June 5, 2008

Lamont Thompson, Senior Planner
Planning and Building Regulations Department
City of Richmond
1401 Marina Way South
Richmond, CA 94804

Planning Commissioners
City of Richmond
1401 Marina Way South
Richmond, CA 94804

Re: **Chevron Renewal Project, SCH #2005072117, City #1101974**
Agenda Report, Consolidated EIR and Staff-recommended EIR and Conditional Use conditions and findings related to oil quality cap;
Expert Report of Greg Karras

Dear Commissioners and Mr. Thompson:

This Project would expand the Richmond Refinery's capacity for heavier oil processing, sulfur recovery, hydrocracking and hydrotreating, catalytic cracking and reforming, and the hydrogen and power production to feed this expanded oil processing. Chevron proposes no increase in total Refinery oil inputs or products, and Refinery crude input *volume* is already capped. The Refinery's only other use for the expanded capacity would be to make the same amount of motor fuels from heavier, harder-to-refine, more contaminated crude and gas oils. Independent expert reviews for CBE, the State Attorney General and others have confirmed that the Project would increase Refinery capacity to process heavier and more contaminated oils and that doing so would increase various types of pollutant releases.

Different grades of petroleum can have drastically different contaminant levels and refining characteristics. Although the types and amounts of pollutant releases will vary with the quality of oils refined, the Project's oil quality switch could result in very large (order of magnitude) increases in pollution over its predicted 30-50 year operating life.

Chevron did not disclose this expansion of capacity for "dirty oil refining" or analyze its environmental consequences, the Environmental Impact Report (EIR) does not do so, and Chevron's statements before the Commission continue to deny that it has any such plan. However, on pages 25-26 of its 10-K Report to the Securities and Exchange Commission for the fiscal year ending December 31, 2007 Chevron states: "Design and engineering for a project to increase the flexibility to process lower API-gravity crude oils at the company's Richmond, California, refinery continued in 2007." Chevron also admits that

the oils refined at Richmond could include "gas oils" derived from tar sands, in its responses to requests for power plant Project component information.[1] The price discounts on heavier and/or more contaminated oils are substantial. If the proposed capacity for such oils is built it will almost certainly be used, and pollutant releases from the Refinery would increase.

It is thus logical to ask that Chevron accept limits on how much its oil input quality could change with the new Project. The Commission has begun to ask this question. On April 10, 2008 the Commission voted to consider a permit condition addressing such a cap on the quality of oils to be refined. This "oil quality cap" is addressed herein.

For the record, I am a senior scientist with CBE and have more than 20 years of experience and expertise in pollution prevention engineering and investigation involving petroleum refineries, including the Richmond plant. I described my qualifications in a July 2007 declaration in this matter to which my CV and publications list were attached. I have reviewed this Project in detail and submitted several previous technical comments on it. In late 2007 I was asked to provide technical advice to the Attorney General's Office on the appropriate form of a permit condition to cap the quality of oil processed by the Refinery. I have collaborated in this analysis with other independent scientists, CBE staff and members living in the community, other community-based groups and staff, and have discussed it with staff of several government agencies, City of Richmond staff, consultants, elected officials and all but one of the Planning Commissioners. I met twice with the City's new consultant, Dr. Sahu, once in person and once by teleconference.

In addition to the two Chevron documents discussed above, after the April 10, 2008 meeting, I have reviewed the following significant data and information that is relevant to the oil quality cap but was not available to CBE before that hearing. I reviewed and analyzed the data regarding Refinery-specific crude oil input quality that was provided by CBE on May 15 and 29, 2008 after Chevron declined City staff's request to provide these data. I reviewed the documents listed in the table appended hereto as Attachment 6-A, which were provided to me in person by Lamont Thompson at approximately 4:45 p.m. Friday, May 30, 2008 and which I understand to be the complete package of materials available from staff for review before the June 5, 2008 hearing on this matter. I reviewed the expert report on this Project by Wilma Subra that was submitted by the Asian Pacific Environmental Network on June 2, 2008; the expert report submitted by Julia May for CBE on June 3, 2008; and the document entitled "Response to CBE Part 2 Comments to Richmond Planning Commission (3/20/2008) on Chevron's FEIR" that is dated June 3, 2008 and was received by CBE on that date.[2]

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[1] See Chevron's March 5, 2008 "Responses to the CBE Comments on the Renewal Project DEIR dated November 15, 2007" at pp. 28-29. This document was first provided to CBE on May 29, 2008 in response to a request made by Adrienne Bloch of CBE pursuant to the California Public Records Act on May 2, 2008.

