ATTACHMENT 2

NRDC Comments on the Initial Study/
Mitigated Negative Declaration for the Valero
Benicia Crude by Rail Project,
July 1, 2013

July 1, 2013

Via Fax to
City of Benicia Community Development Department
Attn: Amy Million
250 East L Street
Benicia, CA 94510
Fax: (707) 747-1637

Re: Notice of Intent to Adopt a Mitigated Negative Declaration for the Valero Crude by Rail Project

Dear Ms. Million:

On behalf of the Natural Resources Defense Council (NRDC), which has over 1.4 million members and activists, 250,000 of whom are Californians and approximately 100 of whom reside in Benicia, we submit the following comments on the Notice of Intent to Adopt a Mitigated Negative Declaration for the Valero Crude by Rail Project. The Notice of Intent for the project was issued on May 28, 2013, and indicated that the public comment period closes on July 1, 2013. Valero applied for a land use permit from the City of Benicia in December of 2012 to allow Valero to receive crude oil by train in quantities up to 70,000 barrels per day, in 100 rail cars per day.

Although the May 31, 2013 Initial Study/Mitigated Negative Declaration [IS/MND] on the Valero Crude by Rail Project assumed the project would cause no significant unmitigated effects on the environment, the IS/MND failed to consider all potential impacts. Our evaluation of the Project, as well as that of two independent experts retained by NRDC to evaluate the project, indicates that it will likely result in significant environmental impacts that have been neither discussed in the Initial Study nor mitigated under the IS/MND. Our comments below focus on air quality, public health, public safety, noise, general hazards and ecological risks.[1]

Because this Project could result in significant impacts to the environment, an Environmental Impact Report [EIR] must be prepared and circulated for public comment before the City may lawfully approve the project. Any significant impacts revealed by the EIR should be thoroughly analyzed and fully mitigated.

I. Air Quality and Public Health Impacts

The two key premises of the IS/MND's air quality analysis—that the new "North American-sourced crudes" received by the refinery as a result of the project will have a sulfur

[1] Selected sources cited have been provided to the City of Benicia in hard copy. All sources cited in NRDC's comments and in the expert reports will be provided in CD to follow.

content and density similar to the refinery's current slate, and that as a result, air emissions will not significantly change—is both unsupported and demonstrably wrong. The range of sulfur contents and densities projected for the new crude slate is wide, and air impacts could vary substantially within that range. Even more importantly, air emissions from crude refining depend on a host of characteristics other than sulfur content and density, and likely changes in those other characteristics are not disclosed or discussed by the IS/MND at all. Nor are other potentially significant air impacts, as further discussed below. The IS/MND thus fails to recognize the full suite of potential air quality and public health impacts of this project or provide any meaningful mitigation for those impacts.

No mitigation is included for the operational phase of this project. The operation of this project has very serious implications for air quality and public health that are not discussed in the IS/MND because the IS/MND fails to consider the appropriate scenarios of crude oils that may be transported by rail.

Valero's application states that "[t]he crude oil to be transported by rail cars is expected to be of similar quality compared to existing crude oil imported by marine vessel" and that the Project would not result in changes in refinery emissions. The May 31, 2013 IS/MND also assumes that there would be no significant change in crude oil slate due to the Project and no change in refinery emissions. But neither Valero's application nor the IS/MND provide data, let alone any analysis, sufficient to support these assumptions.

We have included as attachments to our comment letter, two expert reports that evaluate whether this Project would impact the crude oil slate or refinery emissions. The first report, by The Goodman Group, discusses changes to the refinery's crude slate that would likely occur due to the Crude by Rail Project. The report concludes that, although much of the relevant information needed to evaluate the proposed Project's exact effect on crude oil slate was not made publically available by either Valero or the City of Benicia, the Project is likely to significantly affect crude quality. In particular, the project is likely in the long-term to facilitate the refinery's use of Canadian tar sand crudes blended with diluent or "DilBits."

The second report, by Dr. Phyllis Fox, concludes that Canadian tar sand crudes blended with diluent have the potential to significantly change the profile of and increase air emissions compared to current crude slates. These changes may be, and indeed are likely to be, significant. The transport and refining of dilbits could significantly increase emissions of a wider range of pollutants including but not limited to volatile organic compounds (VOCs); hazardous air pollutants, including benzene and lead; and highly odiferous sulfur compounds. This additional pollution would degrade ambient air quality, adversely affect the health of workers and residents around the subject facilities, and create public nuisance odors. Further, the high acid levels in these crudes would accelerate corrosion of refinery components, contributing to equipment failure and increased accidental releases.

Unfortunately, contrary to CEQA's goals of public disclosure and evaluation, the IS/MND does not disclose enough specific information about the chemical composition of the crudes that would be imported and the crudes that would be displaced to fully assess crude quality changes and resulting air quality and other impacts. The number and nature of the deficiencies are so substantial that the IS/MND should be withdrawn. The City should prepare an EIR with a complete Project description and a thorough environmental impact analysis.

The minor mitigations included for the construction component of the project amount to little more than dust control. The construction phase of the project should require all trucks, construction equipment and any other equipment utilizing a diesel engine to meet the latest and cleanest U.S. EPA emission standards or be retrofitted with exhaust controls to achieve similar emission reductions.

A. Increased Air Emissions Due to Heavier, Lower Quality Crude Oil

The IS/MND fails to disclose or quantify the increases in emissions that could and likely would result from modifications to the crude slate at the Valero refinery that could and likely would result from the Crude by Rail Project. As noted in the concurrently submitted expert report of The Goodman Group, publicly disclosed information supports a finding that the rail project could foreseeably lead to replacing as much as 40% or more of the refinery's current crude slate (70,000 barrels per day) with tar sands crudes. This would make the refinery's overall crude slate heavier, increase emissions, and result in significant environmental impacts.

The CEQA baseline that must be considered for this project is the current slate of crude oil. Current refinery conditions and current air emissions must be analyzed. The use of the proper CEQA baseline is critical to accurately evaluate impacts. The Refinery operates under a permit issued by the Bay Area Air Quality Management District (BAAQMD). This permit establishes maximum amounts of regulated pollutants that can be emitted. However, even if emissions increases from the Crude by Rail Project fell within the limits of existing permits and plans, those increases may still be significant for purposes of CEQA. A long line of Court of Appeal decisions and a California Supreme Court decision hold that impacts of a proposed project are to be compared to the actual environmental conditions existing at the time of CEQA analysis, rather than to allowable conditions defined by a plan or regulatory framework, such as the BAAQMD permit. The California Supreme Court specifically concluded, regarding the ConocoPhillips refinery in Los Angeles, that the pre-existing permits did not establish the baseline for CEQA analysis. *Communities for a Better Environment v. South Coast Air Quality Management District (2010) 48 Cal.4th 310.*

Thus, even if the emission increases identified below, when fully analyzed, fell within existing permit limits, or potential future emissions analyzed with respect to other projects,[2] this would not exclude them from CEQA review for the Crude by Rail Project. The increases in emissions that will occur from importing "North American-sourced crudes" must be quantified and evaluated under CEQA as of current conditions. (And even if those increased emissions had

---

[2] Although the IS/MND neglected to discuss the Valero Improvement Project (VIP) that began in 2002 and remains in progress, that Project envisioned process changes designed to facilitate the import and processing of much higher sulfur and heavier crudes than the current slate. Documents related to the VIP are relevant to our comments because those VIP documents articulate Valero's clear intent to process much dirtier crudes, and provide some insight into the additional energy usage required and potential increased air emissions.

been considered earlier, they would now have to be evaluated now within the regulatory and other framework on the ground now.)

In fact the potential air emissions increases related to this project would be significant, would exceed BAAQMD CEQA significance thresholds and potentially would contribute to adverse health impacts, malodors, and major accidental releases, as well as degradation of ambient air quality. The IS/MND fails to evaluate these potential emission increases and their environmental consequences, yet we find that they are significant and unmitigated, requiring the preparation of an EIR.

1) *Changes in Crude Slate and Chemical Composition*

The air quality impacts of refining North American-sourced crudes such as tar sands depends on the chemical and physical composition of the refinery slate with tar sands crude compared to the current slate. The current slate includes very little tar sands, from 0.5% to 2% of the Refinery total crude slate over the period 2010 to 2012. The Crude by Rail Project could increase the heavy, sour tar sands crude by up to 70,000 BPD, or up to 42% of the permitted refinery throughput. This represents a significant increase in a crude with a dramatically different chemical composition, which will change the emissions profile and cause significant increases in emissions of some pollutants compared to the emissions from the Refinery's current crude slate.[3]

The U.S. Geological Survey ("USGS"), for example, 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 Ecuador, Columbia, and Brazil.[4] These pollutants contribute to smog, soot, acid rain, and odors that affect residents nearby.

---

[3] Straatiev and other, 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, *available at* http://link.springer.com/book/10.1007/978-1-4684-4133-8/page/1;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.

[4] 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.

Additionally, many of these chemicals pose a direct health hazard from air emissions. These metals, for example, mostly end up in the coke. Greater amounts of coke are produced by the tar sands crudes than the current crude slate. The California Air Resources Board 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 up to 42% of the slate to tar sands crude is a significant impact that was not disclosed in the IS/MND. Accordingly, crude quality is critical to a thorough evaluation of the impacts of a crude switch, such as proposed here.

A good crude assay is essential for comprehensive crude oil evaluation.[5] The type of data required to evaluate emissions would require, at a minimum, the following information:

- Trace elements (As, B, Cd, Cl, Co, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Sb, Se, U, V, Zn)
- Nitrogen (total & basic)
- Sulfur (total, mercaptans, H_2S)
- Residue properties (saturates, aromatics, resins)
- Acidity
- Aromatics content
- Asphaltenes (pentane, hexane and heptane insolubles)
- Hydrogen content
- Carbon residue (Ramsbottom, Conradson)
- Distillation yields
- Properties by cut
- Hydrocarbon analysis by gas chromatography

Valero is likely to have access to the crude assay or "fingerprint" of the oil, but it was not made available to the public, foreclosing any meaningful public review. The IS/MND does not contain any crude assays for the current refinery slate, the crude that would be imported by rail, or the crude that is currently imported by ship but would be replaced. The IS/MND also does not contain an analysis of the impact of changes in crude quality on air emissions, asserting that there would be no change. The Initial Study should have evaluated the impacts of refining tar sands crudes on air emissions and other residuals or included conditions of certification specifically prohibiting their import, as publicly available information indicates that Valero is considering tar sands crudes and they would arrive at the Refinery with the largest discount relative to other crudes.

[5] CCQTA, Canadian Crude Oil Quality Past, Present and Future Direction, February 7, 2012, pp. 8 ("Need more than sulfur and gravity to determine the "acceptability and valuation" of crude oil in a refinery. The crude oil's hydrocarbon footprint and contaminants determine the value of crudes.."), Available at: http://www.choa.ab.ca/index.php/ci_id/9210/la_id/1/, provided as Appendix I to TGG Comments.

Although specific information is lacking, significant impacts can reasonably be expected from including tar sands crudes in the crude slate. The IS/MND claims that new "North American-sourced crudes" will not significantly change the range of sulfur content and density of the crude slate; however, it is possible and probable for the range of API and sulfur reported in the IS/MND to remain similar, yet with relatively small shifts in the average levels of sulfur and density and with major shifts in other properties, for emissions to increase. Essentially, the premise of the IS/MND that the composition of the crude slate will not change and thus will not impact air emissions, is inherently false.

