CBE, Sierra Club, Center, ForestEthics et al. Comments on the Revised Draft Environmental Impact Report for the Phillips 66 Company Rail Spur Extension and Crude Unloading Project

ATTACHMENT C1:

Expert Report of Phyllis Fox on the Revised Draft Environmental Impact Report for the Phillips 66 Rail Spur Extension and Crude Unloading Project, November 2014.

1904 Franklin Street, Suite 600 • Oakland, CA 94612 • (510) 302-0430
Southern California: 6325 Pacific Blvd., Suite 300 • Huntington Park, CA 90255 • (323) 826-9771

Comments

on

Revised Draft Environmental Impact Report

for the

Phillips 66 Rail Spur Extension and Crude Unloading Project

Santa Maria, California

Prepared

for

Communities for a Better Environment
Sierra Club
ForestEthics
Center for Biological Diversity

November 24, 2014

Prepared by

Phyllis Fox, Ph.D., PE
Consulting Engineer
745 White Pine Ave.
Rockledge, FL 32955

Table of Contents

I. INTRODUCTION

The Phillips 66 Santa Maria Refinery (SMR), located in San Louis Obispo County, is proposing to modify an existing rail spur to accommodate train delivery of cost-advantaged crude oils, to replace local supplies. The proposed tracks and unloading facilities would be designed to accommodate unit trains of up to five unit trains per week, consisting of 80 tank cars and associated locomotives and other supporting cars as well as periodic manifest trains of fewer cars not dedicated to SMR oil (Project). I was asked by Communities for a Better Environment (CBE), the Sierra Club, ForestEthics, and the Center for Biological Diversity to review the Revised Draft Environmental Impact Report (RDEIR or Santa Maria RDEIR)[1]and prepare comments on a limited number of issues. This RDEIR replaces a former Draft Environmental Impact Report on a similar Project (DEIR)[2] issued in November 2013 that I also commented on.

My evaluation, presented below, indicates the RDEIR fails to disclose the link between the Rail Spur Project and three other directly related projects: (1) the Propane Recovery Project at Phillips 66's Rodeo facility; (2) the Rodeo Refinery Marine Terminal Offload Limit Revision Project; and (3) the Throughput Increase Project at the Santa Maria Refinery. The impacts of these directly related projects should have been evaluated as a single project. Together, they result in many significant impacts that were not disclosed in the Rail Spur Project RDEIR.

CBE-99

The RDEIR fails to evaluate the impacts resulting from a significant switch in crude slate, from locally sourced heavy crudes to tar sands crudes. The entire Project, comprising the four piecemealed projects, would result in significant unmitigated air quality, global warming, water supply, biological, and corrosion-caused risk of upset and other impacts, either not disclosed, improperly analyzed, or not mitigated in the RDEIR.

Finally, the RDEIR's hazard analysis fails to include the portions of the route where train accidents are most likely to occur due to steep grades and poor condition of tracks and bridges – from the stateline to the rail yards in Roseville and Colton, fails to analyze a worst case spill, and fails to disclose the significant difficulty of cleaning up a tar sands spill to waterways. The railroad tracks in these omitted areas parallel the water supply for most of California. A derailment that spilled significant amounts of tar sands crudes in these waterways could shut down the water supply for most of the state, resulting in significant unmitigated impacts on agricultural and municipal water supplies and significant aquatic biological impacts.

My resume is included in Exhibit 1 to these comments. I have over 40 years of experience in the field of environmental engineering, including air emissions and air pollution

[1] San Luis Obispo County, Phillips 66 Company Rail Spur Extension and Crude Unloading Project Revised Public Draft Environmental Impact Report and Vertical Coastal Access Project Assessment, October 2014, SCH # 2013071028; Available at: http://www.slocounty.ca.gov/Assets/PL/Santa+Maria+Refinery+Rail+Project/Phillips+66+Company+Rail+Spur+Extension+Project+(Oct+2014)/Phillips+SMR+Rail+Project+Public+Draft+EIR.pdf.

[2] Marine Research Specialists (MRS), Phillips 66 Company Rail Spur Extension Project Public Draft Environmental Impact Report and Vertical Coastal Access Assessment, November 2013.

control; greenhouse gas emission inventory and control; air quality management; water quality and water supply investigations; hazardous waste investigations; hazard investigations; risk of upset modeling; environmental permitting; nuisance investigations (odor, noise); environmental impact reports/statements, including California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) documentation; risk assessments; and litigation support.

I have M.S. and Ph.D. degrees in environmental engineering from the University of California at Berkeley with minors in Hydrology and Mathematics. I am a licensed professional engineer (chemical, environmental) in five states, including California; a Board Certified Environmental Engineer, certified in Air Pollution Control by the American Academy of Environmental Engineers; and a Qualified Environmental Professional, certified by the Institute of Professional Environmental Practice.

I have prepared comments, responses to comments and sections of EIRs for both proponents and opponents of projects on air quality, water supply, water quality, hazardous waste, public health, risk assessment, worker health and safety, odor, risk of upset, noise, land use and other areas for well over 100 documents. This work includes Environmental Impact Reports (EIRs), Negative Declarations (NDs), and Mitigated Negative Declarations (MNDs) for all California refineries as well as various other permitting actions for tar sands and light shale crude refinery upgrades in Indiana, Louisiana, Michigan, Ohio, South Dakota, Utah, and Texas and liquefied natural gas (LNG) facilities in Texas, Louisiana, and New York. I was a consultant to a former owner of the subject refinery on CEQA and other environmental issues for over a decade and am thus very familiar with both the Rodeo Refinery and the Santa Maria Refinery and their joint operations.

CBE-99 cont

My work has been cited in two published CEQA opinions: (1) *Berkeley Keep Jets Over the Bay Committee, City of San Leandro, and City of Alameda et al. v. Board of Port Commissioners* (August 30, 2001) 111 Cal.Rptr.2d 598 and *Communities for a Better Environment v. South Coast Air Quality Management Dist. (2010) 48 Cal.4th 310*.

II. THE PROJECT IS PIECEMEALED

The Phillips 66 San Francisco Refinery (SFR) consists of two facilities linked by a 200-mile pipeline. Santa Maria RDEIR, Fig. 2-2. The Santa Maria Refinery (SMR) is located in Arroyo Grande, in San Luis Obispo County, while the Rodeo Refinery is located in Rodeo in the San Francisco Bay Area. The Santa Maria Refinery mainly processes heavy, high sulfur crude oil and sends semi-refined liquid products, *e.g.*, gas oil and pressure distillates[3], to the Rodeo Refinery for converting into finished products. See, *e.g.*, Propane Recovery RDEIR, p. 3-25.

CBE-100

[3] The permits to operate for the Santa Maria Refinery and various pump stations along the pipeline indicate that the materials sent from Santa Maria to Rodeo are gas oil and "pressure distillates." The "pressure distillates" are referred to as "naphtha" in the subject RDEIRs. However, there are different types of naphtha, depending upon the boiling range. Full range naphtha, which is presumably what "pressure distillate" is intended to capture, is the fraction of hydrocarbons boiling between 30 C and 200 C. It consists of a complex mixture of hydrocarbons generally having between 5 and 12 carbon atmos and comprises 15% to 30% of the crude oil by weight. Light naphtha is the fraction boiling between 30 C and 90 C and consists of molecules with 5 to 6 carbon atoms. See, *e.g.*, http://en.wikipedia.org/wiki/Naphtha.

Phillips 66 is planning to replace a significant portion of its baseline crude slate with cost-advantaged crudes delivered to its California refineries by ship and rail. There are currently four related projects at the San Francisco Refinery (comprising the Santa Maria and Rodeo Refineries) that have recently been permitted or that are currently in the process of being permitted that are inextricably linked and should have been evaluated as a single Project under CEQA. Two are located at the Rodeo end of the pipeline and two are located at the Santa Maria end of the pipeline. These four projects are:

1. Santa Maria Refinery Throughput Increase Project;[4]
2. Santa Maria Refinery Rail Spur Project (RDEIR);
3. Rodeo Refinery Propane Recovery Project;[5]
4. Rodeo Refinery Marine Terminal Offload Limit Revision Project.[6]

I previously commented on the relationship between the Santa Maria Refinery Throughput Project, the Santa Maria Refinery Rail Spur Project,[7] and the Rodeo Refinery Propane Recovery Project[8] in comments on previous CEQA documents. These comments are included here in Exhibits 2 and 3. I reassert these comments as they are still valid and have not been addressed in either the Santa Maria Refinery Rail Spur Project RDEIR or the Propane Recovery RDEIR. CBE-100 cont

However, the SMR Rail Spur Project and Rodeo Refinery Propane Recovery RDEIRs both raise a new issue that seeks to demonstrate that these two projects are not related. This new issue, an alleged vapor pressure constraint, has not been addressed in other comments on piecemealing. The SMR Rail Spur Project RDEIR, p. 2-31, asserts out of the blue, without mentioning the Rodeo Refinery Propane Recovery Project:

> "Prior to pipeline shipment to the Rodeo Refinery the naphtha and gas oils are stored in tanks located at the SMR. These storage tanks have vapor pressure limits are required by the San Luis Obispo County Air Pollution Control District (SLOAPCD) permit, which limits the vapor pressure to 11 pisa [sic]. Historically, and currently the SMR tanks operate at about 10 psia (pounds per square inch absolute). These pressure limits restrict the amount of propane/butane that can be contained in naphtha and gas oils that are shipped to the Rodeo Refinery. The majority of the

---

[4] Marine Research Specialists, Phillips 66 Santa Maria Refinery Throughput Increase Project, Final Environmental Impact Report, October 2012 (SMF FEIR); Available at: http://slocleanair.org/phillips66feir.