[2] I will be available at the hearing to answer any questions the Commission may have about Chevron's assertions in this late response to CBE's March 20, 2008 comments.

I have been asked to address two questions in this report:

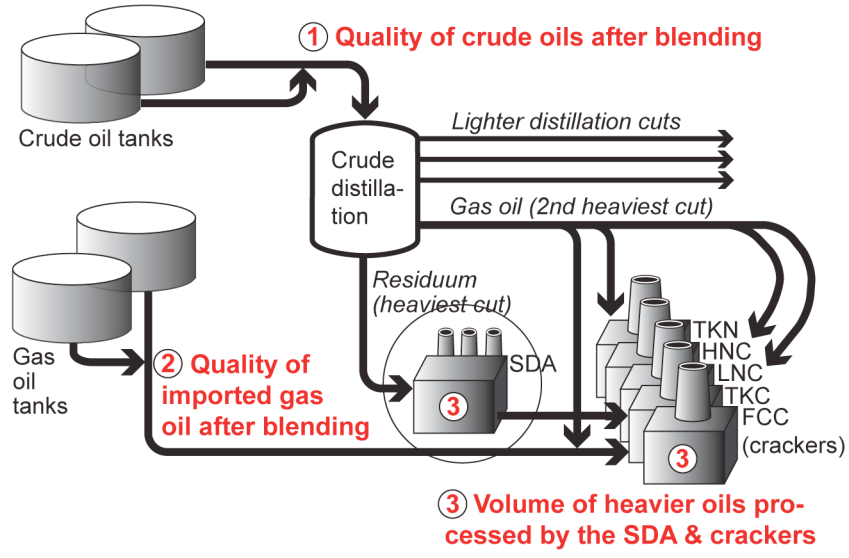
1. Will the alternative cap proposed by City staff be effective in preventing the various types of pollution that could result from using the heavier, more contaminated oils enabled by the Project?

   Short answer: No. Staff's proposal adopts one needed part of the cap only. It would limit pollution caused by increased processing of heavier components of crude oil in the Solvent De-asphalter (SDA) and cracking processes, but it would allow pollution by allowing more contaminated oils into any and all Refinery processes and by allowing more and heavier gas oil into Refinery cracking processes.

CBE's proposed cap limits the quality of crude oils brought into the Refinery, the quality of gas oils brought into the Refinery, and the volume of heavier/dirtier oil processed by deasphalting and cracking. See the illustration below. In contrast, Staff's proposed cap limits only the volume of residuum processed in the SDA, which is circled in the illustration. Staff's proposal would ***not*** limit the quality of crude and gas oil inputs, or the volume of heavier gas oils processed by the Refinery's five cracking units.

Increased contaminants in the crude and heavier pre-processed oils ("gas oils") that Staff's proposal would allow into the Refinery can release more pollutants from the oils (e.g., selenium, mercury, sulfur), or increase pollution-intensive processing (e.g., sulfur, nickel, vanadium), or increase pollution from process malfunctions (e.g., acid corrosion, mercury, sulfur, vanadium, nickel). The increased pollution could occur from various places throughout the Refinery if the staff proposal is not revised to cap oil input quality, and could occur from cracking more and/or heavier gas oils unless the staff proposal is revised to also cap the volume of oil processed by Refinery cracking units.

Three points where dirty oil refining can be measured and capped



2. Can increased pollution from the processing of more contaminated oil be prevented without capping the levels of pollutants in the oil *inputs* to the Refinery by controlling the pollutant *outputs* at their points of emission or release from the Refinery?

   Short answer: No. Both input and output controls are needed. An oil quality cap is essential to prevent increased pollution from the Project because dirty oil refining could cause very large pollutant releases that overwhelm known control technologies, and could cause types of pollution that cannot be controlled. See CBE's March 20, 2008 comments; and Wilma Subra's June 2, 2008 expert report. Control focused on the points of pollutant release also is needed to ensure that pollution does not increase from refining the same quality oil as now in dirtier ways. See Julia May's expert comments for critically important information about needed emission control measures and analysis.

A big enough change in the quality of fossil energy feedstock entering a pollution source can dominate pollutant outputs from that source by increasing pollutant generation more than available controls that attempt to capture, "treat" and manage pollutants in the output streams can address. We see this principle at work in other major parts of the fossil fuel chain. California utilities are being required to phase out electricity from coal in part because even with the best available control technology, coal-fired power plants emit more pollutants than natural gas-fired power plants. Another example: on-road vehicles use unleaded and low-sulfur fuels by law in part because leaded, high sulfur fuels pollute despite the on-board control technology in vehicles.

