COMMUNITIES FOR A BETTER ENVIRONMENT

July 9, 2008

City Council
City of Richmond
1401 Marina Way South
Richmond, CA 94804

Attention:
City Clerk
Lamont Thompson

Re: **DR/CU/EID/EIR 1101974–Chevron Energy and Hydrogen Renewal Project; Appeal of CBE et al., response to new claims relevant to oil input quality cap: Sahu Report; and new claims regarding flaring**

Dear Council members, City Clerk and Mr. Thompson:

After the Planning Commission closed public comment in its hearing on the proposed Chevron Richmond Refinery expansion Project, CBE received a document entitled "Attachment 1 to Staff Report for June 19, 2008, Rationale for Condition C17, by Dr. Ranajit Sahu (June 16, 2008)" (referenced herein as the "Sahu Report") and additional comments by Chevron. CBE received these documents on June 18, 2008.

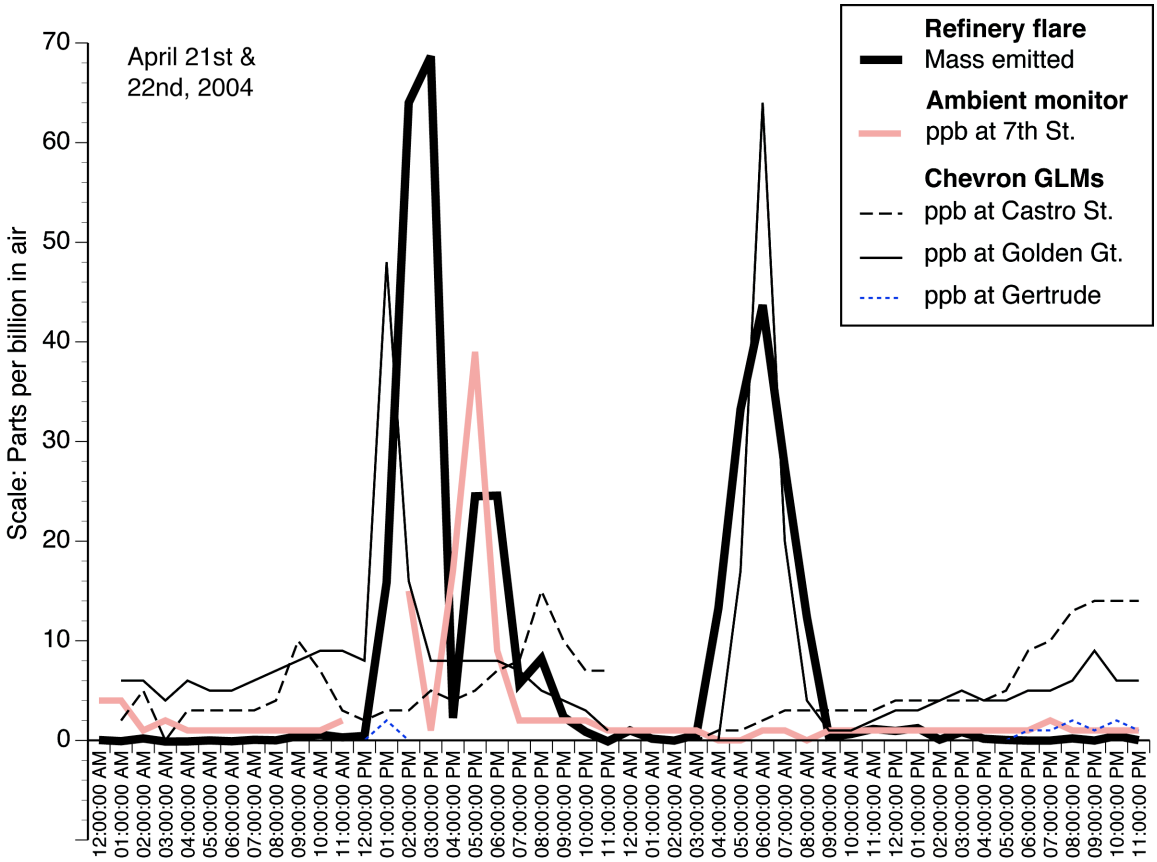
Publicly verified evidence in the record before the City shows that the Project would enable lower quality crude and gas oils to be refined, this could result in significant impacts; the EIR did not analyze those potential impacts, and Chevron's conditions of approval would not prevent those impacts. This letter does not attempt to review all of that evidence. This letter provides a brief technical response to (1) new comments relevant to flaring, and (2) the Sahu Report.