[5] Contra Costa County Department of Conservation and Development, Phillips 66 Propane Recovery Project Recirculated Draft Environmental Impact Report, SCH # 2012072046, October 2014, Available at: http://www.cccounty.us/DocumentCenter/View/33804.

[6] ERM and BAAQMD, CEQA Initial Study, Marine Terminal Offload Limit Revision Project, Phillips 66 Refinery, Rodeo, California, BAAQMD Permit Application 22904, December 2012; Phillips 66, Application for Authority to Construct and Minor Modification to Major Facility Review Permit, Revision of Permit Condition 4336 Part 7, Phillips 66 San Francisco Refinery; Major Facility Review Permit, Phillips 66 – San Francisco Refinery, Facility #A0016, Condition 4336, pp. 497-498, August 1, 2014.

[7] Phyllis Fox, Comments on Environmental Impact Report for the Phillips 66 Rail Spur Extension Project, Santa Maria, California, Prepared for Sierra Club, San Francisco, January 27, 2014.

[8] Phyllis Fox, Comments on Environmental Impact Report for the Phillips 66 Propane Recovery Project, Prepared for Shute, Mihaly & Weinberger LLP on behalf of Rodeo Citizens Association, November 15, 2013.

propane/butane that is contained in the crude oils process at the SMR ends up in the refinery fuel gas. Figure 2-10 provides a simplified flow diagram of the SMR."

The Rodeo Refinery Propane Recovery Project RDEIR, on the other hand, includes a brief discussion of the Santa Maria Refinery. This discussion first asserts that "[t]he proposed Project [Propane Recovery] is independent of and would have no effect on SMF [Santa Maria Facility] operations." Propane RDEIR, p. 3-25. It goes on to make an argument, again out of the blue, that is very similar to the one cited above from the Santa Maria Refinery Rail Spur Project RDEIR (Propane RDEIR, pp. 3-25/26):

> "The storage tanks located along the 200-mile pipeline between the two refineries have maximum vapor pressure limits imposed by the San Luis Obispo County and San Joaquin Valley Air Pollution Control Districts which constrain the amount of butane and propane that can be included in the semi-refined products. Increasing the amount of butane and propane in the semirefined products would increase the vapor pressure of the material. Historically and currently these storage tanks contain products which are at or near the maximum vapor pressure limits. Additional butane and/or propane would cause the products to exceed the vapor pressure limits of the storage tanks. Accordingly, no new butane and propane can be added to the semi-refined products sent from the Santa Maria Refinery to the Rodeo Refinery regardless of the types of crude oil that may be processed at the Santa Maria Refinery."

CBE-100 cont

These arguments attempt to demonstrate that there can be no link between these two projects as vapor pressure permit limits on tanks that store the gas oil and pressure distillate sent from Santa Maria to Rodeo would prohibit any increase in propane and butane as they historically and currently operate near their limits. These claims are incorrect as the assertions are wrong. There either are no vapor pressure limits on the subject tanks, or the materials stored in them have vapor pressures far below their permitted limits.

A. Vapor Pressure Constraints Are Unsupported

The RDEIRs contains no support whatsoever for these vapor pressure claims. Thus, it fails as a CEQA document. Support should include identification of the permits, tanks, and permit conditions that restrict vapor pressure and certified vapor pressure monitoring data for each subject tank. None of this information is in the record.

CBE-101

Therefore, I researched the issue, obtained permits, and identified the tanks that store the subject gas oil and pressure distillate, and obtained vapor pressure monitoring data from the San Luis Obispo County Air Pollution Control District (SLOCAPCD). My research indicates that these claims are wrong.

1. Santa Maria Refinery Tanks

The Santa Maria Refinery produces two semi-refined products – gas oil and pressure distillate. These products are stored in on-site tanks and sent by pipeline to the Rodeo Refinery to convert them to finished products such as gasoline. Emissions from these tanks are regulated by the SLOCAPCD Permit to Operate for the Santa Maria Refinery (Refinery Permit).[9] The Refinery Permit indicates that gas oil is stored in Tanks 800 and 801 and pressure distillate is stored in Tanks 550 and 511. PTO Conditions II.B.1.a and d, p. 8. The vapor pressure of the materials stored in these tanks should not appreciably change during pipeline transport to Rodeo. As discussed below, the vapor pressures of both gas oil and pressure distillate stored in tanks at the Santa Maria Refinery sent to Rodeo are significantly less than claimed in the RDEIRs. CBE-102

a. Pressure Distillate Tanks 800/801

Pressure distillate, the more volatile of the two semi-refined products, is stored in 52,000-barrel, welded-shell, dome-roof tanks that are controlled by a methane blanket and vapor recovery system (Process A-2). These tanks must comply with SLOCAPCD Rule 425[10]. Rule 425, Section D.5.b applies. This section exempts these tanks from vapor pressure limits as emissions are controlled with a vapor loss control device listed in Section E.3 (E.3 Vapor Recovery System). Thus, there are no vapor pressure limits on the tanks that store pressure distillate that is sent to Rodeo as the vapors are recovered, contrary to the assertion in the SMR Rail Spur Project RDEIR that there is a vapor pressure limit of 11 psia.

The SMR Rail Spur Project RDEIR further asserts that the "SMR tanks operate at about 10 psia", without identifying the tanks. SMR Rail Spur Project RDEIR, p. 2-31. As gas oil is much less volatile, this comment likely refers to pressure distillate. Regardless, even if the pressure distillate tanks were limited to a vapor pressure of 11 psia (which they are not as they are otherwise controlled), the vapor pressure of the pressure distillate that is stored in them is not "about 10 psia". Rather, annual emission inventory data obtained from the SLOCAPCD (Exhibit 4) indicate that the pressure distillate tanks have operated at 6.2 psia over the period 2009 to 2013. Thus, the claims in the SMR Rail Spur Project RDEIR, p. 2-31, are wrong as to the pressure distillate storage tanks at the Santa Maria Refinery. These tanks do not have vapor pressure limits as they are controlled. Further, they are operating far below the erroneously claimed limit of 11 psia. CBE-103

b. Gas Oil Tanks 500/501

Gas oil is stored in 76,500 barrel welded-shell, external floating pontoon roof, single shoe seal tanks. Rule 425, Section D.4, limits the vapor pressure of these tanks to 0.5 psia. Vapor pressure data that I obtained from the SLOCAPCD (Exhibit 4) indicate that the gas oils stored in these tanks had true vapor pressures of 0.27 psia over the period 2009 to 2013, much less CBE-104

---

[9] Permit to Operate No. 44-52, Phillips 66 Company - Santa Maria Refinery, November 6, 2013.

[10] SIP Rule 407.A.2, also cited in this condition, is superceded by Rule 425. Email from Dean Carlson, SLOCAPCD, to Phyllis Fox, November 21, 2014, Re: SMR Questions, Response (2).

than 0.5 psia. The SLOCAPCD permit engineer explained that when higher vapor pressure material is encountered, it is routed to the pressure distillate tanks.[11] CBE-104 cont

2. The SMR-to-Rodeo Refinery Pipeline

The semi-refined products stored in Tanks 500, 501, 800, and 801 are pumped into the 200-mile long pipeline and sent to Rodeo for refining into finished products. There are several pump stations along this pipeline, used to increase the pressure as needed to overcome pressure losses from friction during transport. Storage tanks are present at some of these pump stations.

These materials are generally sent directly to Rodeo, without being diverted to tanks along the pipeline, as suggested in the Propane Recovery Project RDEIR, pp. 3-25/26. Phillips Pipeline LLC modified operation of this pipeline several years ago to reduce off-loading of gas oil and pressure distillate at pump stations.[12] While it is possible that an upset or operational abnormality could require material to be temporarily offloaded at pump station tanks, this is not the normal operational mode. Further, as discussed elsewhere, the vapor pressure of the semi-refined products are far below the vapor pressure limits. The former Creston and Summit pump stations were not needed after the operational change and thus no longer have active permits.[13] Other pump stations along the pipeline are primarily used just to push the material along.[14] CBE-105

Thus, gas oil and pressure distillate that enters the pipeline at Santa Maria arrive at Rodeo with the same vapor pressure. The operation is steady state with little variation in measured vapor pressures from year to year.[15] The vapor pressure data reported by SLOAPCD (Exhibit 4) indicates that these tanks operate far below their permit limits. Within the SLOCAPCD, only the Santa Margarita and Shandon pump stations have active SLOCAPCD permits for storage tanks.

a. *SLOCAPCD Pump Stations*

Santa Margarita Pump Station Tanks

The Santa Margarita Pump Station Permit to Operate[16] lists four tanks. Three of them (55422, 55408, 110404) have vapor pressure limits of 11 psia, consistent with pressure distillate. Two of these pressure distillate tanks (55422, 55408) are vented to a carbon absorption vapor control system when pressure distillate is stored. The fourth tank (175420) has a vapor pressure limit of 1.5 psia. Vapor pressure data that I obtained from the SLOCAPCD (Exhibit 4) indicates the following vapor pressure ranges for these four tanks over the period 2009 to 2013: CBE-106

[11] Personal communication, Dean Carlson, SLOCAPCD, to Phyllis Fox, November 20, 2014.

[12] Email from Dean Carlson, SLOCAPCD, to Phyllis Fox, November 21, 2014, Re: SMR Questions, Response (5).

[13] Email from Dean Carlson, SLOCAPCD, to Phyllis Fox, November 20, 2014, Re: P66 Pump Stations.

[14] Email from Dean Carlson, SLOCAPCD, to Phyllis Fox, November 21, 2014, Re: SMR Questions, Response (5).

[15] Email from Dean Carlson, SLOCAPCD, to Phyllis Fox, November 21, 2014, Re: SMR Questions, Response (4).

[16] SLOAPCD, Permit to Operate Number 404-9, Phillips Pipeline LLC, Santa Margarita Pump Station, May 2, 2012, Condition 5.