For example, sulfur content of crude oils represents a complex collection of individual chemical compounds such as hydrogen sulfide, mercaptans, thiophene, benzothiophene, methyl sulfonic acid, dimethyl sulfone, thiacyclohexane, etc. Each crude has a different suite of individual sulfur chemicals. The impacts of "sulfur" depend upon the specific sulfur chemicals and their relative concentrations, not on the range of total sulfur expressed as a percent of the crude oil by weight. Although a range in the total sulfur content of rail-imported crude and the current crude slate may appear similar, even a small increase in total sulfur content can have profound impacts, and the composition of sulfur species also matters. A minor increase in sulfur content was reported by the Federal Chemical Safety Board (CSB) as a major contributing factor in the recent (August 2012) catastrophic fire at the Chevron Richmond Refinery in California.

Similarly, while the lighter sulfur compounds such as mercaptans and disulfides found in light sweet crudes may not significantly increase the overall weight percent sulfur in the crude slate, as claimed in the IS/MND, they do lead to impacts, such as aggressive sulfidation corrosion, which can lead to accidental releases.[6] As another example, the specific sulfur compounds will determine which compounds will be emitted from storage tanks and fugitive component, some of which could result in significant odor impacts, e.g., mercaptans. Thus, regardless of what crude might be brought in by rail, there are potential significant environmental impacts that are due to characteristics of that oil besides total sulfur and API gravity.

The specific chemicals in crude oil also determine which ones will be volatile and lost through equipment leaks and outgassed from tanks, which ones will be difficult to remove in hydrotreaters and other refining processes (thus determining how much hydrogen and energy must be expended to remove them), which ones will cause malodors, and which ones might aggravate corrosion, leading to accidental releases. The IS/MND failed to consider these finer details that have important implications for air quality and public health, and thus, failed to satisfy the disclosure requirements of CEQA and failed to analyze relevant impacts.

2) Heavier Crudes Require More Processing

Canadian tar sands bitumen is distinguished from conventional petroleum by the small concentration of low molecular weight hydrocarbons and the abundance of high molecular

[6] See, for example, Jim McLaughlin, Changing Your Crude Slate, Becht New, May 24, 2013, Available at: http://becht.com/news/becht-news/.

weight polymeric material.[7] Crudes derived from Canadian tar sands bitumen—DilBits, Synthetic crude oils (SCOs) and the combination of the two (SynBits)—are heavier, i.e., have larger, more complex molecules such as asphaltenes,[8] some with molecular weights above 15,000.[9] They generally have higher amounts of coke-forming precursors; larger amounts of contaminants (sulfur, nitrogen nickel, vanadium) that require more intense processing to remove; and are deficient in hydrogen, compared to other heavy crudes.

Thus, to convert them into the same refined products requires more utilities -- electricity, water, heat, and hydrogen. This requires that more fuel be burned in most every fired source at the refinery and that more water be circulated in heat exchangers and cooling towers. Further, this requires more fuel to be burned in any supporting off-site facilities, such as power plants that may supply electricity or Steam-Methane Reforming Plants that may supply hydrogen. Under CEQA, these indirect increases in emissions caused by a project must be included in the impact analysis. The increases in fuel consumption also releases increased amounts of NO_x, SO_2, VOCs, CO, PM10, PM2.5, and HAPs as well as greenhouse gas emissions (GHG). The IS/MND fails to analyze these impacts of crude composition on the resulting emissions from generating increased amount of these utilities.

a. Higher Concentrations of Asphaltenes and Resins

The severity (e.g., temperature, amount of catalyst, hydrogen) of hydrotreating crude oil in a refinery depends on the type of compound a contaminant is bound up in. Lower molecular weight compounds are easier to remove. The difficulty of removal increases in this order: paraffins, naphthenes, and aromatics.[10] Most of the contaminants of concern in tar sands crudes are bound up in high molecular weight aromatic compounds such as asphaltenes that are difficult to remove, meaning more heat, hydrogen, and catalyst are required to convert them to lower molecular weight blend stocks. Some tar sands-derived vacuum gas oils (VGOs), for example, contain no paraffins of any kind. All of the molecules are aromatics, naphthenes, or sulfur species that require large amounts of hydrogen to hydrotreat, compared to other heavy crudes.[11]

---

[7] 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.
[8] Asphaltenes are nonvolatile fractions of petroleum that contain the highest proportions of heteroatoms, i.e., sulfur, nitrogen, oxygen. The asphaltene 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.
[9] 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.
[10] James H. Gary, Glenn E. Handwerk, and Mark J. Kaiser, Petroleum Refining: Technology and Economics, 5th Ed., CRC Press, 2007, p. 200 and A.M. Aitani, Processes to Enhance Refinery-Hydrogen Production, Int. J. Hydrogen Energy, v. 21, no. 4, pp. 267-271, 1996.
[11] See, for example, the discussion of hydrotreating and hydrocracking of Athabasca tar sands cuts in. Gary R. Brierley, Visnja A. Gembicki, and Tim M. Cowan, Changing Refinery Configurations for Heavy and Synthetic Crude Processing, 2006, pp. 11-17. Available at:

Asphaltenes and resins generally occur in tar sands bitumens in much higher amounts than in other heavy crudes. They are the nonvolatile fractions of petroleum and contain the highest proportions of sulfur, nitrogen, and oxygen.[12] They have a marked effect on refining and result in the deposition of high amounts of coke during thermal processing in the coker. They also form layers of coke in hydrotreating reactors, requiring increased heat input, leading to localized or even general overheating and thus even more coke deposition. This seriously affects catalyst activity resulting in a marked decrease in the rate of desulfurization. They also require more intense processing in the coker required to break them down into lighter products. These factors require increases in steam and heat input, both of which generate combustion emissions -- NO_x, SO_x, CO, VOCs, PM10, and PM2.5.

Further, if the crude includes a synthetic crude, SCO, for example, the material has been previously hydrotreated. Thus, the remaining contaminants (e.g., sulfur, nitrogen), while present in small amounts, are much more difficult to remove (due to their chemical form, buried in complex aromatics), requiring higher temperatures, more catalyst, and more hydrogen.[13]

The higher amounts of asphaltenes and resins generate more heavy feedstocks that require more severe processing than lighter feedstocks. The coker, for example, makes more coker distillate and gas oil that must be hydrotreated, compared to conventional heavy crudes. Similarly, the Crude Unit makes more atmospheric and vacuum gas oils that must be hydrotreated.[14] This increases emissions from these units, including fugitive VOC emissions from equipment leaks and combustion emissions from burning more fuel.

b. Hydrogen Deficient

Tar sands crudes are hydrogen deficient compared to heavy and conventional crude oils and thus require substantial hydrogen addition during refining, beyond that required to remove contaminants (sulfur, nitrogen, metals). This again means more combustion emissions from burning more fuel.

---

https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7BA07DE342-E9B1-402A-83F7-36B18DC3DD05%7D&documentTitle=5639138.

[12] 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.

[13] See, for example, Brierley et al. 2006, p. 8 ("The sulfur and nitrogen species left in the kerosene and diesel cuts are the most refractory, difficult-to-treat species that could not be removed in the upgrader's relatively high-pressure hydrotreaters."); Turini et al. 2011 p. 4.

[14] Turini et al. Processing Heavy Crudes in Existing Refineries, prepared for AIChE Spring Meeting, Chicago, IL 2011, p. 9.; available at: http://www.aiche-fpd.org/listing/112.pdf

c. Higher Concentrations of Catalyst Contaminants

Tar sands bitumens contain about 1.5 times more sulfur, nitrogen, oxygen, nickel and vanadium than typical heavy crudes.[15] Thus, much more hydrogen per barrel of feed and higher temperatures would be required to remove the larger amounts of these chemicals. These impurities are removed by reacting hydrogen with the crude fractions over a fixed catalyst bed at elevated temperature. The oil feed is mixed with substantial quantities of hydrogen either before or after it is preheated, generally to 500 F to 800 F.[16]

Canadian tar sands crudes generally have higher nitrogen content, 3,000 to >6,000 ppm[17] and specifically higher organic nitrogen content, particularly in the naphtha range, than other heavy crudes.[18] This nitrogen is mostly bound up in complex aromatic compounds that require a lot of hydrogen to remove. This affects emissions in five ways.

First, additional hydrotreating is required to remove them, which increases hydrogen and energy input. Second, they deactivate the cracking catalysts, which requires more energy and hence more emissions to achieve the same end result. Third, they increase the nitrogen content of the fuel gas fired in combustion sources, which increases NO_x emissions from all fired sources that use refinery fuel gas. Fourth, nitrogen in tar sands crudes is present in higher molecular weight compounds than in other heavy crudes and thus requires more hydrogen and energy to remove. Fifth, some of this nitrogen will be converted to ammonia and other chemically bound nitrogen compounds, such as pyridines and pyrroles. These become part of the fuel gas and could increase NO_x from fired sources. They further may be routed to the flares, where they would increase NO_x emissions.

These types of chemical differences between the current crude slate and the new crude slate facilitated by the Crude by Rail Project were not addressed at all in the IS/MND. Some of these increased utility impacts were revealed in the VIP FEIR as of 2002. For example, the VIP FEIR indicated that the then-proposed changes in the crude slate would cause: (1) an increase in electricity demand of 23 MW; (2) an increase in natural gas consumption of 9.6 MMscf/day; (3) an increase in the firing rate of heaters and boilers of 400 MMBtu/hr; (4) an increase in the hydrogen capacity of 30 MMscf/day; and an increase in coker capacity of 5,000 BPD. Mitigations were proposed in the VIP FEIR for these significant increases in utility demands. However, this decades-old analysis has not been re-evaluated to determine if the current

---

[15] 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.

[16] James H. Gary, Glenn E. Handwerk, and Mark J. Kaiser, Petroleum Refining: Technology and Economics, 5th Ed., CRC Press, 2007, p. 200 and A.M. Aitani, Processes to Enhance Refinery-Hydrogen Production, Int. J. Hydrogen Energy, v. 21, no. 4, pp. 267-271, 1996.

[17] Murray R. Gray, Tutorial on Upgrading of Oil Sands Bitumen, University of Alberta, Available at: http://www.ualberta.ca/~gray/Links%20&%20Docs/Web%20Upgrading%20Tutorial.pdf.

[18] See, for example, James G. Speight, Synthetic Fuels Handbook: Properties, Process, and Performance, McGraw-Hill, 2008, Appendix A.

proposed change in crude slate would result in further increased impacts or if the changed regulatory framework requires more aggressive mitigation.