Hence, a comparison of the *amounts* by which the Project's feedstock switch could increase pollution with the *amounts* by which pollutant control measures can capture or treat each type of pollution is at the heart of the second question posed above.

Unfortunately, the EIR does not answer this question. The EIR does not identify or analyze the Project's change in capacity for dirty oil refining or estimate the amounts of resultant pollutant releases from using this expanded capacity. The available evidence indicates that for several types of significant pollutant releases, the Project's feedstock switch could increase pollution more than available controls could decrease that pollution once it is generated. See 3/20/08 CBE comments; 6/2/08 Subra report.

Staff's proposed SDA cap does not change the answer to this question because many types of pollution are caused by characteristics of crude and gas oils which staff's proposal would not limit in the oil inputs to the Refinery. Two examples of these characteristics are selenium content, and sulfur content.

It is useful to review specific cases of increased pollution caused by higher-selenium and higher-sulfur oil inputs to Bay Area refineries that the refiners attempted to address through control measures.

Selenium is released from the oils processed by refineries in hydrotreating and cracking processes, and moves through refinery sour gas and sour water systems and through waste water treatment to be discharged into the Bay. Staff's proposed SDA cap would not block this pathway because it would allow high-selenium oil input to the Refinery and to its hydrotreating and cracking processes.

In this regard, the proposed prohibition on crude oil import by pipeline will not prevent high-selenium San Joaquin Valley oils from coming to the Refinery. The Richmond Refinery has no operable oil import pipeline now, but it nevertheless has received oil from Rodeo via ships.[3] Oil pipelines from the San Joaquin Valley serve this same area.[4] Of course, crude from other areas, such as high-selenium Eocene crude from the Arab Gulf, can also be shipped to the Refinery.

The relationship between selenium in crude oil inputs to refineries, selenium discharges, and the best available technologies for capturing selenium from refiners' waste water streams, was studied exhaustively at Bay Area refineries in the 1990s.[5] Briefly, refining high-selenium crude oil caused selenium discharge to the Bay to be as much as 10-30 *times* greater, on a discharge-per-barrel-refined basis, and state-of-the-art treatment that took years to design, develop and implement at plants running the highest-selenium oils did not achieve discharge levels as low as those achieved by running low-selenium oils.

In this example, the feedstock-driven excess in discharge overwhelmed the capability of available treatment technology.[6] Put another way, if low-selenium oil caused a selenium discharge of, say, one pound per day, then high-selenium oil caused a discharge of 30 pounds per day, and even treatment that removed 90% of that selenium from the discharge still resulted in a discharge of 3 pounds per day, which is three times the discharge from refining low-selenium oil in the first place.

Also, in this example, the type of pollution generated from the dirty oil refining was controllable at a small number of specific points where the waste water flows combine in a single pipe, and the discharge was continuous. This made the selenium pollution more amenable to control than if it had been released from many different places, or at times when the pollution could not be predicted or controlled. In contrast to this "best-case" situation for control technology, some pollutants can be emitted or discharged from many different points in refineries in amounts that may change when a different oil input is refined (e.g., mercury), and other pollutants in the oil cause increased pollution that cannot be controlled during process upsets and other emergency situations (e.g., sulfur).

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[3] See Chevron's 3/5/08 Response to CBE's 11/15/08 comments at 24, 25.

[4] An oil pipeline map is shown in Sheridan (2006), a CEC Staff Report cited by the FEIR.

[5] See My July 13, 2007 declaration, CBE's previous comments, and the references cited therein for details of this work.

[6] This does not, of course, mean that pollution controls should not have been applied to reduce the pollution from these existing, already-built refinery configurations, to which the selenium treatment was applied in this example.

Sulfur: Refining high-sulfur oil increases pollution by increasing the amounts of sulfur compounds released, the pollution-intensive processing to remove sulfur from the oil, the incidence of malfunctions from acid corrosion, and the amounts of toxic gases that are created as by-products of sulfur removal in high-temperature, high-pressure processes.

Higher sulfur crude oil inputs to the Refinery would send more sulfur into its hydrocracking and hydrotreating processes in the gas oils produced from Richmond's atmospheric and vacuum distillation columns. Higher sulfur gas oils imported from other refineries would also send more sulfur to Refinery hydrotreating and hydrocracking processes. Staff's proposed SDA cap would not limit the amounts of sulfur going into the Refinery or into these processes.