- Tank 55408: 0.26 to 4.79 psia (limit: 11 psia)
- Tank 55422: 0.36 to 5.05 psia (limit: 11 psia)
- Tank 11040: 0.24 to 0.4 psia (limit: 11 psia)
- Tank 175420: 0.07 to 0.49 psia (limit: 1.5 psia)

CBE-106 cont

All of these tanks are operating at vapor pressures far below their permit limits. Thus, the claim in the RDEIRs that they are operating close to their limits, precluding any increase in propane and butane, is incorrect.

Shandon Pump Station Tank

The Shandon Pump Station Permit to Operate lists a single 35,000 barrel pontoon floating roof tank, permitted to store organic liquids with a true vapor pressure not to exceed 1.5 psia.[17] The SLOCAPCD inventory data also indicate that gas oil has been stored in this tank. Over the period 2009 to 2013, the true vapor pressure ranged from 0.12 psia to 0.24 psia, substantially lower than the 1.5 psia vapor pressure limit. Thus, the claim in the RDEIRs that this tank is operating close to its vapor pressure limit, precluding any increase in propane and butane, is incorrect.

CBE-107

b. *<u>SJVAPCD Pump Station Tanks</u>*

There are five pump stations in the San Joaquin Valley Air Pollution Control District (SJVAPCD) along the subject pipeline that have active permits to operate and which include tanks that could store gas oils and pressure distillate, if offloaded during transit to the Rodeo Refinery: (1) McKittrick (S1521); (2) Sunset (S 1522): (3) Shale (S1523); (4) Midway (S1525); and (5) Junction (S 1518). While I was unable to obtain either permits to operate or vapor pressure data for these tanks due to inadequate review time, there is no reason to expect that the vapor pressure of the SMR gas oils and pressure distillates shipped out of the SLOCAPCD into the segment of the pipeline under the jurisdiction of the SJVAPCD (and beyond the Bay Area Air Quality Management District (BAAQMD)) would change during transit to Rodeo. Further, there would be little if any reason to transfer pipeline material into these tanks, once destined for Rodeo.

CBE-108

---

[17] SLOCAPCD, Permit to Operate Number 505-4, Phillips Pipeline LLC, Shandon Pump Station, May 2, 2012, Condition 5.

B. Refinery Fuel Gas

The SMR Rail Spur Project RDEIR asserts that the majority of the propane and butane would be partitioned into the refinery fuel gas. SMR Rail Spur Project RDEIR, p. 2-31. This depends on the design of the crude tower, *i.e.*, the temperature cut points, which was not disclosed in the RDEIR. Distillate cut points could be optimized to route more of the propane and butane into the naphtha. However, I agree that most of the butane likely would be partitioned into the refinery fuel gas, but a significant amount of the propane would be present in the pressure distillate. Butane is present in much lower amounts than propane in the tar sands crudes identified in the RDEIR.

Regardless, the amount partitioned to the fuel gas at Santa Maria would depend on the amount present in the imported crudes, which would depend largely on the type of diluent if tar sands are imported, or otherwise, the specific light crude, as some are highly enriched in propane and butane. CBE-109

The SMR Rail Spur Project RDEIR fails as a CEQA informational document as none of the information required to address this point is disclosed. Further, the semi-refined products from refining rail-imported crudes at the Santa Maria Refinery will generate additional amounts of propane and butane when refined at Rodeo, compared to the SMR baseline crude slate. Thus, the fuel gas argument is without merit.

C. Source of Increased Amounts of Propane and Butane Feedstocks at Santa Maria Refinery

The Santa Maria Rail Spur Project and Propane Recovery Project RDEIRs attempt to rebut any connection between these two projects by hiding behind the vapor pressure argument. However, this argument is not persuasive, as demonstrated above. In fact, most all of the cost-advantaged crudes flooding into the market will allow the SMR to produce propane/butane-rich, semi-refined products and the Rodeo Refinery to recover more propane and butane from them than available in their baseline crude slates.

The amount of propane and butane (or its precursors) in the Santa Maria Refinery rail-imported crudes could be substantial, significantly more than in the SMR baseline crude slate, depending upon the specific crudes that are imported. Pressure distillate is the lighter of the two semi-refined products sent to Rodeo. It is mostly naphtha with some material in the kerosene and diesel boiling range. The raw naphtha, for example, can contain significant amount of pentane,[18] which would be recovered at Rodeo by the Propane Recovery Project. Naphtha, for example, is a feed to the proposed LPG[19] Recovery Unit at the Rodeo Refinery. Further, Santa Maria Refinery gas oil is a feed to various hydrocracking units at Rodeo that break it down into recoverable propane and butane feedstocks. CBE-110

[18] See, for example, Tesoro Material Safety Data Sheet, Naphtha; Available at: http://www.collectioncare.org/MSDS/naphthamsds.pdf.

[19] LPG = Liquefied Petroleum Gas = propane + butane.

The SMR Rail Spur Project RDEIR states that rail-imported crude oils would be sourced from oilfields throughout North America based on market economics and other factors. SMR Rail Spur Project RDEIR, pp. 1-4 & 2-22. The RDEIR identifies two tar sands crudes (RDEIR, pp. 2-3, 4.12-27, Tables 2.6 & 4.3.13, 4.7.14) and admits it has received another for about one year. SMR Rail Spur Project RDEIR pp. ES-14, 4.13-27, 2-31, 2-33, 5-3. While it asserts Bakken crudes will not be imported, the RDEIR does not contain any conditions that restrict the types of crudes that will be imported. Thus, the Santa Maria RDEIR should have evaluated the full range of potential cost-advantaged crudes that could be imported. The crudes that the RDEIR specifically identifies, plus other cost-advantaged crudes available in the market, would increase the amount of propane and butane that could be recovered at the Rodeo Refinery, compared to the SMR baseline. These various crudes are discussed below. CBE-110 cont

1. DilBit Tar Sands Crudes

The SMR Rail Spur Project RDEIR identifies Access Western Blend[20] and Peace River Heavy[21] as potential crudes that could be delivered via rail and processed at the Santa Maria Refinery. SMR Rail Spur Project RDEIR, pp. 2-3, 4.12-27, Tables 2.6 & 4.3.13, 4.7.14. The RDEIR also admits that SMR has received Canadian tar sands crude oil for about one year (post-baseline), specifically Kearl Lake, which made up 2% to 7% of the processed crude slate. SMR Rail Spur Project RDEIR pp. ES-14, 4.13-27, 2-31, 2-33, 5-3. The RDEIR also asserts that Bakken crudes will not be imported. However, the RDEIR does not contain any conditions that restrict the type of crudes that will be imported. Thus, the RDEIR should have evaluated the full range of potential cost-advantaged crude imported.

Most tar sands crudes are too heavy to flow in a pipeline and to be transported in the type of railcar proposed for the Project (*i.e.*, no steam coils or dedicated steaming facilities at Santa Maria), or unloaded and transferred to on-site storage tanks. Thus, they must be diluted or thinned with a lighter hydrocarbon stream to reduce viscosity. These diluted tar sands crudes are called "DilBits," which is a shorthand expression for blends of **dil**uent and tar sands **bit**umen. All of the tar sands crudes mentioned in the RDEIR are DilBits. A DilBit typically contains 25% to 30%+ diluent. The diluent is typically natural gas condensate, pentanes, or naphtha.[22] Diluent presents two opportunities to increase the amount of propane and butane that could be recovered at Rodeo. CBE-111

First, chemical composition data for the three tar sands crudes identified in the RDEIR indicates they are loaded with propanes and butanes. Peace River Heavy contains 0.83 vol% butanes and 7.05 vol% pentanes.[23] Access Western Blend contains 0.69 vol% butanes and

[20] http://www.crudemonitor.ca/crude.php?acr=AWB.

[21] http://www.crudemonitor.ca/crude.php?acr=PH.

[22] Gary R. Brierley, Visnja A. Gembicki, and Tim M. Cowan, Changing Refinery Configurations for Heavy and Synthetic Crude Processing, Available at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BA07DE342-E9B1-402A-83F7-36B18DC3DD05%7D&documentTitle=5639138.

[23] http://www.crudemonitor.ca/crude.php?acr=PH.

8.67% propanes.[24] Kearl Lake contains 0.83 vol% butanes and 10.2 vol% propanes.[25] Thus, it is indisputable that the targeted tar sands crude would contribute to the butane and propane that would be recovered by the Propane Recovery Project at Rodeo.