1. Response to new comments relevant to flaring

Chevron asserts that flare impacts should be assessed from long-term average flare emissions instead of incident emissions. Chamberlin 6/5/08 Testimony. Chevron's assertion is incorrect. Flaring is primarily an *acute exposure* problem.

This chart illustrates hourly pollution in nearby air over two days of intermittent flaring. The thick black line shows sulfur dioxide (SO_2) emissions from Chevron's flares. The other lines show SO_2 concentrations in ambient air measured at four monitors. High concentrations appear in the chart as vertical peaks.

Hourly profile of flare sulfur emissions and sulfur dioxide concentration in air at fence line ground-level monitors (GLMs) and ambient (7th St.) monitor: Chevron Richmond Refinery



Data from BAAQMD; Chart adapted from Figure 1 in CBE-A Attachment 12.

Ambient air concentrations peak at one monitor or another during part of all of every peak in flare emissions. Fence line concentrations peak earlier and higher than those measured at the more distant 7th Street monitor. Different monitors peak at different levels and at different times. These observations describe a large, changing emission plume that is more concentrated near the refinery than further away, and shifts in the wind to hit or miss various monitors over the duration of the flaring.

Results from Air District modeling of these two days of flaring are shown on this map. The ambient air monitors discussed above are shown as white dots. Purple lines show the modeled emissions plumes (impact areas, or "isopleths") for the first day of flaring: light blue lines show the plumes for the second day of flaring. District staff found that: "these isopleths show an impact on the nearby community." 3/3/06 AQMD Staff Rpt. The flare impacts predicted from emissions modeling match those measured.

April 21 and 22, 2004 Chevron Flaring Event
Maximum 1-hour SO2 Air Concentration (ppb)

From AQMD Staff Report in CBE 6/30/08 Attmts: Figure 1. Modeled Lower-Volume Flaring Event.

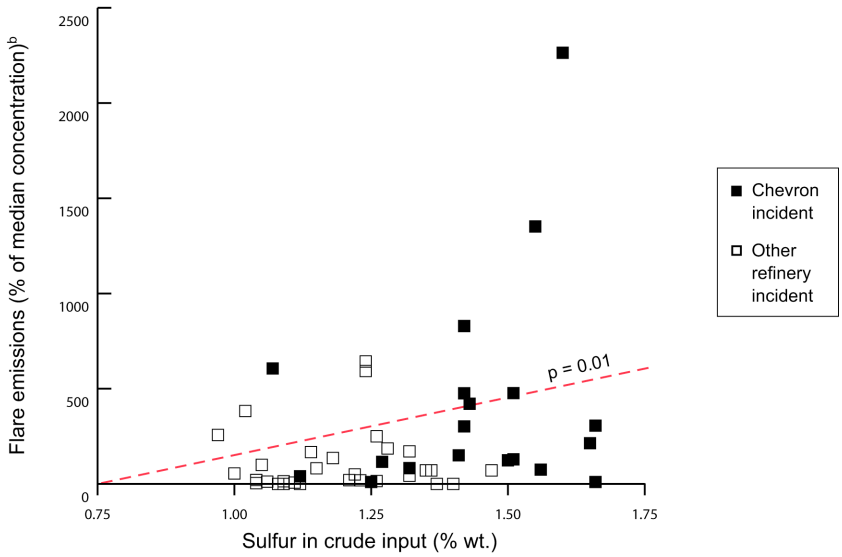
Based on 30 months of continuous air monitoring at these stations, on each of the five days with the highest hourly SO_2 levels at its fence line, Chevron flared. CBE-A Att. 12. On each of the six worst air days at the 7th St. monitor Chevron flared. Id. The same pattern emerged at other refineries with high-SO_2 flaring. Id. Further investigation found that increased SO_2 concentrations in ambient air near the refineries were associated with increased SO_2 emissions from their flares; this association was statistically significant. Id. Most (64%) of the "odor" complaints logged by the Air District against Chevron in a recent three and a half year period were on days when the Refinery flared.[1]

[1] Compare BAAQMD Rule 12-11 data (baaqmd.gov) with CBE Exhibit 6 (DEIR Cmts.).

Based on this evidence the Air District added a 500 lb/day environmental significance threshold for SO_2 emissions to its 500,000 standard cubic feet per day (SCF/d) threshold. 3/3/06 AQMD Staff Report at 7-8; Rule 12-12 §§ 208, 406.