CBE's March 20, 2008 comments showed that, among other emissions, refining higher sulfur oil could greatly increase both the frequency and magnitude of Refinery flare emissions. Moreover, post-Project controls would not prevent this emissions increase. The specific types of flaring that would result from the feedstock switch which were investigated in CBE's March 20 comments—planned and emergency flaring by the TKC, TKN and FCC units—are allowed by the Bay Area Air Quality Management District's Rule 12-12 and Chevron's Flare Minimization Plan.[7]

In her June 2, 2008 expert report Wilma Subra found that higher-sulfur crude oil inputs resulted in large increases in flare incidence and emissions at U.S. Gulf Coast refineries even after available controls were in place. Subra further found that despite the differences in control requirements between the Gulf Coast and the Bay Area, if the Chevron Richmond Project is built as proposed, even with available controls in place the Project could increase flare emissions substantially.

In fact, based on the information available now, refining higher sulfur crude oil has already begun to increase flaring by the Richmond Refinery.

This information is based on two data sets: First, data for all significant flaring incidents at Bay Area refineries from January 2004 through August 2006 where a known process source of the gases flared, and the hydrogen sulfide (H_2S) concentration of these gases, were reported. See CBE-A, Attachment 10 at Table A-4. The data for 49 incidents, in which a hydrocracker or hydrotreater flared, are relevant to analysis of high-sulfur oil impacts on flaring because these two processes remove sulfur from the oil as H_2S gas. Second, monthly sulfur content data were obtained in May 2008 for crude oil inputs to the Refinery, and to other Bay Area refineries that flared from these processes.[8]

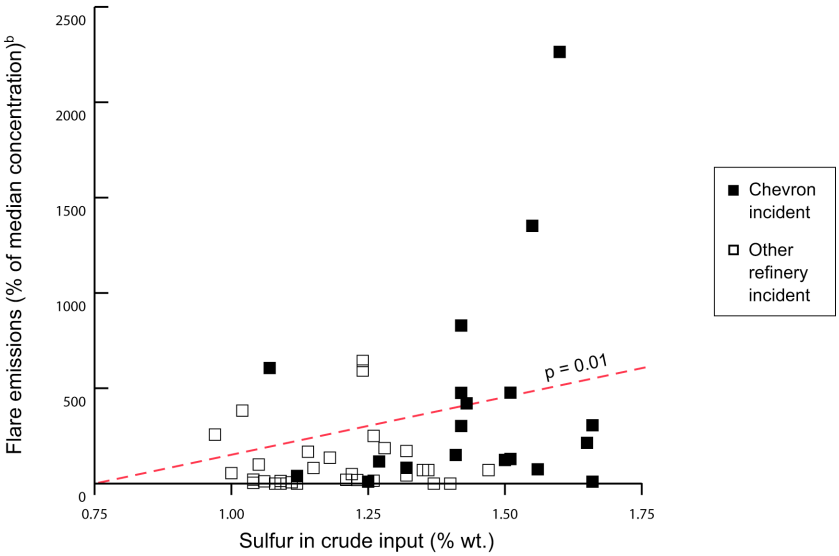
[7] Note that other types of flaring, which were not included in CBE's 3/20/08 emissions projection, could also be caused by the Project but can and should be controlled through measures that are not yet proposed by the Staff Report or EIR. See the expert comments of Julia May.

[8] These were the ConocoPhillips Rodeo, Tesoro Avon and Valero Benicia refineries. As for Chevron, the monthly crude sulfur content data are from US EIA company level imports data and represent foreign crude shipments delivered to and processed by each refinery. These other refineries (other than Chevron Richmond) receive Central Valley crude by pipeline in amounts that appear to dominate the domestic portion of their reported total crude throughputs. For

The chart below shows each of the 49 significant incidents discussed above as a box. Black boxes are Richmond Refinery incidents. White boxes are incidents at other refineries. Boxes are higher on the vertical scale if the H_2S concentration flared is higher. (Each incident concentration is shown as the percentage of the median for the type of process that flared, since hydrocrackers and hydrotreaters are known to flare at different concentrations.) Boxes are farther to right if the refinery that flared was running a higher sulfur mix of crude oils in the 30-day period leading up to the flare incident.

It can be seen that higher sulfur crude oil inputs are related to higher flare emissions and frequency. Increasing flare gas H_2S concentrations are associated with increasing crude sulfur content across all four refineries, and this association appears statistically significant ($p = 0.01$). Further, the frequency of Chevron's flaring increased during the months when relatively higher-sulfur crude was refined at the Richmond Refinery.