The SMR Rail Spur Project RDEIR alleges these butanes and propanes would be partitioned into the refinery fuel gas at SMR and thus would not reach the Rodeo Refinery. Most of the butane, present in much smaller amounts, could be partitioned to the fuel gas, depending on the temperature cut points of the distillation tower. However, most of the propane would remain in the straight run naphtha produced in the crude tower. SMR Rail Spur Project RDEIR, Fig. 2-10. Thus, the amount of butane and propane remaining in the semi-refined products headed to Rodeo, principally the pressure distillate, would be higher than in the baseline in which only heavy sour crudes were processed. SMR Rail Spur Project RDEIR, pp. 2-31. Further, operation of the crude tower could be modified to incorporate more of the propane and butane into the naphtha fraction. CBE-111 cont

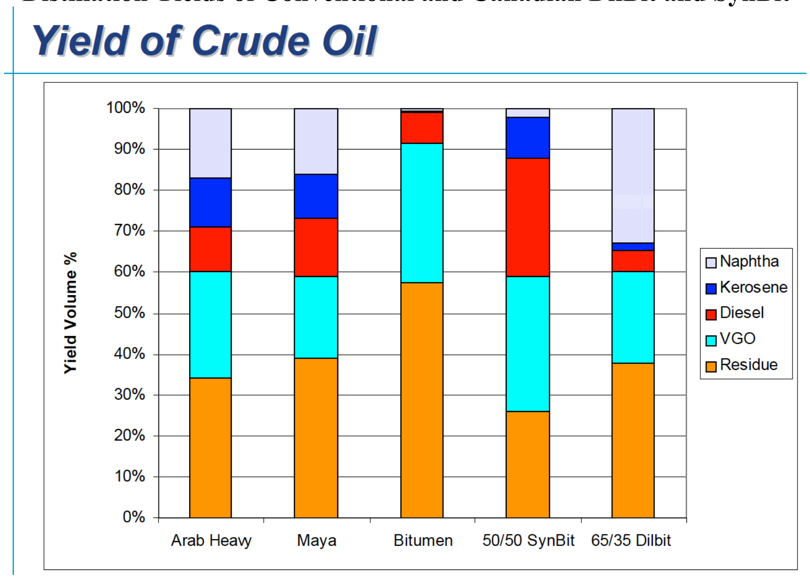
Second, DilBits, when refined, will yield much greater amounts of naphtha,[26] the lighter component of the pressure distillate sent to Rodeo and one of the feedstocks for propane recovery. Propane Recovery Project RDEIR, Fig. 3-6. The higher yield of naphtha from distilling DilBits, compared to heavy crudes, is illustrated in Figure 1. This bar chart compares the output of the distillation column (crude tower) for two commonly refined conventional heavy crudes (Arab Heavy and Maya, which are similar to the Santa Maria Refinery baseline crude slate) and three Canadian tar sands crudes (raw bitumen, SynBit, and DilBit). The last bar in Figure 1, 65/35 DilBit (65% bitumen, 35% diluent) is most similar to the crudes identified in the SMR Rail Spur Project RDEIR. Raw bitumen would be unlikely in large amounts without additional steam support at the proposed rail terminal. The SMR is not designed to refine SynBits so they also are unlikely imports.

[24] http://www.crudemonitor.ca/crude.php?acr=AWB.

[25] http://www.crudemonitor.ca/crude.php?acr=KDB.

[26] N. Yamaguchi, Tight Oil and Oil Sands in the U.S. Crude Slate: What Fuel Marketers Need to Know, Available at: http://fuelmarketernews.com/tight-oil-oil-sands-u-s-crude-slate-fuel-marketers-need-know/.

Figure 1
Distillation Yields of Conventional and Canadian DilBit and SynBit



(From: Kevin Turini and others, Processing Heavy Crudes in Existing Refineries, Slides, 2011 AIChe Meeting, Chicago, IL

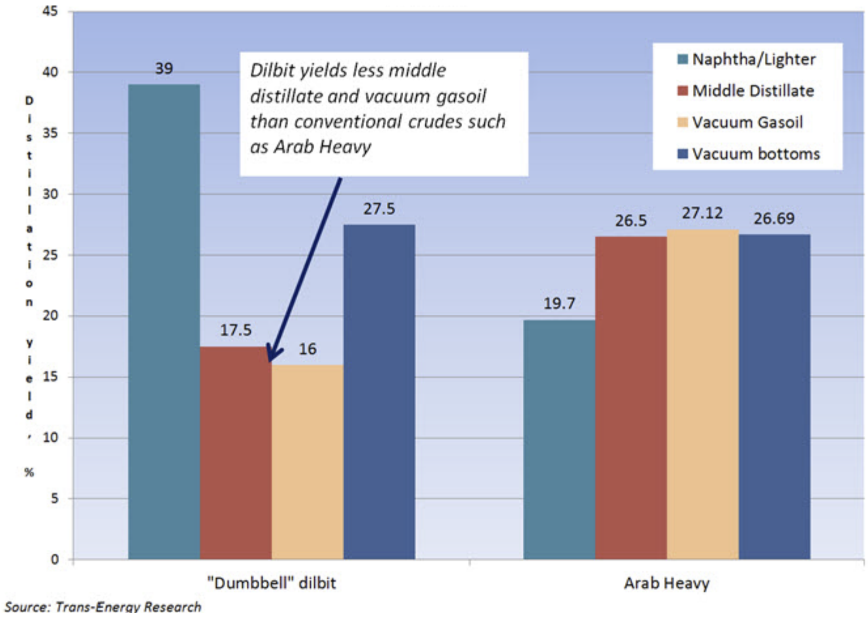
DilBits are sometimes referred to as "dumbbell" or "barbell" crudes as the majority of the diluent is C_5 to C_{12} and the majority of the bitumen is C_{30}+ boiling range material, with very little in between.[27] This means these crudes have a lot of material boiling at each end of the boiling point curve, but little in the middle. The 65/35 DilBit bar in Figure 1 indicates that these crudes generate about twice as much "naphtha" as the heavy crudes they would replace.

This is further confirmed by a different distillate yield bar chart from another source in Figure 2. This figure likewise confirms that switching from a heavy crude to a DilBit crude would roughly double the amount of naphtha distilled from the crude, from 19.7% to 39% and decrease gas oil from 27% to 16%. Additional amounts of both naphtha and gas oil would be produced by cracking the vacuum bottoms in the coker.

CBE-111 cont

[27] Gary R. Brierley and others, Changing Refinery Configuration for Heavy and Synthetic Crude Processing, 2006; Available at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BA07DE342-E9B1-402A-83F7-36B18DC3DD05%7D&documentTitle=5639138.

Figure 2
Distillation Yields of a Conventional Heavy Crude (Arab Heavy) and DilBits



(from: Nancy Yamaguchi, Tight Oil and Oil Sands in the U.S. Crude Slate: What Fuel Marketers Need to Know, Fuel Marketer News; Available at: http://fuelmarketernews.com/tight-oil-oil-sands-u-s-crude-slate-fuel-marketers-need-know/)

The DilBits yield very little middle distillate fuels, such as diesel, heating oil, kerosene, and jet fuel and more coke, than other heavy crudes. A typical DilBit, for example, will have 15% to 20% by weight light material, basically the added diluent, 10% to 15% middle distillate, and the balance, >75% is heavy residual material (vacuum gas oil and residue) exiting the distillation column. These characteristics, which distinguish DilBits from the current baseline crude slate, have two major implications. CBE-111 cont

First, refining of DilBits at SMR will generate more naphtha, the lighter semi-refined product, and less gas oil, thus changing the semi-refined product distribution. The increased amount of naphtha, when processed at the Rodeo Refinery, will generate more propane and butane. Naphtha, for example, is one of the feeds to the proposed LPG Recovery Unit. Propane Recovery Project RDEIR, Fig. 3-6. In other words, the increased amounts of naphtha produced from imported DilBit tar sands (or light tight crudes) would contain higher amount of propane and butane precursors, which would not be partitioned to refinery fuel gas at the Santa Maria Refinery as they would be present in the pressure distillate and refined at the Rodeo Refinery to recover butane and propane.

The Project proposes to import 37,142 bbl/day of cost-advantaged crudes by rail. The average baseline crude throughput for the Santa Maria Refinery (2010-2012) is 38,029 bbl/day. SMR Rail Spur Project RDEIR Table 2.7. Throughput data obtained from the SLOCAPCD indicates that this crude input generated 20,714 bbl/day of gas oil and 11,633 bbl/day of pressure distillate. Exhibit 5. Figures 1 and 2 indicate that DilBits could roughly double the amount of naphtha distilled from the crude oil. Assuming that all of the pressure distillate is naphtha, replacing 37,142 bbl/day of conventional heavy crudes with an equivalent amount of DilBit crude could increase naphtha yield from 11,633 bbl/day to 22,723 bbl/day (37,142/38,029 ×

11,633 × 2 = 22,723) in the baseline and significantly more once the SMR Throughput Project is operating at capacity. This significant increase in naphtha in the pressure distillate sent to Rodeo would allow the recovery of significant additional propane and butane at the Rodeo Refinery, relative to the baseline. This increase in naphtha in the pressure distillate would not exceed any tank vapor pressure limits as all of the tanks are operating far below their limit and the vapor pressure of the naphtha itself and the pressure distillate in which it is present are less than tank vapor pressure limits. CBE-111 cont

Second, the refining of DilBits at SMR will increase the amount of coke. This would increase emissions from coke dust and truck transport of coke, an impact not disclosed in the SMR Rail Spur Project RDEIR. This is further discussed in Comment III.

2. Other Tar Sand Crudes

The RDEIR also does not exclude the import of heavier tar sands crudes. In general, at refineries with cokers, such as Santa Maria Refinery, even decreases in API gravity (*i.e.*, heavier crude) can result in more propane and butane in the semi-refined products.[28] CBE-112

3. Light Crudes

Finally, while the RDEIR asserts that Bakken crudes would not be imported (SMR Rail Spur Project RDEIR, pp. ES-5, 1-4, 2-1, 2-22), there are many other cost-advantaged light crudes that could be imported by rail. In general, the lighter the crude, the more butane and propane that can be recovered when it is refined.[29] These include new sources of cost-advantaged North American crudes, such as from the Permian (west Texas), Eagle Ford (south Texas), Granite Wash (Texas Panhandle), and Niobrara (Colorado) basins,[30] as well as Rocky Mountain Sweet (Casper, WY), and Mississippian Lime (Oklahoma).[31] Many of these crudes are already being refined by Phillips 66.[32] These crudes contain significant amounts of propane and butane and their precursors. The RDEIR does not exclude the rail import of any of these light, cost-advantaged crudes. CBE-113

---

[28] NPC North American Resource Development Study, September 15, 2011, p. 18.

[29] See, *e.g.*, NPC North American Resource Development Study, Natural Gas Liquids (NGLs), September 15, 2011, p. 18; Available at: http://www.npc.org/prudent_development-topic_papers/1-13_ngl_paper.pdf.