The chart Chevron referenced in questioning the environmental significance of the flare incidents shown is copied below. We presented this chart on June 5, 2008 to illustrate that the intuitively obvious "dirty in-dirty out" effect, where more polluted input oil creates more pollutant release, is documented by specific local data. Second—and this was news to many of us—Chevron's crude switch has *already begun* to increase its flare emissions during the months when the Refinery runs relatively higher-sulfur oil blends. The answer to Chevron's first question is that every incident shown is significant as defined by the Air District criteria for environmental significance discussed above.

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]



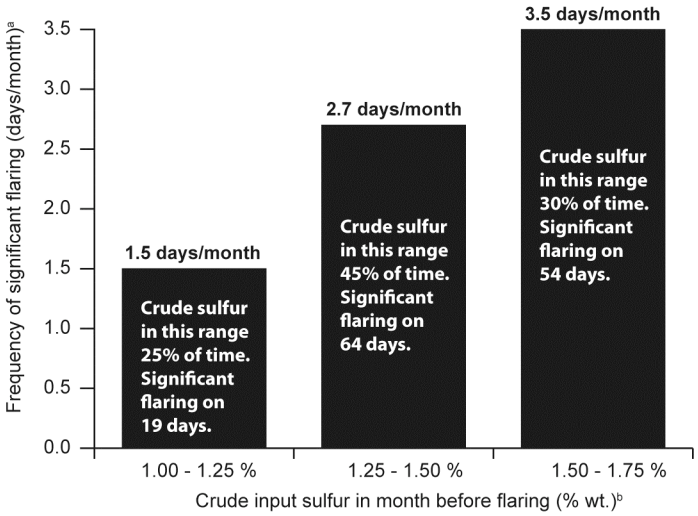
a. Based on data for all significant flaring incidents with these processes as primary sources reported to the Bay Area Air Quality Management District in this period, and refinery-specific crude input sulfur content for the 30-day period ending the day flaring initiated. Crude input data from EIA company-level 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.

Chevron also questioned whether the number of data points (incidents) is sufficient to draw firm conclusions about a significant increase. Chamberlin 6/5/08. For the point of this chart, the data appear to support an increase in flare gas sulfur content with increasing crude input sulfur content that is significant at $p = 0.01$ in regression analysis. For e*nvironmental* significance, we can look also at the number of days of flaring above 500,000 SCF/d and/or 500 lb/d SO_2, and include *all* Refinery sources. (Because it tracks sulfur the chart above looks only at refinery processes that remove sulfur from oil.)

The bar chart below shows the same monthly crude oil inputs as the chart above. It shows data for all environmentally significant flaring at Richmond over a recent period of more than four years. Review of this chart shows a clear change in the frequency of this flaring between months of relatively lower and higher sulfur crude input.

Flaring frequency more than doubled, from 1.5 to 3.5 days/month, as crude sulfur input increased by 0.5% sulfur, from the 1-1.25% range to the 1.5-1.75% range. It also increased step-wise: In the middle crude input range (1.25-1.5%) the frequency was in the middle at 2.7 days/month. These results are based on a total of 137 observations (137 significant flare-days). The smallest of the data subsets compared still included 19 observations and comprised 25% of this 4.3-year period.

Increase in significant flare incidents with higher sulfur crude oil inputs: Richmond Refinery data from January 1, 2004 through April 30, 2008



Flaring frequency increased with increasing crude sulfur content in this 52-month period. Flaring from BAAQMD Rule 12-11 data (baaqmd.gov; 6/30/08 attachments). Richmond crude input sulfur from EIA Company-level monthly reports (6/30/08 attachments) and data submitted by Chevron (esp. EIR crude throughput and ANS domestic source; Chevron 4/3/08 submission).
a. Significant flaring defined by BAAQMD Rule 12-12 (>500 lb. SO2 and/or 500,000 scf per day).
b. Weighted average total crude input sulfur based on 30 days ending the day of flaring or, for flaring related to and following the Crude Unit fire on 1/15/07, ending the day the fire started.

The frequency *and* magnitude of flaring drive its environmental significance. Going back to page 4, the dashed line in the scatter chart representing the central trend (from regression analysis) suggests that on average, significant flaring emission concentrations increased by approximately five times (500%) as crude sulfur input increased by an increment of 0.5% sulfur (from 1-1.5%). Flaring frequency more than doubled as crude sulfur increased by this same 0.5% increment. Thus, environmentally significant flaring occurred more than twice as often and its emissions appear to have been about five times as concentrated when Chevron's crude input blends had 0.5% higher sulfur content.