Sulfur in crude oil v. sulfur in emissions from 49 hydrocracker or hydrotreater flaring incidents at four Bay Area refineries, January 1, 2004–August 30, 2006.[a]



a. Based on data for all significant flaring incidents with these processes as primary sources reported to the Bay Area Air Quality Management District in this period, and refinery-specific crude input sulfur content for the 30-day period ending the day flaring initiated. Crude input data from EIA company-level import data and domestic input data (Chevron: Alaska North Slope crude, see EIR; other refiners: SJV Heavy crude, see EIR for sulfur content and NPDES total throughput).
b. Percentage of the median H_2S concentration for the type of process that flared (medians are 1.05% H_2S in flared gas for hydrocracking and 0.14% for hydrotreating, for these incidents: see CBE-A Attachment 10). Flaring H_2S causes emissions of sulfur dioxide, H_2S and other compounds.

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purposes of this specific analysis only, the domestic crude input to these other refineries (Rodeo, Avon, Benicia) is assumed as San Joaquin Valley Heavy crude. SJVH is 1.3% sulfur while Alaska North Slope crude (ANS) is 0.9% sulfur. This assumption may overestimate actual sulfur content of crude inputs at the refineries other than Chevron slightly if the domestic portion of their total crude input includes significant amounts of ANS instead of SJVH. Even with this potential overestimate for other refineries, however, the sulfur content of Chevron's slate ranges higher than those of the other refiners in this period. See also 5/15/08, 5/29/08 CBE comments.

Before and during this period, the average sulfur content of the Richmond Refinery's crude input was increasing while its average gravity, total acidity, nickel and vanadium content were decreasing and appeared less variable than was sulfur. See 5/29/08 CBE comment. Since the mechanisms by which sulfur in refined oils causes increased flare emissions and incidence are known, and result in the variability observed, this is evidence that refining higher sulfur oils has already increased pollution from significant flare incidents at Bay Area refineries, including the Richmond Refinery.

The increase in flare emission concentrations across these incidents is very large. On average, flare gas H_2S content increased by roughly five times as monthly sulfur content increased by 50%, from 1.0% to 1.5% in the crude inputs. During this period the highest sulfur crude blends refined were far below the 3% sulfur design reported for Chevron's proposed Project, and the mix of crude oils refined at Richmond stayed below 1.5% sulfur. These observations support the potential for very large increases in flare emissions from the Project, consistent with those Subra reports at Gulf Coast refineries that switched to higher sulfur oils, and those projected in CBE's 3/20/08 comments.

The short-term reduction in Refinery flaring reported recently by Chevron was related to other factors such as the multi-year major maintenance schedules, was anticipated, and is tangential to analysis of potential impacts over the Project's 30-50 year operating life.

Chevron's root-cause analyses of these incidents concluded that they were caused by unforeseen malfunctions or planned maintenance needs and the flaring was necessary to address emergency situations, or to avoid overloading compressors or the fuel gas system, which could cause emergency situations. These situations require bypassing compressors and the fuel gas system.[9] Thus, the gases flared by the hydrocrackers and hydrotreaters in similar future incidents can reasonably be expected to bypass treatment in the fuel gas system. The gases from these hydrocracking and hydrotreating units would also bypass other Refinery process units, including the proposed new Continuous Catalytic Reformer (CCR). Therefore, the proposed upgraded treatment in the fuel gas system, CCR unit design, and upgraded South Yard compressors would not prevent pollution from similar future incidents. Flaring from these causes is allowed by Air District Rule 12-12, and by Chevron's Flare Minimization Plan.

In sum, the higher-sulfur oil inputs that the Project would enable could not be limited by staff's proposal to cap SDA throughput alone and would greatly increase emissions from significant flaring incidents, which would not be prevented by available control measures.

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[9] Chevron's Flare Minimization Plan states on page 39: "In order to recover flare gas for use in the fuel gas system, three criteria must be met. First, there must be sufficient flare gas compressor capacity. Second, there must be sufficient gas treating capacity. Finally, there must be available available storage volume or a user (e.g., fired heater) with a need for the gas. If any of these conditions are not met, then the gas cannot be recovered into the fuel gas header." Large, sudden increases in the volume and/or decreases in the quality of refinery gases that are caused by planned and unplanned hydrocracker and hydrotreater shutdowns overwhelm this system.

Opinion

If staff's proposal to cap SDA throughput is applied without oil input quality limits, even with full application of available control focused on pollutant "outputs" after dirtier oil refining generates this pollution, the Project would be likely to result in greatly increased environmental releases of one or more pollutants. Further, those emissions, discharges and/or other environmental releases would likely result in significant impacts. Finally, the causes, types, and amounts of this potential pollution from the Project as well as the means to lessen or avoid its potential impacts are not disclosed or analyzed by the EIR.

Respectfully submitted June 5, 2008

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