[30] Dangerous Goods Transport Consulting, Inc., 2014, p. 23 (vol% C2 – C5 in Eagle Ford crude reported as 8.3%); Available at: composhttps://www.afpm.org/WorkArea/DownloadAsset.aspx?id=4229.

[31] Alan Mazaud, Exergy Resources, May 23, 2013, Pennsylvania Rail Freight Seminar, Slide: Growth of Domestic Production of Tight Oil.

[32] Phillips 66 Third Quarter Conference Call Slides, October 29, 2014; Available at: http://investor.phillips66.com/files/doc_presentations/2014/Earnings/PSX-Q3-News-Release-Slides-FINAL_v001_k94fx2.pdf.

4. Other Sources of Propane/Butane

The gas oils and naphthas sent to Rodeo would be further refined. This refining itself produces propane and butane. For example, the pressure distillate would be fed to hydrotreaters and hydrocrackers, which would produce propane- and butane-rich streams. The gas oils would be feed to cokers and hydrotreaters, which would also produce propane- and butane-rich streams. Thus, the increased amount of propane and butane that could be recovered when these semi-refined products generated from a lighter crude slate are further refined at Rodeo. Additional propane and butane could be generated at Rodeo itself by switching to a lighter crude slate. CBE-114

D. Summary

In sum, the claims made in the RDEIRs in an attempt to decouple the Santa Maria Refinery Rail Spur Project and the Rodeo Refinery Propane Recovery Project based on vapor pressure limits have no merit. Some of the tanks have no vapor pressure limits at all, as vapors are recovered. All of the tanks operate far below their permitted vapor pressure limits. Further, the pipeline is operated to send semi-refined materials directly to Rodeo, without interim storage in pump station tanks along the pipeline. Even if semi-refined products had to be offloaded, their vapor pressures are far below permit limits. Thus, there is ample head room to increase the vapor pressure of semi-refined products shipped from Santa Maria to Rodeo. CBE-115

III. EMISSIONS ARE UNDERESTIMATED

The SMR Rail Spur Project RDEIR estimated emissions from locomotives, fugitive emissions from railcars, pipeline components and crude oil storage tanks, a vapor recovery carbon canister, and vehicle traffic. SMR Rail Spur Project RDEIR, Sec. 4.3.4.2 & Appx. B. However, it omitted other sources of emissions, discussed below.

The SMR Rail Spur Project is proposing to replace the **majority** of the current crude slate (2010-2012: 38,100 bbl/day) with up to 100% tar sands crudes. The Project proposes to import 37,142 bbl/day of cost-advantaged crudes by rail. SMR Rail Spur Project RDEIR, p. 2-23. Thus, the Project would replace 97% of the baseline crude slate with up to 100% tar sands crude. The Throughput Increase Project will increase the crude permit level to 48,950 bbl/day. SMR Throughput Increase FEIR, p. 1-1. Thus, at full buildout, up to 76% of the crude slate will be different crudes than in the baseline, potentially 100% tar sands crudes. These new crudes have many chemical and physical properties that distinguish them from the baseline crude slate and that will result in impacts that were not evaluated in the SMR Rail Spur Project RDEIR. These were discussed for both tar sands and light crudes in my previous comments in Exhibits 2 and 3, which are incorporated here by reference. CBE-116

A. Emission Changes Due To Changes in Fuel Gas Composition

The SMR Rail Spur Project RDEIR asserts that if significant amounts of propane and butane were present in the imported crudes, as discussed in Comment II, they would be partitioned into the Santa Maria refinery fuel gas. Assuming, *arguendo*, that this is correct, it CBE-117 would significantly increase the heat content of the refinery fuel gas. This would have several impacts. First, combustion temperatures would be higher in all heaters and boilers, as propane and butane burn with a hotter flame than natural gas and baseline refinery fuel gas, not enriched with propane and butane.[33] This would increase emissions nitrogen oxides (NOx) from all refinery fuel gas fired sources, compared to the baseline. Second, propane and butane have higher GHG global warming potentials than other components in refinery fuel gas.[34] Thus, greenhouse gas emissions from all heaters and boilers would increase. Finally, the significant increase in heat content may require modification or replacement of existing burner in heaters and boilers. None of these impacts were addressed in the SMR Rail Spur Project RDEIR. CBE-117 cont

B. Increased Combustion Emissions from Tar Sands Bitumen Not Evaluated

The SMR Rail Spur Project RDEIR indicates that tar sands crudes will be imported. The composition of tar sands crudes is chemically different from other heavy crudes currently processed at the SMR as they are tar sands bitumen mixed with diluent. They are unique for two major reasons: (1) presence of large quantities of volatile diluent full of reactive organic gases (ROG) and toxic chemicals as discussed above and (2) unique chemical composition of the bitumen, the heavy fraction. The previous comment discussed diluent, which will modify the composition of the both the semi-refined products sent to the Rodeo Refinery and the SMR refinery fuel gas. This comment discusses the unique composition of tar sands bitumens that require more intense processing and thus result in higher emissions.

Tar sands bitumens are composed of higher molecular weight chemicals and are deficient in hydrogen compared to conventional heavy crudes. This means more energy will be required and more emissions produced to convert them into the same slate of semi-refined and refined products. More energy will be required to add hydrogen and break the bonds of the larger molecules. CBE-118

The SMR Rail Spur Project RDEIR concedes the hydrogen point. However, the SMR Rail Spur Project RDEIR argues that hydrogen addition occurs at the Rodeo Refinery, not at the Santa Maria Refinery, and thus did not include these emissions. SMR Rail Spur Project RDEIR, pp. 4.3-69/70. However, as explained in my comments in Exhibits 2 and 3 and comments by others on the SMR Rail Spur Project RDEIR (Pless 2014[35]; Karras 2014), the Rodeo Refinery Propane Recovery Project and the SMR Rail Spur Project should have been evaluated under CEQA as a single project as they depend on each other. Thus, the increase in emissions of criteria pollutants and greenhouse gases from most fired sources due to tar sands bitumen derived semi-refined products refined at the Rodeo Refinery should have been included in the emission inventory for the SMR Rail Spur Project.

[33] Flame Temperatures of Some Common Gases; Available at; http://www.engineeringtoolbox.com/flame-temperatures-gases-d_422.html.

[34] See, *e.g.*, http://www.epa.gov/climateleadership/documents/emission-factors.pdf.

[35] Letter from Petra Pless to Laura Horton, Re: *Review of the Phillips 66 Company Rail Spur Extension and Crude Unloading Project Revised Public Draft Environmental Impact Report and Vertical Coastal Access Project Assessment*, November 21, 2014.

The Rodeo Refinery RDEIR is silent as to other crude quality factors that will increase emissions at Rodeo. Canadian tar sands bitumen is distinguished from conventional petroleum by the small concentration of low molecular weight hydrocarbons and the abundance of high molecular weight polymeric material.[36] Crudes derived from Canadian tar sands bitumen – DilBits, SCOs and SynBits – are heavier, *i.e.*, have larger, more complex molecules such as asphaltenes and resins,[37] some with molecular weights above 15,000.[38] They are the nonvolatile fractions of petroleum and contain the highest proportions of sulfur, nitrogen, and oxygen.[39] They have a marked effect on refining and result in the deposition of high amounts of coke during thermal processing in the coker, which would occur at the Santa Maria Refinery. They require more intense processing in the coker to break them down into lighter products. CBE-119

These differences are not reflected in any of the lumper parameters (API gravity, vacuum resid percentage, sulfur, TAN) presented in the SMR Rail Spur Project RDEIR. SMR Rail Spur Project Table 4.3-13 and p. 4.3-70. These differences mean that the coker at the Santa Maria Refinery will have to work harder to convert vacuum bottoms from distilling tar sand crude into gas oil, which will increase combustion emissions of NOx, sulfur oxides (SOx), carbon monoxide (CO), ROG, particulate matter with an aerodynamic diameter of 10 and 2.5 micrometers or less (PM10 and PM2.5), and greenhouse gases (GHGs). These increases in emissions were not included in the emission inventory.

C. **Increased Metal Content from Tar Sands Were Not Evaluated**

The Project could increase the import of heavy sour tar sands crude by up to 76% of the entire permitted capacity of the Santa Maria Refinery, once the SMR Throughput Project is fully operational. These crudes have higher metal content than the baseline crude slate.[40] This represents a significant increase in a type of crude that will increase emissions compared to the CBE-120

[36] O.P. Strausz, The Chemistry of the Alberta Oil Sand Bitumen; Available at: http://web.anl.gov/PCS/acsfuel/preprint%20archive/Files/22_3_MONTREAL_06-77_0171.pdf.

[37] Asphaltenes are nonvolatile fractions of petroleum that contain the highest proportions of heteroatoms, i.e., sulfur, nitrogen, oxygen. The asphalt fraction is that portion of material that is precipitated when a large excess of a low-boiling liquid hydrocarbon such as pentane is added. They are dark brown to black amorphous solids that do not melt prior to decomposition and are soluble in benzene and aromatic naphthas.

[38] O.P. Strausz, The Chemistry of the Alberta Oil Sand Bitumen; Available at: http://web.anl.gov/PCS/acsfuel/preprint%20archive/Files/22_3_MONTREAL_06-77_0171.pdf.

[39] James G. Speight, The Desulfurization of Heavy Oils and Residua, Marcel Dekker, Inc., 1981, Tables 1-1, 2-2, 2-3, 2-4 and p. 13 and James G. Speight, Synthetic Fuels Handbook: Properties, Process, and Performance, McGraw-Hill, 2008, Tables A.2, A.3, and A.4.