3) *Failure to Mitigate Air Emissions of Crudes*

The VIP environmental analysis was performed over 10 years ago. Much has changed in the last 10 years, from the suite of tar sands products available in the market, to the transportation options (marine shipping may have been the focus 10 years ago, while the current development is for rail), to the timing of implementation of the VIP, to the regulatory framework. Thus, a new, full, thorough analysis is required in conjunction to the proposed Crude by Rail Project and the crude slate composition. The impacts of importing unidentified crudes by rail cannot be reasonably evaluated without considering and re-evaluating the impacts of the VIP modifications to the refinery.

a. VOC emissions of the Project are Significant and Unmitigated

The VIP FEIR, for example, assumes that the use of a higher percentage of sour crudes would mitigate increases in VOC emissions from increasing crude throughput.[19] However, the dilbits that may now be imported with this Project would result in much higher VOC emissions than the originally anticipated heavier crude oil. These VOC emissions include large amounts of hazardous air pollutants, such as benzene, toluene and xylenes that result in significant health impacts, including elevated cancer risk.

Increased VOC emissions impacts have not been sufficiently analyzed for the current project. While we have focused our comments mainly on the reasonably foreseeable possibility that the Crude by Rail project will bring in heavy bitumen tar sands crudes, the IS/MND asserts that the imported crudes could include up to 70,000 BPD of light, low density crudes, which would create increased VOC emissions. These crudes have a much higher vapor pressure than the crude slate contemplated in the VIP FEIR and would significantly increase VOC emissions from tanks, pumps, compressors, valves, and connectors throughout the Refinery compared to the scenario analyzed in the VIP FEIR. Further, the FEIR explicitly assumes that the imported heavy sour crudes would mitigate increases in VOC emissions. This assumption did not consider the fact that diluents are now widely used to blend with the crudes, which similarly have significant VOC emissions increases associated with them, discussed below.

---

[19] ESA, Valero Refining Company's Land Use Application for the Valero Improvement Project, Environmental Impact Report, Draft, October 2002 (DEIR), The Benicia Planning Commission certified the Final EIR, consisting of the DEIR and the Responses to Comments in Resolution No. 03-4. This FEIR was amended in 2007. See VIP RTC, p. IV-61. Supporting documents available at: http://www.ci.benicia.ca.us/index.asp?Type=B_BASIC&SEC=%7B737165B4-11C5-4974-9B0B-0AE4AC535ECC%7D.

The BAAQMD CEQA significance threshold for VOCs is 15 tons/year based on conservative 1999 guidance.[20] Assuming 70,000 BPD of the crude throughput or 42% of the total, is light sweet crude, as now asserted in the Crude by Rail project, the VOC emissions would increase to more than 104 tons/year or by 31 tons/year. This exceeds the BAAQMD CEQA significance threshold by a factor of two and is a very significant unmitigated impact, triggering an EIR. Actual increases could be much higher under any of the currently understood plausible scenarios, importing light sweet crude under the Crude by Rail Project, or importing diluent-blended DilBit under the VIP project, as explored further below.

b. Cumulative impacts of simultaneous construction of the VIP Project and the Crude By Rail Project are significant and unmitigated.

The Initial Study for the Crude by Rail Project estimated that the daily average construction exhaust emissions from building the rail terminal would be 51.9 lb/day.[21] The CEQA significance threshold is 54 lb/day.[22] Taken together with NOx emissions from the VIP Project, which is still being constructed, cumulative NOx emissions are likely to exceed the significance threshold. The last portion of the VIP project, the new Hydrogen Plant, will be under construction at the same time that the new rail terminal is being constructed. The VIP FEIR did not calculate construction emissions, as this was not required at the time, which is an example of the change in regulatory framework. If the NOx emissions from constructing the Hydrogen Plant would exceed 2.1 lb/day, cumulative NOx emissions from simultaneously constructing the Hydrogen Plant and the Crude by Rail project would be cumulatively significant. The IS/MND does not analyze cumulative NOx emissions and provides no support for an implicit assumption that NOx emissions from constructing the Hydrogen Plant would be less than 2.1 lb/day (i.e., 25 times less than from constructing the rail terminal). It is reasonable to assume—at least absent contrary analysis—that the emissions from constructing the Hydrogen Plant will exceed 2.1 lb/day (i.e., not be 25 times less than for constructing the rail terminal) and that the cumulative impacts of constructing the two projects simultaneously will exceed the significance threshold.

c. Emissions must be reduced to assure that regulatory levels are not exceeded.

Ten years have passed since the environmental analysis was done for the VIP and the FEIR was certified. As the VIP FEIR was certified in 2003, and amended in 2007, the regulatory and informational framework within which the Project would be developed today has

[20] Newer guidelines adopted in 2010 lowered the thresholds of significant for VOCs and other pollutants to 10 tons per year. However, the newer guidance is on hold due to ongoing litigation. See: http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES.aspx

[21] ESA, Valero Crude by Rail Project, Initial Study/Mitigated Negative Declaration, Use Permit Application 12PLN-00063, Prepared for City of Benicia, May 2013,Table 3-1.

[22] BAAQMD Recommended CEQA Threshold of Significance, Available at: http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/Staff-Recommended%20and%20Existing%20CEQA%20Thresholds%20Table%2010-07-09.ashx?la=en.

changed dramatically, rendering the 2002 analysis obsolete.

Since the VIP FEIR was certified in 2003, new scientific evidence about the potential adverse impacts of air pollutants has become available, and in response, new guidance has been published and several federal and state ambient air quality standards have been revised. These include:

- The 8-hour CA ozone standard was approved by the Air Resources Board on April 28, 2005 and became effective on May 17, 2006.
- The EPA lowered the 24-hour PM2.5 standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ in 2006. EPA designated the Bay Area as nonattainment of the PM2.5 standard on October 8, 2009.
- On June 2, 2010, the U.S. EPA established a new 1-hour SO_2 standard, effective August 23, 2010.
- The EPA promulgated a new 1-hour NO_2 standard of 0.1 ppm, effective January 22, 2010.
- The EPA issued the greenhouse gas tailoring rule in May 2010, which requires controls of GHG emissions not contemplated in the VIP FEIR.
- The California Air Resources Board has identified lead and vinyl chloride as ‘toxic air contaminants’ with no threshold level of exposure below which there are no adverse health effects determined.
- The EPA issued a final rule for a national lead standard, rolling 3-month average, on October 15, 2008.

Emissions must be reduced to assure that these new regulatory levels are not exceeded. Lead, for example, can be present in very high concentrations in fugitive dusts from coke storage, handling, and export, especially when heavy sour crudes are being processed. There is a long history of nuisance coke dust issues at this Refinery that impact residents.[23] The VIP would increase coke production and thus fugitive coke dust emissions with elevated lead levels. The proposed Crude by Rail Project also could increase coke production, depending upon the specific "North American-sourced crude" that it imports. [24] Coke contains many contaminants including lead.[25] The California Air Resources Board has concluded there is no safe threshold level of exposure for lead; any amount poses significant health risks. Thus, the cumulative increase in coke fugitive emissions estimated in the VIP EIR and facilitated by the Crude by Rail Project are a significant public health impact.

---

[23] See, e.g., VIP DEIR, p. 4.2-14.

[24] The VIP DEIR did not disclose the actual coke increase, but did acknowledge that it would increase coke exports over the dock by 12 ships per year and by rail of 5 rail cars per day. VIP DEIR, p. 3-52. The capacity of a coke ship and coke rail cars was not disclosed.

[25] For example, see a Material Safety Data Sheet for Petroleum Coke: http://www.tsocorp.com/stellent/groups/corpcomm/documents/tsocorp_documents/msdspetrocoke.pdf

Further, the VIP DEIR assumed health impacts from coke dust exposure would be mitigated by complying with the then-current PM10 and PM2.5 regulations.[26] However, these have been significantly lowered and an ambient air quality standard for lead has been promulgated. There has been no demonstration that the increase in lead and heavy metal-laden coke dust, that could reasonably be expected to result from the Crude to Rail Project, could comply with these new standards, or that such compliance would mitigate lead health impacts, given CARB's zero threshold finding, or that other contaminants in coke dust would not pose a significant risk to public health.

B. Increased Air Emissions from Diluent

The majority of the crudes that will eventually be transported by rail will likely be a blend of bitumen and diluent due to their discounted price compared to conventional light sweet crudes. When heavy crude is shipped by pipeline, it needs to be diluted so that it will flow in the pipe, and this is similarly the case for un-heated railcars. We estimate that the Dilbit likely to be imported by this project will contain 20% to 30% diluent based on the description of the rail facility in the IS/MND.[27]

Regardless, the mixture of diluent and bitumen does not behave the same as a conventional crude, as the distribution of hydrocarbons is very different. The blended lighter diluent evaporates easily when exposed to ambient conditions, leaving behind the heavy ends, the vacuum gas oil (VGO) and residuum.[28] Thus, when a DilBit is released accidentally, it will generally create a difficult to cleanup spill as the heavier bitumen will be left behind.[29] Further, in a storage tank, the diluent also can be rapidly evaporated and emitted through tank openings.

These conventional DilBits, which are the most likely "North American-sourced crude" to be imported by rail over the long term, given the current economic outlook, are sometimes referred to as "dumbell" 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 the more desirable

---

[26] VIP DEIR, p. 4.8-14.

[27] Bitumen blended to pipeline specifications can be loaded on and off conventional rail tank cars like other light crudes. The amount of diluent depends on the type of rail tank car and design details of the offloading facilities. Although this information was not provided in the IS/MND, the document did discuss the use of conventional rail cars and a conventional unloading terminal. Further, the number of rail cars, 100 per day, or 700 barrels per car, suggests a lighter material, with more diluent.

[28] The residuum is the residue obtained from the oil after nondestructive distillation has removed all of the volatile materials. Residua are black, viscous materials. They may be liquid at room temperature (from the atmospheric distillation tower) or almost solid (generally vacuum residua), depending upon the nature of the crude oil.

[29] 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.

middle range.[30] Thus, they yield very little middle distillate fuels, such as diesel, heating oil, kerosene, and jet fuel and much 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 show major differences between DilBits and the crudes currently refined at Benicia.[31]

The large amount of light material in DilBits is very volatile and can be emitted to the atmosphere from storage tanks and equipment leaks of fugitive components (pumps, compressors, valves, fittings) in much larger amounts than other heavy crudes that it would replace. It is unlikely that any other heavy crudes processed at the Refinery currently arrive with diluent, since EIA crude import data do not identify any crudes that are blended with diluent. Thus, the use of diluent to transport tar sands crudes is likely an important difference between the current heavy crude slates processed at the Refinery and the tar sands crudes that could replace them. This diluent will have impacts during railcar unloading as well as at many processing units within the Refinery.

The diluent is a low molecular weight organic material with a high vapor pressure that contains high levels of VOCs, sulfur compounds, and HAPs. These would be emitted during unloading and present in emissions from the crude tank(s) and fugitive components from its entry into the Refinery with the crude until it is recovered and marketed, or at least between the desalter and downstream units where some of it is recovered. The presence of diluent would increase the vapor pressure of the crude, substantially increasing VOC and HAPs emissions from tanks and fugitive component leaks compared to those from displaced heavy crudes not blended with diluent. The IS/MND and the VIP FEIR did not disclose the potential presence of diluent and made no attempt to estimate these diluent-derived emissions.

The composition of some typical diluents is reported on the website, www.crudemonitor.ca.[32] The specific diluents that would be used by the Project are unknown. However, the CrudeMonitor information indicates that several different types of diluents contain very high concentrations (based on 5-year averages) of the hazardous air pollutants

---

[30] 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.

