the dispersion modeling until such time as the emissions analysis are properly conducted and corrected and the dispersion modeling redone in order to take into account these additional emissions.

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