[40] Straatiev and others, 2010, Table 1; Brian Hitchon and R.H. Filby, Geochemical Studies - 1 Trace Elements in Alberta Crude Oils; http://www.ags.gov.ab.ca/publications/OFR/PDF/OFR_1983_02.PDF; F.S. Jacobs and R.H. Filby, Trace Element Composition of Athabasca Tar Sands and Extracted Bitumens, Atomic and Nuclear Methods in Fossil Energy Research, 1982, pp 49-59; James G. Speight, The Desulfurization of Heavy Oils and Residua, Marcel Dekker, Inc., 1981, Tables 1-1, 2-2, 2-3, 2-4 and p. 13 and James G. Speight, Synthetic Fuels Handbook: Properties, Process, and Performance, McGraw-Hill, 2008, Tables A.2, A.3, and A.4; Pat Swafford, Evaluating Canadian Crudes in US Gulf Coast Refineries, Crude Oil Quality Association Meeting, February 11, 2010; Available at: http://www.coqa-inc.org/20100211_Swafford_Crude_Evaluations.pdf .

current Refinery slate. The impacts from this change were not evaluated in the SMR Rail Spur Project RDEIR.

The U.S. Geological Survey (USGS) reported that "natural bitumen," the source of all Canadian tar sands-derived oils, contains 102 times more copper, 21 times more vanadium, 11 times more sulfur, six times more nitrogen, 11 times more nickel, and 5 times more lead than conventional heavy crude oil, such as those currently refined from local sources.[41] The SMR Rail Spur Project RDEIR reported vanadium and nickel concentration in a current "typical crude blend" compared to two potential tar sands crudes. SMR Rail Spur Project RDEIR, Table 4.3-13. This comparison shows that the vanadium concentration in Access Western Blend (190 ppmw) and Peak River Heavy (167 ppmw) are higher than the upper end of the range of major baseline crude sources. The SMR Rail Spur Project RDEIR is silent as to the significance of this reported increase in vanadium. The SMR Rail Spur Project RDEIR did not present any data for any other metal, known to be elevated in tar sands crudes.

The environmental damage caused by these metal pollutants includes bioaccumulation of toxic chemicals up the food chain and a direct health hazard from air emissions. These metals, for example, mostly end up in the coke. Thus, higher levels of metals will be present in the coke dust and coke pile runoff/seepage. The SMR Rail Spur Project DEIR indicated that "[m]etals that are present in coke have been detected in groundwater at concentrations above the California Department of Health maximum contamination levels (MCL) in the area around the coke pile runoff area..." SMR Rail Spur Project DEIR, p. 4.7-39/40. This statement has vanished from the SMR Rail Spur Project RDEIR. Thus, a switch to tar sands crude could contribute to this existing significant impact from the coke pile, which was not disclosed in the SMR Rail Spur Project RDEIR. CBE-120 cont

Further, larger amounts of coke may be produced by the tar sands crudes than the current crude slate. The metal content of fugitive dust from coke piles could increase to dangerous levels. The California Air Resources Board, for example, has classified lead as a pollutant with no safe threshold level of exposure below which there are no adverse health effects. Thus, just the increase in lead from switching to tar sands crude is a significant impact that was not disclosed in the SMR Rail Spur Project RDEIR. Accordingly, crude quality is critical for a thorough evaluation of the impacts of a crude switch as facilitated by rail import to the SMR.

---

[41] R.F. Meyer, E.D. Attanasi, and P.A. Freeman, Heavy Oil and Natural Bitumen Resources in Geological Basins of the World, U.S. Geological Survey Open-File Report 2007-1084, 2007, p. 14, Table 1; Available at http://pubs.usgs.gov/of/2007/1084/OF2007-1084v1.pdf.

D. Sump Emissions Were Omitted

Unloading facilities generally include liquid spill containment sumps with the capacity to contain the contents of at least one tank car. Crude oil that spills into these sumps would release vapors including ROG, which are ozone precursors, and toxic air contaminant (TAC) emissions. The RDEIR is silent as to sumps and their emissions. CBE-121

E. Rail Car Fugitive Emissions Were Omitted

ROG and TACs are emitted from rail cars from their point of origin through unloading as rail cars are not vapor tight. The SMR Rail Spur Project RDEIR did not include these emissions.

The crude oil would be shipped in tank cars, such that the volume of loaded crude oil shipped is less than the capacity of the rail car to accommodate expansion during shipping. This volume reduction creates free space at the top of the tank car, which provides space for entrained gases, such as those from diluent, to be released from the crude oil[42] and emitted to the atmosphere during transit and idling in rail yards.[43]

As rail cars are not vapor tight, these vapors in the head space above the oil are emitted to the atmosphere during rail transport and at the unloading terminal. The vapor in the headspace can flash during transport, when temperature increases or pressure drops, causing valves to open, emitting ROG and TACs. CBE-122

These losses are consistent with the well-known "crude shrinkage" issue associated with crude by rail. The crude delivered is significantly less than the crude loaded. The reported range in crude shrinkage is 0.5% to 3% of the loaded crude.[44] Some of this shrinkage is likely due to emissions from the rail car during transit. The emissions of ROG and TACs from rail cars has been confirmed by field measurements.[45] The SMR Rail Spur Project RDEIR did not include these ROG and TAC emissions in its emission calculations or the health risk assessment.

Tank cars have domes to allow space for the product to expand as temperatures rise. Each dome has a manhole through which the tank car can be loaded, unloaded, inspected, cleaned, and repaired. Dome covers may be hinged and bolted on or screwed on. Most domes

---

[42] Anthony Andrews, Congressional Research Service, Crude Oil Properties Relevant to Rail Transport Safety: In Brief, February 18, 2014, pp. 8-9.

[43] A DOT 111 (or comparable) tank car generally has a capacity of 34,500 gallons or 263,000 lbs. gross weight on rail. Under some conditions, the maximum gross weight can be increased to 286,000 lbs. At an API gravity of 50^{o}, a tank car can hold its maximum volume of 31,800 gallons and not exceed the 286,000 lb gross weight on rail limit. As the API gravity drops, the amount of oil that can be carried must also drop. Thus, a tank car of Bakken crude, at its highest density of 39.7^{o} API, can only hold 30,488 gallons, a volume reduction of about 1,300 gallons. Further, as crude oil density (and thus API gravity) is temperature dependent, volume will increase as temperature increases. Thus, the shipper may have to reduce the shipped volume even further. This volume reduction creates a space above the crude oil where vapors accumulate.

[44] Alan Mazaud, Exergy Resources, Pennsylvania Rail Freight Seminar, May 23, 2013, p. 17. Available at: http://www.parailseminar.com/site/Portals/3/docs/Alan%20Mazaud%20Presentation%20-%20AM.pptx

[45] http://www.youtube.com/watch?v=35uC1gLctnw.

have vents and safety valves to let out vapors.[46] Thus, they are sources of ROG emissions that were omitted from the emission calculations. Further, when dome covers are left open, any residual vapors escape to atmosphere. Residual material clings to the bottom and sides of empty rail cars and emits ROG and TACs while the rail cars idle at the site, waiting for the entire unit train to be unloaded. Open covers are common in rail yards as they are opened for inspections and repairs. The ROG and TAC emissions from these sources were not included in the SMR Rail Spur Project RDEIR's emission inventory.

Further, each tank car has a bottom outlet which is used for loading and unloading that includes pumps, manifolds, and valves, all of which leak ROG and TACs. Finally, liquid leaks occur when unloading arms are disconnected, even with state-of-the-art no leak arms. These disconnect leaks evaporate, contributing to ROG and TAC emissions.

An estimate of these emissions can be based conservatively on the lower end of the range of crude shrinkage (0.5%) discussed above and the maximum freight weight per car of 106 tons from the TRN Spec Sheet-1. Assuming 80 cars/train and five unit trains per week (SMR Rail Spur Project RDEIR, p. ES-5), a total of 30 ton/day[47] of ROG can be emitted as the trains travels from Canada to the Santa Maria Refinery rail terminal. The distance travelled outside of California was not reported, but is estimated to be about 1500 miles. The distance within California, on the longest route, is estimated as 300 miles one way. SMR Rail Spur Project RDEIR, p. B-9. Thus, about 17% of the 30 ton/day of ROG would be emitted in California or about 5 ton/day of ROG (10,000 lb/day) can be emitted within California from rail car leakage.[48] Of the 300 miles within California, 67 miles are within the boundary of the SLOCAPCD via the northern route. SMR Rail Spur Project RDEIR, p. B-9. Thus, 1.1 ton/day (2,200 lb/day) of ROG emissions can be emitted within the SLOAPCD from rail car leakage.[49] These daily emissions greatly exceed the SLOCAPCD daily ROG+NOx CEQA significance threshold of 25 lb/day (RDEIR, Table 4.3-17), requiring additional mitigation not identified in the RDEIR. These ROG emissions could be reduced by modifying the rail cars before they are shipped to minimize or eliminate leakage. CBE-122 cont

These ROG emissions contain the same chemicals found in the crude oil, including benzene, toluene, ethylbenzene, and xylene (collectively "BTEX") and hexane. Some crudes can contain up to 7% benzene by weight. Thus, greater than 154 lb/day of benzene could be emitted in California from rail car leakage. This rail car leakage is much greater than the amount of benzene (and other TACs) included in the SMR Rail Spur Project RDEIR's health risk assessment.

[46] Chapter 11. Tank Car Operations, Available at: http://www.globalsecurity.org/military/library/policy/army/fm/10-67-1/CHAP11.HTML.