[31] Stratiev and others, 2010, Table 1, compared to DilBit crude data on www.crudemonitor.ca.

[32] Condensate Blend (CRW) - http://www.crudemonitor.ca/condensate.php?acr=CRW; Fort Saskatchewan Condensate (CFT) - http://www.crudemonitor.ca/condensate.php?acr=CFT; Peace Condensate (CPR) - http://www.crudemonitor.ca/condensate.php?acr=CPR; Pembina Condensate (CPM) - http://www.crudemonitor.ca/condensate.php?acr=CPM; Rangeland Condensate (CRL) - http://www.crudemonitor.ca/condensate.php?acr=CRL; Southern Lights Diluent (SLD) - http://www.crudemonitor.ca/condensate.php?acr=SLD.

(HAPs) benzene (5,200 ppm to 9,800 ppm); toluene (10,300 ppm to 25,300 ppm); ethyl benzene (900 ppm to 2,900 ppm); and xylenes (4,600 ppm to 23,900 ppm).

The sum of these four compounds is known as "BTEX" or benzene-toluene-ethylbenzene-xylene. The BTEX in diluent ranges from 27,000 ppm to 60,900 ppm. The BTEX in DilBits, blended from these materials, ranges from 8,000 ppm, to 12,400 ppm.[33] Similarly, the BTEX in synthetic crude oils (SCOs) ranges from 6,100 ppm to 14,100 ppm.[34] These are very high concentrations that were not considered in the emission calculations in the IS/MND nor in the VIP FEIR. These high levels could result in significant worker and public health impacts.

The ATC estimated emissions of these compounds (ATC, Table 3-3) from Tank 1776 and fugitive components using the "default speciation profile" for crude oil from the EPA program, TANKS4.09d, for all constituents except benzene. For benzene, the IS/MND variously claims it substituted either 0.06 wt % or 0.6 wt % for the default value.[35] Thus, the IS/MND's assumptions as to benzene in fugitive emissions are inconsistent. The default crude oil speciation profile from the TANKS4.09d model reports benzene at 0.6 wt %.[36] Thus, the

---

[33] DilBits: Access Western Blend (AWB) -http://www.crudemonitor.ca/crude.php?acr=AWB; Borealis Heavy Blend (BHB) -http://www.crudemonitor.ca/crude.php?acr=BHB; Christina Dilbit Blend (CDB) -http://www.crudemonitor.ca/crude.php?acr=CDB; Cold Lake (CL) - http://www.crudemonitor.ca/crude.php?acr=CL; Peace River Heavy (PH) - http://www.crudemonitor.ca/crude.php?acr=PH; Seal Heavy (SH) - http://www.crudemonitor.ca/crude.php?acr=SH; Statoil Cheecham Blend (SCB) - http://www.crudemonitor.ca/crude.php?acr=SCB**;** Wabasca Heavy (WH) - http://www.crudemonitor.ca/crude.php?acr=WH; Western Canadian Select (WCS) - http://www.crudemonitor.ca/crude.php?acr=WCS; Albian Heavy Synthetic (AHS) (DilSynBit) - http://www.crudemonitor.ca/crude.php?acr=AHS.

[34] SCOs: CNRL Light Sweet Synthetic (CNS) - http://www.crudemonitor.ca/crude.php?acr=CNS; Husky Synthetic Blend (HSB) - http://www.crudemonitor.ca/crude.php?acr=HSB; Long Lake Light Synthetic (PSC) - http://www.crudemonitor.ca/crude.php?acr=PSC; Premium Albian Synthetic (PAS) - http://www.crudemonitor.ca/crude.php?acr=PAS; Shell Synthetic Light (SSX) - http://www.crudemonitor.ca/crude.php?acr=SSX; Suncor Synthetic A (OSA) - http://www.crudemonitor.ca/crude.php?acr=OSA; Syncrude Synthetic (SYN) - http://www.crudemonitor.ca/crude.php?acr=SYN.

[35] See Appendix A.1 of the IS/MND (The Air Permit Application or Authority To Construct, “ATC”), p. 11, pdf 17, in the note following Table 3-3, states that benzene in crude oil was assumed to be 0.6%. However, in Table 3-5, p. 12, pdf 18, it is stated that benzene in the crude oil was assumed to be 0.06%. Similarly, the supporting appendices indicate that 0.06% benzene was actually used in the fugitive emissions calculations. ATC, Attach. B-3, Fugitive Component Emissions, pdf 33. Similar data for tank emission calculations cannot be checked as it is claimed to be confidential. ATC, Attach. B-2.

[36] The profile, "Tanks_Crude_Speciation.xls" can be extracted from the TANKS409d model available at http://www.epa.gov/ttnchie1/software/tanks/ by using the "Data --> Speciation

IS/MND apparently lowered the benzene concentration in rail-imported crude oil by a factor of ten.[37] This contradicts published crude composition for the range of North American-sourced crudes that could be imported by the Project, as reviewed above and summarized in Table 1. The benzene value used in the IS/MND substantially underestimates the amount of benzene that would be present in tank and fugitive component emissions when processing either DilBits or Bakken crudes.

Table 1 compares the concentration of BTEX used to estimate BTEX emissions in the IS/MND with the BTEX concentrations in various diluents, two widely traded DilBits, including the DilBit that Valero used in its cost analysis (Fig. 2), Western Canadian Select, and Bakken crude oils. This table shows that regardless of which material is imported by the Crude by Rail Project, benzene emissions would be much higher than estimated in the IS/MND. Further, benzene emissions are higher in the most recently collected samples than in the five-year averages in Table 1. These benzene emissions would result in significant health impacts.

Profiles --> Export" menu selection and choosing crude oil. This spreadsheet confirms that the default benzene level for crude oils is 0.6wt.%.

[37] The information in IS/MND Appendix A confirms that the lower value for benzene in crude, 0.06wt.%, was used to calculate benzene emissions.

Table 1
Comparison of BTEX Levels Assumed in IS/MND with Levels in Diluents and DilBits

	Default Crude ATC Attach.B-3 (wt.%)	Diluents (5-yr Avg)[38] (wt.%)	Christina DilBit[39] (5-yr Avg) (wt.%)	Western Canadian Select[40] (5-yr Avg) (wt.%)	Bakken[41] Crude (wt.%)
Benzene	0.06	0.83-1.27	0.27	0.15	0.1-1.0
Ethylbenzene	0.4	0.11-0.33	0.06	0.06	0.33
Toluene	1.00	1.32-2.89	0.44	0.27	0.92
Xylenes	1.4	0.59-2.71	0.34	0.27	1.4

The ATC discloses that annual emissions of benzene from Tank 1776 exceed the BAAQMD chronic trigger level (6.4 lb/yr trigger level compared to a net increase of 28.3 lb/yr).[42] Further, the IS/MND and underlying ATC fail to disclose that benzene emissions from fugitive components, when calculated using the correct benzene level (at least 0.6%, rather than 0.06%), also exceed the BAAQMD screening level (6.4 lb/hr screening level compared to 20 lb/hr emitted, adjusted to 0.6% benzene).

The Initial Study conducted a screening health risk assessment. It found no significant health impact.[43] However, the benzene emissions used in this analysis apparently (the records lacks sufficient data to be certain) were underestimated by factors of 2.5 to 4.5 assuming DilBits and up to a factor of 17 for Bakken crudes. Although there is one DilBit with an unusually low benzene concentration of 0.06 wt.%, Borealis Heavy Blend, there is no evidence that this is the only DilBit that would be imported by rail.

---

[38] The reported range includes the following diluents: Condensate Blend, Saskatchewan Condensate, Peace Condensate, Pembina Condensate, Rangeland Condensate, and Southern Lights Diluent. The composition data for all of these diluents is found at http://www.crudemonitor.ca. Concentrations reported in volume % (v/v) in this source were converted to weight % by dividing by the ratio of compound density in kg/m^3 at 25 C (benzene =876.5 kg/m^3, toluene = 0.866.9 kg/m^3, ethylbenzene 866.5 kg/m^3, and the xylenes 863 kg/m^3) to crude oil density in kg/m3, as reported at www.crudemonitor.ca, 5-year average. See also Cenovus Energy Inc. Material Safety Data Sheet, Condensate (Sour) and Condensate (Sweet), Available at: http://www.cenovus.com/contractor/msds.html.

[39] Christina DilBit Blend (CDB) -.http://www.crudemonitor.ca/crude.php?acr=CDB. Concentrations reported in volume % (v/v) converted to weight % as explained in footnote 44..

[40] Western Canadian Select (WCS) -http://www.crudemonitor.ca/crude.php?acr=WCS. Concentrations reported in volume % (v/v) converted to weight % as explained in footnote 44..

[41] Cenovus Energy, Material Safety Data Sheet for Light Crude Oil, Bakken (benzene), Available at: http://www.cenovus.com/contractor/docs/CenovusMSDS_BakkenOil.pdf. Other components of BTEX from Keystone DEIS, Tables 3.13-1 (density) and 3.13-2 (BTEX). Concentrations reported in volume % (v/v) converted to weight % as explained in footnote 44.

[42] ATC, p. 17-18 & Table 4-3.

[43] IS, p. II-15.

Although crude oil contains many different chemicals that are carcinogens, benzene is the only carcinogen included in the HAP emission calculations in the IS/MND.[44] The only sources of benzene disclosed in the IS/MND is Tank 1776 and fugitives, which were underestimated due to the use of an anomalously low crude concentration. Thus, the cancer risks reported in the IS/MND in Table 3-3 can be adjusted for this error by multiplying that cancer risk by the benzene ratios reported above. With this correction, the cancer risk to the maximum exposed worker increases from the 4 in a million reported in the IS/MND to up to 20 in a million for DilBits and up to 76 in a million for Bakken crudes. For the maximum exposed residential receptor, the reported cancer risk increases from 2 in a million reported in the IS/MND to up to 10 in a million for DilBits and to 39 in a million for Bakken crudes. These cancer risk levels equal or exceed the assumed cancer significance threshold of 10 in a million. Thus, these are significant unmitigated impacts both to workers and nearby residents that were not disclosed in the IS/MND and are directly caused by the failure of the IS/MND to consider the composition of the crude that is being imported.

Information on diluents from the CrudeMontior also indicates elevated concentrations of volatile mercaptans (9.9 to 103.5 ppm), which are highly odiferous and toxic compounds that will create odor and nuisance problems at the Refinery in the vicinity of the unloading area, crude storage tanks and supporting fugitive components. Mercaptans can be detected at concentrations substantially lower than will be present in emissions from the crude tanks and fugitive emissions from the unloading rack and related components, including pumps, valves, flanges, and connectors.[45]

Thus, unloading, storing, handling and refining bitumens mixed with diluent and shale crudes such as Bakken would emit VOCs, HAPs, and malodorous sulfur compounds, not found in comparable levels in conventional crudes, depending upon the DilBit or shale crude source. There are no restrictions on the crudes, diluent source or their compositions nor any requirements to monitor emissions from tanks and leaking equipment where DilBit-blended and other light crudes would be handled. As the market has experienced shortages of diluents, any material with a suitable thinning ability could be used, which could contain still other hazardous components, with the potential for even greater air quality and health impacts than discussed here.

C. Health Impacts of Chemical Constituents in DilBits

Heavy bitumen tar sands and diluents are composed of hundreds of chemicals with known health impacts. Below is a summary of the health impacts of some of those hazardous compounds associated with refining dirtier crude oils. Many of these compounds present significant hazards to human health at varying levels of exposure.

---

[44] IS/MND, Appx. A.

[45] American Industrial Hygiene Association, Odor Thresholds for Chemicals with Established Occupational Health Standards, 1989; American Petroleum Institute, Manual on Disposal of Refinery Wastes, Volume on Atmospheric Emissions, Chapter 16 - Odors, May 1976, Table 16-1.

1. Hydrogen Sulfide is a flammable and colorless gas that smells like rotten eggs. It is a broad spectrum poison that can be lethal at high concentrations. At low concentrations, hydrogen sulfide can cause irritation to the eyes, nose and throat. Additionally, exposure may result in incoordination, memory loss, hallucinations, personality changes, loss of sense of smell, cough, and shortness of breath; people with asthma may experience difficulty breathing. In occupational settings, workers have died from exposure to high levels of hydrogen sulfide.[46]

2. Mercaptans[47] are a large class of toxic compounds that generally have a strong and unpleasant odor even at very low concentrations. They are added in small amounts to natural gas to help detect gas leaks. Because they are extremely flammable, mercaptans present fire and explosion hazards in industrial processe. Exposure to mercaptans may cause irritation of the skin, eyes, and upper respiratory tract. All mercaptans negatively affect the central nervous system. Workers accidentally exposed to high levels of mercaptans experienced muscular weakness, nausea, dizziness, stupor, and uncounsciousness (narcosis).[48]

3. Thiophene[49] is a highly flammable and hazardous component of petroleum.[50] Exposure to thiophene results in adverse effects to the skin, eyes, nose and throat.[51] Workers breathing thiophene vapors generated from normal handling of the material may experience respiratory irritation, dizziness, fatigue, unconsciousness, loss of reflexes, lack of coordination, and vertigo. Long term exposure to thiophene may damage the liver, or produce asthma-like symptoms which may continue for months or years after exposure to the chemical stops.[52]

4. Benzothiophene[53] is a solid compound with an odor similar to naphthalene (mothballs). It is found in petroleum, and used primarily in industries such as pharmaceuticals and in

---

[46] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Hydrogen Sulfide*, U.S. Department of Health and Human Services, July 2006.

[47] Mercaptans are also commonly known as thiols, thioalcohols, or sulphydrates.

[48] Stellman, Jeanne Mager, *Encyclopaedia of Occupational Health and Safety,* vol. 4,Geneva: International Labor Office, 1998.

[49] Thiophene is also called divinylene sulphide, thiacyclopentadiene, and thiofuran

[50] National Library of Medicine Hazardous Substances Databank , 'Thiophne', http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~xlH0IB:1 (accessed June 2013)

[51] New Jersey Department of Health and Senior Services, ‘Thiophene Hazardous Substance Fact Sheet’, December 2000, http://nj.gov/health/eoh/rtkweb/documents/fs/1851.pdf (accessed June 2013)

[52] Santa Cruz Biotechnology, ‘ThiopheneMaterial Safety Data Sheet’ March 2009, http://datasheets.scbt.com/sc-251237.pdf (accessed June 2013)

[53]Benzothiophene is also known as thianaphthene, benzo(b)thiophene, 1-benzothiophene, 1-thiaindene, 2,3-benzothiophene, benzothiofuran, benzothiophen, thianaphtene, thianaphthen, thianaphthene, and thionaphthene

research.[54] A person exposed to benzothiophene may experience irritation of the eyes, skin, or respiratory tract.[55]

5. Methylsulfonic acid[56] is used in the process of refining petroleum. The general population is exposed through breathing outdoor air.[57] Methylsulfonic acid is harmful to humans and can irritate or burn the eyes, skin, and mucous membranes.[58] Inhaling methylsulfonic acid vapor is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.[59]

6. Dimethyl sulfone[60,61] is an odorless, combustible liquid and vapor. If inhaled as a dust, it may cause respiratory irritation. It may also cause irritation to the eyes.[62]

7. Thiacyclohexane[63] is a sulfur containing component of crude oil. It is highly flammable, and exists in both liquid and vapor form. Exposure to thiacyclohexane may cause skin or eye irritation. At present, the short and long-term toxicity of this compound is not fully

[54] Merck Index, 'Thianaphthene Structure Details', n.d., http://themerckindex.cambridgesoft.com/themerckindex/Forms/Search/ContentArea/ChemBioVizSearch.aspx?FormGroupId=200000&AppName=THEMERCKINDEX&AllowFullSearch=true&KeepRecordCountSynchronized=false&SearchCriteriaId=5&SearchCriteriaValue=95-15-8&CurrentIndex=0 (accessed June 2013)

[55] National Institue of Health Haz-Map Database, 'Benzothiophene Haz-Map Category Details', *Haz-Map*, n.d., http://hazmap.nlm.nih.gov/category-details?id=12230&table=copytblagents (accessed June 2013)

[56] Methylsulfonic acid is also called methanesulfonic acid

[57] National Library of Medicine Hazardous Substances Data Bank, 'Methanesulfonic Acid -', *Toxnet: Toxicology Data Network* http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+5004 (accessed June 2013)

[58] Occupational Safety and Health Administration 'Methanesulfonic Acid Chemical Sampling Information', n.d., http://www.osha.gov/dts/chemicalsampling/data/CH_250710.html (accessed June 2013)

[59] National Library of Medicine Hazardous Substances Data Bank, 'Methanesulfonic Acid', http://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+5004 (accessed June 2013)

[60] Dimethyl sulfone is also known as methyl sulfone, methylsulfonylmethane, sulfonylbismethane, methane, sulfonylbis-, and dimethyl sulphone

[61] Dimethyl sulphone is commonly known as methylsulfonylmethane, or MSM, and used widely as a food supplement and medicine.

[62] Gaylord Chemical Corporation, 'Dimethyl Sulfone Material Safety Data Sheet', August 20, 2004, http://www.clean.cise.columbia.edu/msds/dimethylsulfoxide.pdf (accessed June 2013)

[63] Synonyms include thiapyran, tetrahydro- (4CI), thiopyran, tetrahydro- (6CI), pentamethylenesulfide, penthiophane, tetrahydro-2H thiopyran, tetrahydrothiapyran, tetrahydrothiopyran, thiacyclohexane, thiane. Search for this compound using thiane, or its CAS number 1613-51-0.

understood.[64]

8. Pentane[65] is a volatile organic compound (VOC) commonly found in natural gas and crude oil. Aside from the fact that is highly flammable—mixtures of pentane and air can be explosive—pentane has been identified as a central nervous system (CNS) depressant.[66] Exposure to pentane vapors can cause irritation to the eyes, skin, and respiratory system, as well as, nausea, vomiting, headaches, and dizziness.[67,68] Chronic or long-term exposure can result in anoxia, or a severe lack of oxygen to body organs and tissues.[69] Exposure to high levels of pentane can be deadly.[70]

9. Naphtha[71] is a highly flammable, toxic organic solvent distilled from petroleum with a wide range of industrial and commercial uses. Exposure to naphtha can cause headaches, dizziness, nausea, and vomiting.[72] Naphtha vapor is a central nervous system depressant as well as an irritant of the mucous membranes and the respiratory tract—exposure to high concentrations can cause fatigue, lightheadedness, and loss of consciousness.[73] Female workers exposed to naphtha experienced reproductive impacts in the form of disturbances in menstrual cycles, abnormal uterine bleeding, and a disturbance of the ovarian function.[74] Long-term exposure may cause damage to the liver, kidneys, blood, nervous system, and skin.[75] Naphtha contains benzene which is a known carcinogen. [76]

---

[64] Alfa Aesar, 'Tetrahydrothiopyran Material Safety Data Sheet', June 2011, http://www.msds.com/servlet/B2BDocumentDisplay?document_version_nri=5175301&manuf_nri=704&manuf_name=&supplier_nri=704&page_number=1&search_source=centraldb&CLIENT_session_key=A736334_Kitty89&CLIENT_language=2 (accessed June 2013)

[65] Also known as n-Pentane, normal-Pentane

[66] National Library of Medicine Hazardous Substances Data Bank, 'PENTANE', http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~mKkbnT:1 (accessed June 2013)

[67] NIOSH, 'CDC - NIOSH Pocket Guide to Chemical Hazards - n-Pentane', November 2010, http://www.cdc.gov/niosh/npg/npgd0486.html (accessed June 2013)

[68] NIOSH, 'n-Pentane International Chemical Safety Cards', October 1999 http://www.cdc.gov/niosh/ipcsneng/neng0534.html (accessed June 2013)

[69] National Library of Medicine Hazardous Substances Data Bank, 'Pentane', http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~mKkbnT:1 (accessed June 2013)

[70] NIOSH, 'n-Pentane International Chemical Safety Cards', October 1999 http://www.cdc.gov/niosh/ipcsneng/neng0534.html (accessed June 2013)

[71] Like pentane, naphtha may be used as a diluent in heavy crude oils.

[72] New Jersey Department of Health and Senior Services, 'Naphtha Hazardous Substance Fact Sheet', April 2007, http://nj.gov/health/eoh/rtkweb/documents/fs/0518.pdf (accessed June 2013)

[73] National Library of Medicine Hazardous Substances Data Bank, 'Naphtha', http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~PqjFcw:1 (accessed June 2013)

[74] National Library of Medicine Hazardous Substances Data Bank, 'Naphtha', http://toxnet.nlm.nih.gov/cgi-bin/sis/search/f?./temp/~PqjFcw:1 (accessed June 2013)

[75] Collection Care, 'Naphtha Material Safety Data Sheet', June 27, 2011, http://www.collectioncare.org/MSDS/naphthamsds.pdf (accessed June 2013)

BTEX: The following compounds (benzene, toluene, ethylbenzene, and xylene) are some of the VOCs found in petroleum.

10. Benzene is a common component of crude oil and gasoline, and a widespread environmental pollutant resulting mainly from refinery activity.[77] People are primarily exposed to benzene through breathing contaminated air. Benzene is a known carcinogen; long term exposure can cause leukemia.[78] Inhalation of high doses of benzene may impact the central nervous system leading to drowsiness, dizziness, irregular heartbeat, nausea, headaches, and depression.[79] Female workers experiencing high exposure levels over the course of many months experienced reproductive impacts, such as a decrease in the size of their ovaries. In animal studies, breathing benzene was associated with developmental effects such as low birth weight, delayed bone formation, and bone marrow damage.[80]

11. Toluene is a volatile organic compound (VOC) used widely in industry as a raw material and as a solvent. Toluene concentrations are highest in areas of heavy traffic, near gas stations and petroleum refineries. According to California's list of chemicals known to cause cancer or reproductive toxicity, toluene is listed as a developmental toxicant.[81] Similar to many organic solvents, toluene acts as a respiratory tract irritant, particularly at high air concentrations.[82] For this reason, it can be more harmful to people with asthma. A ubiquitous air pollutant, exposure to toluene constitutes a serious health concern as it has negative impacts on the central nervous system. Exposure to toluene can cause headaches, impaired reasoning, memory loss, nausea, impaired speech, hearing, and vision, amongst other health effects.[83] Long term exposure may damage the

---

[76] New Jersey Department of Health and Senior Services, 'Naphtha Hazardous Substance Fact Sheet', April 2007, http://nj.gov/health/eoh/rtkweb/documents/fs/0518.pdf (accessed June 2013)

[77] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Benzene*, U.S. Department of Health and Human Services, August 2007.