[47] ROG emissions from train transit = (106 ton/car)(80 car/train)(5 train/week)(0.005)/(7 days/week) = **30 ton/day.**

[48] ROG emitted within California = (30 ton/day)(300/1500+300) = **5 ton/day.**

[49] ROG emitted within SLOCAPCD = (30 ton/day)(67/1500+300) = **1.1 ton/day.**

IV. THE SMR RAIL SPUR PROJECT RDEIR DID NOT EVALUATE THE INCREASE IN RISK OF ACCIDENTS AT THE SANTA MARIA REFINERY

The SMR Rail Spur Project RDEIR includes a brief discussion of the impact of changes in crude slate on hazards at the Refinery, designated as Impact #HM.3. SMR Rail Spur Project RDEIR pp. 4.7-63 and 4.7-65. This discussion touches on naphthenic acid corrosion, pointing to various inspection programs and ultimately dismissing corrosion-related accidents because "... the expected range of sulfur and TAN would be within the range of the crudes that are currently being processed at the SMR. Therefore, the change in crude slate would not be expected to change the sulfur or TAN levels compared to the crude sources that are currently being processed at the SMR." SMR Rail Spur Project RDEIR, Table 4.7-14 and p. 4.7-66. This is an inadequate discussion and the conclusions are wrong for several reasons.

First, corrosion failures in refineries are of great concern because of the high likelihood of "blowout" or catastrophic failure of components. This can happen because corrosion occurs at a relatively uniform rate over a broad area, so a pipe can get progressively thinner until it bursts, rather than leaking at a pit or local thin area that could be found during visual inspections. The process fluids carried in these lines are often above their auto-ignition temperature, resulting in large fires. They also usually carry toxic and hazardous materials, such as sulfur compounds (hydrogen sulfide, mercaptans, benzene) that can lead to toxic clouds, which can have significant adverse effects on surrounding communities.

Second, as background, it is important to recognize that the Rail Spur Project is proposing to replace the **majority** of the current crude slate (38,100 bbl/day) with up to 100% tar sands crudes. The Project proposes to import 37,142 bbl/day of cost-advantaged crudes by rail. SMR Rail Spur Project RDEIR, p. 2-23. Thus, the Project would replace 97% of the baseline crude slate with up to 100% tar sands crude. The SMR Throughput Increase Project will increase the crude permit level to 48,950 bbl/day. SMR Throughput Increase Project FEIR, p. 1-1. Thus, at full buildout, up to 76% of the crude slate will be different crudes than in the baseline, potentially 100% tar sands crudes. CBE-123

Third, tar sands crudes have high Total Acid Numbers (TAN),[50] which indicates high organic acid content, typically naphthenic acids. Naphthenic acid attack occurs primarily in crude units and vacuum units, such as those at the SMR. SMR Rail Spur Project RDEIR, Fig. 2-10. They also form sludge and gum which can block pipelines and pumps. However, some acids are relatively inert. Thus, the TAN number does not always represent the true corrosive properties of a crude oil. Further, different acids will react at different temperatures, making it difficult to determine which processing units may be affected. As a rule-of-thumb, crude oils with a TAN number greater than 0.5 mg KOH/g are considered to be potentially corrosive and indicates a level of concern. A TAN number greater than 1.0 mg KOH/g is considered to be very high.[51] Canadian tar sands crudes are very high TAN crudes. The DilBits,

---

[50] The Total Acid Number measures the composition of acids in a crude. The TAN value is measured as the number of milligrams (mg) of potassium hydroxide (KOH) needed to neutralize the acids in one gram of oil.

[51] Margaret Sheridan, California Crude Oil Production and Imports, Staff Paper, California Energy Commission, April 2006, p. 6; Available at: http://www.energy.ca.gov/2006publications/CEC-600-2006-006/CEC-600-2006-006.PDF.

for example, range from 0.98 to 2.42 mg KOH/g.[52] The Project is proposing to import crudes at the upper end of this range (SMR Rail Spur Project RDEIR, Table 4.7.14), far above the level of concern and far above the "typical crude blend" refined at SMR in the baseline. SMR Rail Spur Project RDEIR, Table 4.7-14. Thus, the RDEIR should have included a detailed analysis of the corrosion potential of the proposed crude slate and imposed mitigation.

Further, while the industry benchmark for TAN corrosion is 0.5, crudes with lower TANs can still cause significant corrosion problems, depending upon the specific acids. Sweet low TAN crudes, such as those currently flooding the market, and which could be imported by the Rail Spur Project, are also known to cause TAN corrosion.[53] The SMR Rail Spur Project RDEIR is silent on corrosion issues related to these crudes.

Fourth, each crude has its own unique characteristic chemistry and thus effects on corrosion. Refineries that process a consistent diet of a particulate crude or crude blend can base future predictions of corrosion potential on past experience. However, when a major switch in crude slate occurs, as proposed here, predicting future corrosion based on historic operating ranges or "typical crude blends", as in the SMR Rail Spur Project RDEIR, is not reliable. A new slate, even when major lumper parameters are in the historic range, minimizes the accuracy, or even the feasibility of predictions based on historic data.[54] CBE-123 cont

The rationale that sulfur levels and TAN of the crude slate would stay within the reported range and thus corrosion is not an issue, ignores the possibility of gradual creep in both sulfur and TAN within the usual range that could still be significant. The SMR Rail Spur Project RDEIR, for example, concedes that the new crude slate would increase sulfur by 0.8%. SMR Rail Spur Project RDEIR, p. 4.3-46. From a corrosion standpoint, this is a significant increase. The SMR Rail Spur Project RDEIR did not discuss the impact of a 0.8% increase in sulfur on corrosion-induced accidents at the SMR.

The high proportion of tar sands crudes in the future crude slate renders the ranges in SMR Rail Spur Project RDEIR Table 4.7-14 as irrelevant for concluding that the new crudes fall within the range of historic crudes. For example, if 100% Peace River Heavy[55] were refined, both its average sulfur and TAN level would exceed the sulfur (5.0%>4.2%) and TAN (2.5>1.0 mg KOH/g) concentrations in the baseline "typical crude blend." In fact, even the lower end of the reported range of sulfur and TAN in Peace River Heavy would exceed the "typical crude blend." The fact that the sulfur and TAN of Peace River Heavy falls within the reported ranges (S: 2.1 to 5.2%; TAN: 0.4-4.0 mg KOH/g) is simply irrelevant, as the SMR did not operate, on average, at the upper end of the range. Because the sulfur and TAN data for

[52] www.crudemonitor.ca.

[53] M.J. Nugent, J.D. Dobis, Experience with Naphthenic Acid Corrosion in Low TAN Crudes, Corrosion 98, Paper No. 577

[54] See discussion in API Recommended Practice 939-C, Guidelines for Avoiding Sulfidation (Sulfidic) Corrosion Failure in Oil Refineries, First Edition, May 2009.

[55] Access Western Blend (TAN: 1.69-1.85 mg KOH/g; S: 3.94-3.96%); http://www.crudemonitor.ca/crude.php?acr=AWB and Peace River Heavy (TAN: 2.42 to 2.58 mg KOH/g; S: 4.94 to 5.08%); http://www.crudemonitor.ca/crude.php?acr=PH.

these tar sands crudes exceed the "typical crude blend" by significant amounts, corrosion impacts are significant and should have been disclosed, analyzed, and mitigated.

Fifth, the SMR Rail Spur Project RDEIR did not discuss or even mention sulfidation corrosion, which is a concern for refineries such as SMR, built in 1955 before current American Petroleum Institute (API) standards were developed to control corrosion and before piping manufacturers began producing carbon steel in compliance with current metallurgical codes. Rather, it notes in passing that "[h]igh sulfur levels can lead to sulfide related corrosion." SMR Rail Spur Project RDEIR, p. 4.7-65.

The early construction date suggests the metallurgy used throughout much of the SMR may not be adequate to handle the unique chemical composition of tar sands crudes without significant upgrades. There is no assurance that required metallurgical upgrades would occur if tar sands crudes dominate the crude slate, as they are very expensive and are not required by any regulatory framework. Experience with changes in crude slate at the Chevron Refinery in Richmond in the San Francisco Bay Area suggest required metallurgical upgrades are ignored, leading to catastrophic accidents.[56]

CBE-123 cont

Sulfidation corrosion generally occurs above about 500 F for carbon steel pipe and above about 600 F for 5 Cr low-alloy steel. Some sulfide species are more corrosive than others, including mercaptans, hydrogen sulfide, and disulfides, all of which occur at elevated levels in tar sands crudes. Sulfidation corrosion manifests as uniform thinning and thus cannot be detected from visual inspections. Low silicon carbon steel can corrode 2 to 10 times faster than higher silicon carbon steel.[57]

How much low silicon carbon steel piping is present at SMR? What impact will an admitted 0.8% increase in sulfur have on this piping? What sulfur compounds are present in the 0.8% increase in sulfur? The SMR Rail Spur Project RDEIR did not disclose either the specific suite of sulfur compounds in the proposed imports or the metallurgy and operating conditions in the units potentially susceptible to sulfidation corrosion. Thus, it fails as an informational document under CEQA.

A catastrophic blowout due to sulfur creep recently occurred at the Chevron Richmond Refinery near the Rodeo Refinery. This refinery gradually changed crude slates, while staying within its established crude unit design basis for total weight percent sulfur of the blended feed to the crude unit.[58] This change increased corrosion rates in the 4-sidecut line, which led to a

[56] U.S. Chemical Safety and Hazard Investigation Board, Interim Investigation Report, Chevron Richmond Refinery Fire, Chevron Richmond Refinery, Richmond, California, August 6, 2012, Draft for Public Release, April 15, 2013; Available at: http://www.csb.gov/chevron-refinery-fire/.

[57] E.H. Niccolls, J.M. Stankiewicz, J.E. McLaughlin, and K. Yamamoto, High Temperature Sulfidation Corrosion in Refining, September 2008, 17th International Corrosion Congress, Corrosion Control in the Service of Society, Vol. 1 of 5, as cited in: Interim Investigation Report, Chevron Richmond Refinery Fire, August 6, 2012; Available at: http://www.csb.gov/assets/1/19/Chevron_Interim_Report_Final_2013-04-17.pdf.