[78] California EPA Office of Environmental Health Hazard Assessment, 'Chemicals Known to the State to Cause Cancer or Reproductive Toxicity', 2013, http://oehha.ca.gov/prop65/prop65_list/files/P65single052413.pdf (accessed June 2013)

[79] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Benzene*, U.S. Department of Health and Human Services, August 2007.

[80] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Benzene*, U.S. Department of Health and Human Services, August 2007.

[81] California EPA Office of Environmental Health Hazard Assessment, 'Chemicals Known to the State to Cause Cancer or Reproductive Toxicity', 2013, http://oehha.ca.gov/prop65/prop65_list/files/P65single052413.pdf (accessed June 2013)

[82] Agency for Toxic Substances and Disease Registry, *Toluene Toxicity*: *Case Studies in Environmental Medicine*, U.S. Department of Health and Human Services, Division of Toxicology and Environmental Medicine, February 2001, http://www.atsdr.cdc.gov/csem/toluene/docs/toluene.pdf (accessed June, 2013)

[83] Agency for Toxic Substances and Disease Registry, *Toluene Toxicity*: *Case Studies in Environmental Medicine*, U.S. Department of Health and Human Services, Division of

liver and kidneys.[84]

12. Ethylbenzene is a commonly occurring component of petroleum. Once refined, it is used in many consumer products such as gasoline, pesticides, varnishes and paints. Ethylbenzene has been recently classified as a possible human carcinogen by the International Agency for Research on Cancer (IARC)[85], and has been associated with a number of adverse health outcomes. Breathing high levels can cause dizziness as well as throat and eye irritation; chronic, low-level exposure over several months to years can result in kidney damage as well as hearing loss.[86]

13. Xylene[87] is a VOC in petroleum. Short term exposure to xylene may result in a number of adverse human health effects including irritation of the skin, eyes, nose and throat, difficulty breathing, damage to the lungs, impaired memory, and possible damage to the liver and kidneys. Long term exposure may affect the nervous system presenting symptoms such as headaches, lack of muscle coordination, dizziness, confusion, and loss of balance.[88] More serious long term health effects include memory impairment, red and white blood cell abnormalities, abnormal heartbeat (in laboratory workers), liver damage, mutagenesis (mutations of genes), reproductive system effects, and death due to respiratory failure.[89]

14. Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during incomplete combustion.[90,91,92] Infants and children are *especially*

Toxicology and Environmental Medicine, February 2001, http://www.atsdr.cdc.gov/csem/toluene/docs/toluene.pdf (accessed June, 2013)

[84] National Institute for Occupational Safety and Health, ‘Toluene’, *NIOSH Pocket Guide to Chemical Hazards*, 2010, http://www.cdc.gov/niosh/npg/npgd0619.html (accessed June 2013)

[85] Henderson, Leigh, David Brusick, Flora Ratpan, and Gauke Veenstra, ‘A Review of the Genotoxicity of Ethylbenzene’, *Mutation Research/Reviews in Mutation Research,* 635 (2007), 81-89 <doi:10.1016/j.mrrev.2007.03.001>

[86] Agency of Toxic Substances and Disease Registry, *Toxicological Profile for Ethylbenzene, ToxFAQs*, 2010, http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=382&tid=66 (accessed June 2013)

[87] Also known as dimethyl benzene

[88] Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Xylene,* U.S. Department of Health and Human Services, August 2007.

[89] Zoveidavianpoor, M., A. Samsuri, and S. R. Shadizadeh, ‘The Clean Up of Asphaltene Deposits in Oil Wells’, *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 35 (2013), 22–31 <doi:10.1080/15567036.2011.619630>

[90] Salmon A.G. and Meehan T. Potential Impact of Environmental Exposures to Polycyclic Organic Material (POM) on Children’s Health, California Office of Environmental Health Hazard Assessment (OEHHA). http://www.oehha.ca.gov/public_info/public/kids/pdf/PAHs%20on%20Children's%20Health.pdf

susceptible to the hazards of PAHs, a class of known human mutagens, carcinogens, and developmental toxicants found in diesel exhaust.[93] Greater lifetime cancer risks result from exposure to carcinogens at a young age. These substances are known to cross the placenta to harm the unborn fetus, contributing to fetal mortality, increased cancer risk and birth defects.[94] Prenatal exposure to PAHs may also be a risk factor for the early development of asthma-related symptoms and can adversely affect children's cognitive development, with implications for diminished school performance.[95] Exposure of children to PAHs at levels measured in polluted areas can also adversely affect IQ.[96]

15. Lead is a well-known toxic heavy metal with diverse and severe health impacts.[97] In particular, lead is associated with neurological, hematological, and immune effects on children, and hematological, cardiovascular and renal effects on adults. Children are particularly sensitive to the effects of lead, including sensory, motor, cognitive and behavioral impacts. Cognitive effects of special concern include decrements in IQ scores and academic achievement, as well as attention deficit problems. Children in poverty and black, non-Hispanic children face higher exposures to lead and are consequently more susceptible to lead's health impacts. Reproductive effects, such as

---

[91] Agency for Toxic Substances and Disease Registry, Public Health Statement for Polycyclic Aromatic Hydrocarbons (PAHs). August 1995. http://www.atsdr.cdc.gov/PHS/PHS.asp?id=120&tid=25

[92] Perera FP. DNA Damage from Polycyclic Aromatic Hydrocarbons Measured by Benzo[a]pyrene-DNA Adducts in Mothers and Newborns from Northern Manhattan, The World Trade Center Area, Poland, and ChinaCancer Epidemiol Biomarkers Prev 2005;14(3):709–14.

[93] Salmon A.G. and Meehan T. "Potential Impact of Environmental Exposures to Polycyclic Organic Material (POM) on Children's Health," California Office of Environmental Health Hazard Assessment (OEHHA). http://www.oehha.ca.gov/public_info/public/kids/pdf/PAHs%20on%20Children's%20Health.pdf
Agency for Toxic Substances and Disease Registry, Public Health Statement for Polycyclic Aromatic Hydrocarbons (PAHs). August 1995. http://www.atsdr.cdc.gov/PHS/PHS.asp?id=120&tid=25.

[94] Perera FP. "DNA Damage from Polycyclic Aromatic Hydrocarbons Measured by Benzo[a]pyrene-DNA Adducts in Mothers and Newborns from Northern Manhattan, The World Trade Center Area, Poland, and China," *Cancer Epidemiology Biomarkers & Prevention* 14, no. 3 (2005):709–14.

[95] Perera FP, Rauh V, Tsai WY, Kinney P, Camann D, et al. "Effects of transplacental exposure to environmental pollutants on birth outcomes in amultiethnic population," *Environmental Health Perspective* 111 (2003): 201–205.
Perera FP et. al. "Effect of Prenatal Exposure to Airborne Polycyclic Aromatic Hydrocarbons on Neurodevelopment in the First 3 Years of Life among Inner-City Children," *Environmental Health Perspective* 114 (2006):1287–1292.

[96] Perera, FP et. al. "Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years," *Pediatrics* 124 (2009):e195–e202.

[97] The lead health impacts are also derived from the final rule on the National Ambient Air Quality Standards for Lead, 73 Fed. Reg. 66964, 66975-76 (Nov. 12, 2008).

decreased sperm count in men and spontaneous abortions in women, have been associated with lead exposure. EPA has classified lead as a probable human carcinogen.

16. Nickel is associated with chronic dermatitis, respiratory impacts and potentially also reproductive impacts.[98] The EPA has classified nickel refinery subsulfide as a Group A, human carcinogen and nickel carbonyl as a Group B2, probable human carcinogen.

D. Accidental Releases

The Benicia Refinery was built 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. While some of Benicia's metallurgy was updated as part of the VIP, metallurgy used throughout much of the Refinery is likely not adequate to handle the unique chemical composition of tar sands crudes without significant upgrades. There is no assurance that required metallurgical upgrades would occur as they are very expensive and not required by any regulatory framework. Experience with changes in crude slate at the nearby Chevron Refinery in Richmond suggests that failure to perform required metallurgical upgrades can lead to catastrophic accidents.[99] The IS/MND is silent on corrosion issues and metallurgical conditions of the Refinery.

Both DilBit and SynBit crudes have high Total Acid Numbers (TAN), which indicates high organic acid content, typically naphthenic acids. These acids are known to cause corrosion at high temperatures, such as occur in many refining units, e.g., in the feed to cokers. Crude oils with a TAN number greater than 0.5 mg KOH/g[100] are generally considered to be potentially corrosive and indicative of a level of concern. A TAN number greater than 1.0 mg KOH/g is considered to be very high. Canadian tar sands crudes are high TAN crudes. The DilBits, for example, range from 0.98 to 2.42 mg KOH/g.[101]

Sulfidation corrosion from elevated concentrations of sulfur compounds in some of the heavier distillation cuts is also a major concern, especially in the vacuum distillation column, coker, and hydrotreater units. The specific suite of sulfur compounds may lead to increased corrosion. The IS/MND did not disclose either the specific suite of sulfur compounds or the TAN for the proposed crude imports.

---

[98] Agency for toxic substances and Disease Registry, Public Health Statements, http://www.atsdr.cdc.gov/

[99] 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/.

[100] 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.

[101] www.crudemonitor.ca.

A crude slate change could result in corrosion from the particular suite of sulfur compounds or naphthenic acid content, which can lead to significant accidental releases, even if the crude slate is within the current design slate basis, due to compositional differences. This recently occurred at the nearby Chevron Richmond Refinery, which 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. The IS/MND and VIP FEIR assume, however, that crude slate changes within the refinery design range of sulfur and API will not be a problem. In fact, although the sulfur composition at Chevron Richmond remained within the design range, they did change significantly over time.[102] This change increased corrosion rates in the 4-sidecut line, which led to a catastrophic pipe failure in the #4 Crude Unit on August 6, 2012. This release sent 15,000 people from the surrounding area for medical treatment due to the release and created huge black clouds of pollution billowing across the Bay. It also put workers at the unit in grave danger, with several escaping the gas cloud and inferno narrowly.

These types of accidents can be reasonably expected to result from incorporating tar sands crudes into the Benicia slate, even if the range of sulfur and gravity of the crudes remains the same, unless significant upgrades in metallurgy occur, as these crudes have a significant concentration of sulfur in the heavy components of the crude coupled with high TAN and high solids, which aggravate corrosion. The gas oil and vacuum resid piping, for example, may not be able to withstand naphthenic acid or sulfidation corrosion from tar sands crudes, leading to catastrophic releases.[103] Catastrophic releases of air pollution from these types of accidents were not considered in the IS/MND.

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 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.[104] These potential emissions must be evaluated and mitigated.