[58] US Chemical Safety and Hazard Investigation Board, Chevron Richmond Refinery Pipe Rupture and Fire, August 6, 2012, p.34 ("While Chevron stayed under its established crude unit design basis for total wt. % sulfur of

catastrophic pipe failure in the #4 Crude Unit on August 6, 2012. This accident sent 15,000 people from the surrounding area for medical treatment due to the release and resulting fire that created huge black clouds of pollution billowing over the surrounding community and across the San Francisco Bay.[59]

The SMR has a similar crude unit, identified as the "crude tower" in SMR Rail Spur Project RDEIR Figure 2-10. These types of accidents can be reasonably expected to result from incorporating tar sands crudes into the Santa Maria Refinery crude slate, even if the range of sulfur and TAN of the crudes remain the same, unless significant upgrades in metallurgy occur, as these crudes have a significant concentrations of sulfur in the heavy components of the crude coupled with high total acid numbers (TAN) and high solids, which aggravate corrosion. A crude slate change could result in corrosion from, for example, the particular suite of sulfur compounds or naphthenic acid content, that leads to significant accidental releases, even if the crude slate is within the current design slate basis, due to compositional differences. The gas oil and vacuum resid piping, for example, may not be able to withstand naphthenic acid or sulfidation corrosion from refining 76% to 97% tar sands crudes, leading to catastrophic releases.[60] CBE-123 cont

Elevated levels of TAN and sulfur can cause accidents that result in catastrophic releases of air pollution. Such releases were not considered in the SMR Rail Spur Project RDEIR. Rather, the SMR Rail Spur Project RDEIR relies on the SMR's existing Process Safety Management program, including the Management of Change (MOC) and Mechanical Integrity (MI) programs, to prevent corrosion. SMR Rail Spur Project RDEIR, pp. 4.7-65/66. However, these programs were also in place at the Chevron Richmond Refinery (and many other similarly afflicted refineries) at the time of the August 2012 accident discussed above. They did not prevent a catastrophic accident caused by sulfur (or TAN) creep. The recent Chevron Refinery Modernization Project FEIR incorporated many additional mitigation measures to improve these programs,[61] which should be required for the Santa Maria Refinery to mitigate the increase in sulfur and TAN in crudes imported by the Rail Spur Project.

Refinery emissions released in upsets and malfunctions can, in some cases, be greater than total operational emissions recorded in formal inventories. For example, a recent investigation of 18 Texas oil refineries between 2003 and 2008 found that "upset events" were

---

the blended feed to the crude unit, the sulfur composition significantly increased over time. This increase in sulfur composition likely increased corrosion rates in the 4-sidecut line.").

[59] U.S. Chemical Safety and Hazard Investigation Board, Interim Investigation Report, Chevron Richmond Refinery Fire, Chevron Richmond Refinery, Richmond, California, August 6, 2012, Draft for Public Release, April 15, 2013, Available at; http://www.csb.gov/chevron-refinery-fire/.

[60] See, for example, K. Turini, J. Turner, A. Chu, and S. Vaidyanathan, Processing Heavy Crudes in Existing Refineries. In: Proceedings of the AIChe Spring Meeting, Chicago, IL, American Institute of Chemical Engineers; New York, NY, Available at: http://www.aiche-fpd.org/listing/112.pdf.

[61] See, for example, Chevron Refinery Modernization Project, Revisions to Draft EIR Volumes 1 and 2, p. 4-40, Mitigation Measure 4.13-7h, Available at: http://chevronmodernization.com/project-documents/.

frequent, with some single upset events producing more toxic air pollution than what was reported to the federal Toxics Release Inventory database for the entire year.[62]

Catastrophic releases of air pollution from these types of corrosion-caused accidents were not considered in the SMR Rail Spur Project RDEIR and are significant. Mitigation should be imposed, including at least the following: CBE-123 cont

- All mitigation measures required in the Chevron Refinery Modernization Project FEIR;
- 100% component inspection of all carbon steel piping systems susceptible to sulfidation corrosion; and
- Modification of work processes for review of damage mechanisms for processes covered by the Process Safety Management standard to conform with the American Petroleum Institute Recommended Practice 571, Damage Mechanisms Affecting Fixed Equipment in the Refining Industry. The revised work processes shall require consideration of damage mechanism reviews as part of the Process Hazard Analysis process.[63]

V. RAIL ACCIDENTS WERE UNDERESTIMATED AND ARE SIGNIFICANT

The RDEIR evaluated "potential public safety and hazardous materials impacts" from train derailments and unloading accidents that could lead to fires and explosions. RDEIR, Sec. 4.7. Elsewhere, the RDEIR evaluates the impacts of derailments on water resources and biological resources. RDEIR, Secs. 4.4 & 4.13. These analyses are fundamentally flawed and incomplete, as explained below.

First, the RDEIR only analyzed impacts from the Roseville and Colton Rail Yards to the Project site. It did not analyzed impacts from the California border to these rail yards, arguing that trains could enter California at five different locations and thus the specific route was "speculative". RDEIR, pp. 4.7-1, 4.13-7. Routes are not "speculative" when they are known, as here. The trains can take any of them, depending on conditions. As they are known and any of these known routes can be taken, they are not speculative. The RDEIR should have evaluated all of them. Further, the trains can take multiple routes from the rail yards to the Santa Maria Rail Yard. The RDEIR, inconsistently, did not conclude that this rendered these routes speculative. CBE-124

This is a serious omission as the segments from the state line to the rail yards pass through some of the state's most sensitive ecological areas and parallel the water supply for most of the state. These route segments also contain many high hazard areas for derailments.

[62] J. Ozymy and M.L. Jarrell, Upset over Air Pollution: Analyzing Upset Event Emissions at Petroleum Refineries, Review of Policy Research, v. 28, no. 4, 2011.

[63] Terms and Conditions of Probation, People v. Chevron U.S.A. Inc., Superior Court of the State of California, County of Contra Costa, Case No. 1-162745-4.

Emergency response teams have generally good coverage in the urban areas, but none are located near the high hazard areas in rural Northern California that the RDEIR did not analyze.[64]

Second, the RDEIR did not analyze a worst case derailment. The RDEIR assumed a worst-case spill of 180,000 gallons, or about six tanker cars. RDEIR, p. 4.7-47. No support was provided for this choice. Rail accident records should have been reviewed to select a worst-case spill. The July 2013 Lac-Mégantic derailment spilled about 1.6 million gallons of Bakken crude oil, or about 53 railcars, covering an area of 77 acres.[65] The RDEIR should have based its analysis on a spill of at least 1.6 million gallons.

Third, the RDEIR did not analyze the impacts of a derailment on the state's water supply, which originates in the northern portion of the state along the rail segments eliminated from its analysis as "speculative". The rail routes from the state line to the rail yards parallel major rivers, such as the Sacramento, Yuba, Feather and American Rivers, which supply most of the water used throughout the state, distributed by a complex system of reservoirs and pipelines operated by Central Valley Project and the State Water Project. A significant spill of crude oil into any of these rivers would potentially shutdown the water supply for a significant portion of the state. This would have catastrophic and far reaching consequences that the RDEIR does not acknowledge, let alone analyze.

CBE-124 cont

Fourth, the RDEIR notes that when spilled, a DilBit will sink (RDEIR, 4.13-27), but the RDEIR fails to disclose the resulting consequences on water supply and biological resources. The RDEIR is also silent on the difficulty of cleaning up the spill. An oil pipeline burst near Marshall, Michigan in July 2010, spilling a million gallons of DilBit in the Kalamazoo River. This spill decimated Talmadge Creek, a tributary to the Kalamazoo River, and about 40 miles of the river, prompting a more than $1 billion cleanup that, four years later, is still under way.[66] While most conventional crudes float on water, most of the DilBit, the bitumen component, sinks and clings to bottom sediments. This submerged oil is significantly harder to cleanup. The Kalamazoo spill, which occurred in 2010, is still not cleaned up.[67] The RDEIR failed to disclose

[64] Interagency Rail Safety Working Group, State of California, Oil by Rail Safety in California. Preliminary Findings and Recommendations, June 10, 2014.

[65] NTSB, Safety Recommendation In reply refer to: R-14-4 through -6; January 21, 2014. Available at: http://www.ntsb.gov/doclib/recletters/2014/R-14-004-006.pdf.

[66] Keith Matheny, Environmental Disasters Lurk in Energy Pipelines, Detroit Free Press, October 12, 2014, Available at: http://www.freep.com/story/money/business/michigan/2014/10/12/energy-environmental-threats/17046063/.

[67] A Dilbit Primer: How It's Different from Conventional Oil, Inside Climate News. Available at: http://insideclimatenews.org/news/20120626/dilbit-primer-diluted-bitumen-conventional-oil-tar-sands-Alberta-Kalamazoo-Keystone-XL-Enbridge?page=show; Lindsey Smith, 3 Years and Nearly $1 Billion Later, Cleanup of Kalamazoo River Oil Spill Continues, Michigan Radio, July 25, 2013, Available at: http://michiganradio.org/post/3-years-and-nearly-1-billion-later-cleanup-kalamazoo-river-oil-spill-continues; NOAA Office of Response and Restoration, As Oil Sands Production Rises, What Should We Expect at Diluted Bitumen (Dilbit) Spills?, Available at: http://response.restoration.noaa.gov/about/media/oil-sands-production-rises-what-should-we-expect-diluted-bitumen-dilbit-spills.html; Witt O'Brien, A Study of Fate and Behavior of Diluted Bitumen Oils on Marine Waters, November 2013, Available at: http://www.transmountain.com/uploads/papers/1391734754-astudyoffateandbehaviourofdilutedbitumenoilsonmarinewater.pdf

the difficulty of cleaning up a large spill in one of California's headwater rivers that supply California's municipal, industrial, and agricultural water. CBE-124 cont

;