E. Unmitigated Impacts of Locomotive Emissions

The location of air emissions matters a great deal with respect to exposure levels and resulting health impacts to workers and residents. Yet the IS/MND fails to evaluate the likely pollutant exposure levels from locomotive activity of the proposed project compared to the marine shipping activity that would be replaced. In fact, the IS/MND states that the resulting emissions from rail activity will be lower than shipping. It is not clear whether that comparison accounted for all of the environmental regulations that shippers must now comply with

---

[102] US Chemical Safety and Hazard Investigation Board, 2013, p.34 ("While Chevron stayed under its established crude unit design basis for total wt. % sulfur of 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.").
[103] See, for example, Turini and others, 2011.
[104] 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.

including much cleaner, lower sulfur marine fuels. Regardless, the slightly lower locomotive emissions reported are misleading because those emissions are occurring much closer to residential populations and thus may result in significantly higher exposure to toxic diesel exhaust.

The diesel engines in locomotives emit fine particulate matter (particles that are 2.5 microns or less in diameter or "PM2.5"), NOx, and VOCs along with many other toxic chemicals.[105] The soot in diesel exhaust—diesel PM—is especially toxic, not only due to the very small size of the soot particles, but also because these particles contain roughly 40 different toxic air contaminants, 15 of which are recognized carcinogens.[106] In fact, diesel PM itself has been identified as a carcinogen by the World Health Organization as well as the State of California,[107] which lists it as a "Toxic Air Contaminant." Dozens of studies have shown a high risk of lung cancer in occupations with high diesel exposures, including rail workers, truck drivers, and miners. Recent studies of miners indicate that the most heavily exposed workers have a risk of lung cancer approaching that of heavy smokers; studies also show that elevated risks of lung cancer apply not only to workers but to the general population in areas with high levels of diesel PM (*e.g.*, near freeways and busy freight corridors).[108]

Moreover, diesel pollution is estimated to contribute to roughly 60,000 or more premature deaths attributable to outdoor air pollution in the U.S.[109] People who live or go to school near

---

[105] NRDC, Clean Cargo: A Guide to Reducing Diesel Air Pollution from the Freight Industry in Your Community, January 2013.

[106] Diesel exhaust contains the following toxic constituents: acetaldehyde, acrolein, aniline, antimony compounds, arsenic, benzene, beryllium compounds, biphenyl, bis[2-ethylhexyl]phthalate, 1,3-butadiene, cadmium, chlorine, chlorobenzene, chromium compounds, cobalt compounds, cresol isomers, cyanide compounds, dioxins and dibenzofurans, dibutylphthalate, ethyl benzene, formaldehyde, hexane, inorganic lead, manganese compounds, mercury compounds, methanol, methyl ethyl ketone, naphthalene, nickel, 4-nitrobiphenyl, phenol, phosphorus, POM including PAHs and their derivatives, propionaldehyde, selenium compounds, styrene, toluene, xylenes.
www.oehha.ca.gov/public_info/facts/dieselfacts.html;
www.oehha.ca.gov/air/toxic_contaminants/html/Diesel%20Exhaust.htm.

[107] www.oehha.ca.gov/prop65/prop65_list/files/P65single021712.pdf;
http://press.iarc.fr/pr213_E.pdf.

[108] Silverman, D.T., et al. "The Diesel Exhaust in Miners Study: A Nested Case-Control Study of Lung Cancer and Diesel Exhaust," Journal of the National Cancer Institute, Vol. 104, No. 11, June 6, 2012,
www.oxfordjournals.org/our_journals/jnci/press_releases/silvermandjs034.pdf.

[109] According to U.S. EPA, the following regulations avoid 52,000 annual premature deaths by 2030: 2001 highway Diesel (8,300); 2004 Nonroad Diesel (12,000), 2008 Locomotive/Marine (1,100), 2010 Emission Control Area (IMO ECA)/marine fuel (31,000). Assuming a 90% diesel PM reduction from each rule (though some of the rules yield 95% reductions), this means that diesel PM emissions led to roughly 58,200 premature deaths before the rules were in place. This is likely a significant under-estimate since several diesel PM sources are not accounted for here, such as light duty diesel trucks and stationary diesel engines.

rail yards face disproportionately higher exposure to diesel exhaust and associated health impacts, including increased risks of asthma and other respiratory effects, cancer, adverse birth outcomes, adverse impacts to the brain (including potentially higher risk of autism),[110] heart disease, and premature death.[111]

---

[110] Autism spectrum disorders (ASDs) - a group of developmental disabilities that can cause significant social, communication and behavioral challenges - have increased 78 percent since 2002 to impact 1 in 88 children, according to the Centers for Disease Control and Prevention (CDC), *see* http://www.cdc.gov/Features/CountingAutism/. While experts are still working to better understand the risk factor, they agree that risk factors are not only genetic but environmental. Several recent studies in California have shown how air pollution contributes to autism, finding elevated risks in areas of elevated air pollution and in close proximity to freeways.

[111] Kim, J., et al. "Traffic-Related Air Pollution and Respiratory Health: East Bay Children's Respiratory Health Study," *American Journal of Respiratory and Critical Care Medicine* 2004;170:520-526.

McConnell, R., et al. "Childhood Incident Asthma and Traffic-Related Air Pollution at Home and School," *Environmental Health Perspectives* 2010; 118(7):1021-1026.

Van Vliet, P., M. Knape, et al. "Motor Vehicle Exhaust and Chronic Respiratory Symptoms in Children Living Near Freeways," *Environmental Research* 1997; 74(2):122-32.

Appatova, A.S., et al. "Proximal Exposure of Public Schools and Students to Major Roadways: A Nationwide U.S. Survey," *Journal of Environmental Planning and Management* 2008; 51(5):631-646.

Nicolai, T., D. Carr, S.K. Weiland, H. Duhme, O. Von Ehrenstein, C. Wagner, and E. von Mutius. "Urban Traffic and Pollutant Exposure Related to Respiratory Outcomes and Atopy in a Large Sample of Children," *European Respiratory Journal* 2003;21:956–963.

Brunekreef, B.; N.A. Janssen, J. de Hartog, H. Harssema, M. Knape, and P. van Vliet. "Air Pollution From Truck Traffic and Lung Function in Children Living Near Motorways," *Epidemiology* 1997; 8(3):298-303.

Duhme, H., S.K. Weiland, et al. "The Association Between Self-Reported Symptoms of Asthma and Allergic Rhinitis and Self-reported Traffic Density on Street of Residence in Adolescents," *Epidemiology* 1996; 7(6):578-582.

Edwards, J., S. Walters, et al. "Hospital Admissions for Asthma in Preschool Children: Relationship to Major Roads in Birmingham, United Kingdom," *Archives of Environmental Health* 1994; 49(4):223-227.

Gauderman W.J., et al. "Childhood Asthma and Exposure to Traffic and Nitrogen Dioxide," *Epidemiology* 2005; 16:737-743.

McConnell, R., Berhane K, Yao L, Jerrett M, Lurmann F, Gilliland F, et al. 2006. Traffic, susceptibility, and childhood. *Environ Health Perspect* 2006; 114(5):766-772.

Gauderman WJ et al. Effect of exposure to traffic on lung development from 10 to 18 years of age: a cohort study. *Lancet* 2007; 369(19561): 571-7.

Wilhelm et al.. Environmental Public Health Tracking of Childhood Asthma Using California Health Interview Survey, Traffic, and Outdoor Air Pollution Data. *Environmental Health Perspectives* 2008;116(8):1254-1260.

Meng et al.. Are Frequent Asthma Symptoms Among Low-Income Individuals Related to Heavy Traffic Near Homes, Vulnerabilities, or Both? AEP 2008; 18(5):343-350.

Detailed health assessments of some major California rail yards found extremely high cancer risk from the operations, with elevated cancer risk extending as far as eight miles away.[112] Locomotives may produce about half of all harmful diesel particulate matter emissions in rail yards.[113] Locomotive engines are not only highly polluting, they are incredibly long-lasting, which means many older, high-polluting locomotives are still in operation throughout the U.S.[114] Emissions standards for locomotives lag behind the standards for trucks and even off-road equipment. New Tier 4 standards, comparable to those for modern trucks, will not start

---

Venn et al. Living Near A Main Road and the Risk of Wheezing Illness in Children. *American Journal of Respiratory and Critical Care Medicine* 2001; 164:2177-2180.
Lin, Munsie, Hwang, Fitzgerald, and Cayo.. Childhood Asthma Hospitalization and Residential Exposure to State Route Traffic. *Environmental Research, Section A* 2002; 88:73-81.
English P., Neutra R., Scalf R. Sullivan M. Waller L. Zhu L. Examining Associations Between Childhood Asthma and Traffic Flow Using a Geographic Information System. *Environmental Health Perspectives* 1999; 107(9):761-767.
van Vliet et al.. Motor exhaust and chronic respiratory symptoms in children living near freeways. *Environmental Research* 1997; 74:12-132.
Pearson et al.. Distance-weighted traffic density in proximity to a home is a risk factor for leukemia and other childhood cancers. *Journal of Air and Waste Management Association* 2000; 50:175-180.
Raaschou-Nielsen, O., Hertel, O., Thomsen, B.L., & Olsen, J.H. Air Pollution from traffic at the residence of children with cancer. *Am J Epidemiol* 2001; 153:433-443.
Knox and Gilman. Hazard proximities of childhood cancers in Great Britain from 1953-1980. *Journal of Epidemiology and Community Health* 1997; 51:151-159.
Hoek, Brunekreef, Goldbohn, Fischer, van den Brandt. Association between mortality and indicators of traffic-related air pollution in the Netherlands: a cohort study. *Lancet* 2002; 360(9341):1203-9.
Finkelstein et.al. Traffic Air Pollution and Mortality Rate Advancement Periods. *Am J Epidemiol* 2004; 160:173-177.
Gan, W. Q. Changes in Residential Proximity to Road Traffic and the Risk of Death from Coronary Heart Disease. *Epidemiology* 2010; 21(5):642-649.
Heather E. Volk, PhD, MPH; Fred Lurmann; Bryan Penfold; Irva Hertz-Picciotto, PhD; Rob McConnell, MD. Traffic-Related Air Pollution, Particulate Matter, and Autism. *JAMA Psychiatry*. 2013;70(1):71-77. doi:10.1001/jamapsychiatry.2013.266.

[112] California Air Resources Board, Railyard Health Risk Assessments and Mitigation Measures, www.arb.ca.gov/railyard/hra/hra.htm. Cancer risks exceed 1,000 per million next to some of the largest railyards.

[113] "Supplement to the June 2010 Staff Report on Proposed Actions to Further Reduce Diesel Particulate Matter at High-Priority California Railyards." California Air Resources Board, July 5, 2011. Available at: http://www.arb.ca.gov/railyard/commitments/suppcomceqa070511.pdf, page 2.

[114] EPA, Fact Sheet: EPA Finalizes More Stringent Emissions Standards for Locomotive Engines and Marine Compression-Ignition Engines (PDF) (5 pp, 134K, EPA420-F-08-004, March 2008); available at:
http://www.epa.gov/otaq/regs/nonroad/420f08004.pdf

to be phased in until 2015; these Tier 4 locomotives will emit 80 percent less NOx and 90 percent less PM than a train engine built in 2008.[115] Where Tier 4 locomotives are not yet available, diesel particulate filters (DPFs) and selective catalytic reduction (SCR, a common catalyst based technology used to reduce NOx emissions) can be installed on existing locomotives to achieve emissions reductions similar to those of certified Tier 4s.[116]

Also, very high concentrations of NO_2 are present in the exhaust emissions from diesel train engines that would be used at the newly proposed rail terminal.[117] These NO_2 emissions are routinely high enough to exceed the new 1-hour NO_2 standard. While annual NO_2 emissions may be offset by reducing ship imports, the ambient impacts would occur at different locations and times, exceeding the new 1-hour NO_2 standard. This was not considered in the IS/MND and is a significant impact that requires that an EIR be prepared. These emissions can and must be mitigated, for example by using an electronic positioning system,[118] rather than the locomotive engine, to move the cars through the unloading facility.

In addition to electronic positioning systems, mitigations for line haul locomotives should also be included. We recommend tier 4 compliant locomotives or locomotives retrofitted with exhaust controls that can meet tier 4 standards; and a commitment not to idle locomotive engines in the unloading facility, including the use of locomotive idle controls.

II. Public Safety and Noise Impacts

With residential areas just 3,000 feet away from this project (IS/MND at I-2), noise from this project is certain to be a major nuisance. It appears from the project description (IS/MND at I-11 and elsewhere) that the rail activity of four 50-car trains per day would occur predominantly at night. Operations would occur constantly, "24 hours per day/7 days per week/365 days per year." (IS/MND at I-11) Each train crossing Park Road would block that intersection for more than eight minutes for a total of more than half an hour per day of that intersection being blocked (IS/MND at I-11).

While the travel delays caused by lengthy rail crossings may pose a safety concern and a nuisance to the community, our primary concern over health impacts related to the additional rail traffic is in regard to noise. The analysis erroneously dismisses noise from the additional train traffic as "not result[ing] in substantial permanent increases in ambient noise levels," and

---

115 U.S. Environmental Protection Agency. "EPA Finalizes More Stringent Emissions Standards for Locomotives and Marine Compression-Ignition Engines." Regulatory Announcement EPA420-F-08-004, March 2008. Available at: http://www.epa.gov/otaq/regs/nonroad/420f08004.htm.

116 West Coast Collaborative, Locomotive and Rail Sector meeting materials, 2012, http://westcoastcollaborative.org/wkgrp-loco.htm.

117 See attached expert report from Dr. Phyllis Fox.

118 See, for example, Oregon Department of Environmental Quality, Standard Air Contaminant Discharge Permit, Coyote Island Terminal, LLC, July 24, 20120, p. 3, Condition 1.1.a (an electric powered positioning system for maneuvering railcars through the Railcar Unloading Building).

the project "noise would be similar to noise levels generated by existing refinery operations." (IS/MND at II-53 and II-54) The analysis fails to consider the horns and noise of the four additional trains going through at-grade crossings, particularly at night when most of the activity is expected. Grade separations at major rail crossings should be considered as mitigation.

The IS/MND also fails to adequately address residents' existing noise concerns or to discuss the adverse effects that noise has on people. The IS/MND provides no attempt to gauge existing levels of communication interference, sleep interference or physiological responses and annoyance, nor does it attempt to predict future levels associated with the Project.

The IS/MND also dismisses impacts related to construction noise, on the basis that the nearest residence is 2,700 feet away and thus the project is in compliance with local performance standards (IS/MND at II-53). However, compliance with a certain standard does not necessarily mean noise impacts are insignificant.[119] This is especially true in an area that is already adversely impacted by high noise levels. The IS/MND (at II-52) concedes that worst case noise impacts could be 58 dBA at the nearest residence. In fact, noise from locomotive horns may be much higher and it is not clear that this was considered in the IS/MND. The Federal Rail Administration estimates that railroad horns are in the 95-115 dBA range from 100 feet away and that "the noise resulting from the sounding of train horns has a similar impact to that of low flying aircraft and emergency vehicle sirens."[120]

In any case, noise levels from this project are likely to be above the level that the U.S. Environmental Protection Agency ("EPA") states is significant. EPA holds that a noise impact is significant if it exceeds 55 DNL, identified as the requisite level with an adequate margin of safety for areas with outdoor uses, including residential and recreational uses.[121] However, the IS/MND offers no mitigation for these impacts. Mitigating noise impacts is important not only to address the nuisance aspect of it but also because research on noise from transportation shows significant health impacts.

A. **Communication Interference**

A primary concern in environmental noise problems is communication interference including speech interference and interference with activities such as watching television. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech. There are specific methods of describing speech interference as a function of distance between speaker and listener and voice level.

---

[119] *See Oro Fino Gold Mining Corporation v. County of El Dorado*, 225 Cal. App. 872, 881-82 (1990).
[120] Federal Rail Administration, Horn Noise FAQ, available at: http://www.fra.dot.gov/Page/P0599
[121] *See* EPA, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety" 21 (March, 1974), http://www.nonoise.org/library/levels74/levels74.htm.

B. **Sleep Interference**

Sleep interference is a major noise concern in noise assessment and is most critical during nighttime hours. Noise can make it difficult to fall asleep, create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter stages and cause awakening. Noise may also cause awakening which a person may or may not be able to recall. Extensive research has been conducted on the effect of noise on sleep disturbance. Recommended values for desired sound levels in residential bedrooms range from 25 to 45 dBA, with 35 to 40 dBA being the norm.

The National Association of Noise Control Officials has published data on the probability of sleep disturbance with various single event noise levels. Based on experimental sleep data as related to noise exposure, a 75 dBA interior noise level event will cause noise induced awakening in 30 percent of the cases.

C. **Physiological Responses**

These are measurable effects of noise on people such as changes in pulse rate and blood pressure. Generally, physiological responses are a reaction to a loud short term noise such as a rifle shot or a loud jet overflight, or in this case the horn of a train. Noise above 60 decibels ("db") has been shown to have distinct psychological impacts, such as worsening children's mental health, concentration, and classroom behavior in children at school.[122] Other studies show that chronic noise exposure contributes to a worsening of heart disease and higher rates of stroke, after accounting for the risks association with air pollution.[123]

---

[122] Matsuoka, M., Hricko, Al, Gottlieb, R., and De Lara, J., Global Trade Impacts: Addressing the Health, Social and Environmental Consequences of Moving International Freight through Our Communities, Occidental College and University of Southern California (Los Angeles, 2011) (hereinafter "Global Trade Impacts"), citing World Health Organization, Guidelines for Community Noise, Chapter 3, Adverse Health Effects of Noise (1999), available at: http://www.who.int/docstore/peh/noise/Comnoise3.htm; van Kempen, E.E., van Kamp, I., Stellato, R.K., et al., "Children's Annoyance Reactions to Aircraft and Road Traffic Noise," J. Accoust. Soc. Am. (2009) 125(2): 895-904; U.S. Department of Transportation, Federal Railroad. Administration, The General Health Effects of Transportation Noise (2002), Document # DTS-34-RR297-LR2 FRS/RDV-03/01; Lercher, P., "Ambient Neighborhood Noise and Children's Mental Health," Occup. Environ. Med. (2002) 59(6): 380-6; Evans, G.W., "Child Development and the Physical Environment," Annual Review of Psychology (2006) 57: 423-51.

[123] Global Trade Impacts, 18, citing Babisch, W., "Transportation Noise and Cardiovascular Risk: Updated Review and Synthesis of Epidemiological Studies Indicate that the Evidence Has Increased," Noise & Health (Jan. 2006), Vol. 8, Iss. 30, 1-29; Sorensen, M., Hvidberg, M., Andersen, Z. J., et al., "Road Traffic Noise and Stroke: A Prospective Cohort Study," Eur. Heart J. (Jan. 25, 2011).

Annoyance is a very individual characteristic which can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability. The level of annoyance depends on the characteristics of the noise, defined as the loudness, frequency, time and duration of the noise, and how much speech and/or sleep interference results from the noise. The level of annoyance is also a function of the attitude of the receiver. Personal sensitivity to noise varies widely. It has been estimated that 2 to 10 percent of the population is highly susceptible to annoyance from noise not of their own making, while approximately 20 percent is unaffected by noise.

III. General Hazards and Ecological Risks

The IS/MND completely fails to consider or mitigate the potential for rail car accidents or spills. While the IS/MND concedes that crude oil is a hazardous material (IS/MND at II-37), it erroneously concludes that the "quantities of crude delivered by rail and marine vessel offset each other, it is, at a minimum, expected that the relative risks offset each other and that rail transport would present no new significant hazard above the current Refinery baseline risk for marine transport of crude oil to the Refinery." In fact, there is a history of major spills of hazardous materials along California rail routes.[124]

Due to the nature of the very dense and toxic diluted bitumen that the rail cars are likely to carry, as discussed above, these fuels in particular pose an especially serious environmental and public health threat when accidentally released into the environment. EPA recently noted that spills of diluted bitumen require different response action or equipment than for conventional oil spills.[125] Dilbit spills are simply more difficult and more expensive to clean up.[126] In fact, three years after a major spill of dilbit into the Kalamazoo River in Michigan, the heavy oil remains at the bottom of the river requiring dredging and $1 billion clean-up cost.[127] The IS/MND fails entirely to consider the possibility of a dilbit spill into the fragile San Francisco Bay Delta, and what the wildlife, ecosystem, economic and human health implications would be.

It is important to note that human health impacts of bituminous oil spills can be quite serious. We are only beginning to understand the full potential of impacts but spills like the one in Marshall, Michigan give a cautionary sense of how severe impacts can be. There public health officials found numerous acute health impacts lasting for days and spanning numerous areas: Cardiovascular, dermal, gastrointestinal, neurological, ocular, renal, respiratory and other

[124] For example, there was a very major spill into Upper Sacramento River in 1991. See: http://www.dfg.ca.gov/ospr/NRDA/Cantara.aspx
[125] EPA, Comment letter to US Department of State regarding the Supplemental Draft Environmental Impact Statement from TransCanada's proposed Keystone XL project, 2013.
[126] Environmental Working Group, Poisons in the Pipeline, Tests Find Toxic Stew in Oil Spill, June 2013, page 6.
[127] EPA, 2013

impacts.[128, 129]

IV. Conclusion

The Crude by Rail Project has significant unmitigated effects on the environment. These effects must be analyzed in an Environmental Impact Report and fully mitigated before this Project may lawfully be approved.

Sincerely,

Diane Bailey, Senior Scientist
dbailey@nrdc.org
415-875-6127

Elizabeth Forsyth
Attorney
eforsyth@nrdc.org
415-875-6162

[128] Michigan Department of Community Health, *Acute Health Impacts of the Enbridge Oil Spill*, November 2010. http://www.michigan.gov/documents/mdch/enbridge_oil_spill_epi_report_with_cover_11_22_10_339101_7.pdf [accessed 19 June 2013]

[129] U.S Department of Health and Human Services and ATSDR, *Kalamazoo River/Enbridge Spill: Evaluation of Crude Oil Release to Talmadge Creek and Kalamazoo River on Residential Drinking Water Wells in Nearby Communities*, 27 February 2013, p. 90. http://www.michigan.gov/documents/mdch/enbridge_oil_spill_epi_report_with_cover_11_22_10_339101_7.pdf [accessed 20 June 2013]