2. Response to the Sahu Report.

The Sahu Report presents an incomplete analysis.

The Sahu Report is the first and only document on record in which Dr. Sahu addresses the Project. It is barely more than two pages long. It is limited to seven paragraphs of narrative discussing selected portions of CBE's comments and proposed oil quality cap, in which four sentences discussing Dr. Sahu's recommendations for oil quality limits are embedded, and much of the evidence for such limits is not addressed.

The Sahu Report does not include any statement defining its scope, methods, data, assumptions or limitations. No data are presented. No data are referenced with adequate specificity to determine what data Sahu reviewed. No quantitative results are presented. Qualitative conclusions are presented as brief sentences with qualifiers such as "assures" or "adequately addresses" or "properly accounts for" without the explanation needed to interpret the conclusions or determine what Sahu did or did not do to arrive at them. This does not provide the information necessary to support the conclusions Sahu states.

The Sahu Report does not identify or analyze the Project's expansion of capacity for refining heavier and more contaminated oils or the potential impacts of this expansion.

Despite the City's stated intent to prevent increased pollution from the Project, and the EIR's failure to identify and analyze impacts from the Project's capacity for refining heavier and more contaminated oils, the Sahu Report does not address these issues.

The Sahu Report does not identify the design specifications of the process equipment that would be expanded for any feedstock parameter—its capacity for how much more oil, heavier oil, higher-sulfur oil, etc. It does not identify that equipment's current design capacity. It does not, in fact, identify the equipment that would expand capacity at all.

Although it discusses the comprehensive oil quality cap, the Sahu Report does not estimate how much pollution the cap could prevent. It does not estimate how much of the increases in pollutants caused by the oil switch other measures could block from release into the environment if this cap is not imposed. It does not estimate how much *any* pollutant could increase as a result of using the Project's expanded capacity for heavier and more contaminated oil. It does not even analyze potential impacts on Refinery neighbors from acute exposures to emissions from pollution incidents.

The Sahu Report does not estimate how much more often pollution incidents could recur because of the oil switch. Despite the more severe process conditions required for heavier and more contaminated oils, which violate the industrial safety tenet of Inherently Safer Systems, it does not analyze the impacts of this *inherently hazardous* system. It does not analyze the impacts of interactions between oil characteristics on pollution incidents. It does not identify all the characteristics of current or potential feedstock that could cause pollution. The Sahu Report does not even address the pollutants in Chevron's current oil input in a transparent and appropriate manner.

The Sahu Report makes many errors that affect its analysis and conclusions.

The Sahu Report claims that the Refinery crude input already exceeds CBE's proposed limits of 12 parts per million nickel and 30 ppm vanadium.[2] However, Chevron publicly reported all its crude inputs for 2007 on April 3, 2008, and data from assays in the public record show the levels for 98% of its crude input volume in this period.[3] Based on these data the remaining 2%, from the Brazilian crude called Roncador, would have to exceed 265 ppm nickel *and* 595 ppm vanadium for Sahu's claim to be true. None of the many hundreds of oil assays in the record identify any oil this high in both pollutants.

Sahu further suggests Chevron's crude input is already at staff's proposed mercury limit of 27 parts per billion.[4] This claim is even less plausible. Estimates of current annual average mercury inputs in crude oils processed are shown in the table below.

Estimates of mercury in crude oil processed by Chevron, Bay Area & U.S. refineries

Estimate Source	Scope of Estimate	Mercury in Crude Input ppb	kg/year	Sahu Estimate percent of this
Staff C17- limit	**Chevron Richmond**	**27**	**327**	**100%**
CBE cap - limit	**Chevron Richmond**	**8**	**97**	**337%**
CBE - actual	**Chevron Richmond**	**4**	**49**	**667%**
Chevron - actual	**Chevron Richmond**	**5**	**57**	**574%**
WSPA - actual for 5 Bay Area refineries combined		6	218	150%
EPA/API - actual for all U.S. refineries combined		3.5	3,000	11%

Current annual average mercury content and annual mass mercury inputs in crude oils processed. Sources: Staff C17 (6/19/08 Staff Report & Att. 1); CBE (current actual and proposed limit, 5/29/08 cmt); Chevron/TRI (5-yr avg. crude input reported to EPA's TRI per Chevron 4/9/08 cmt); EPA/API (CBE Att. 1-J); 3/20/08 Western States Pet. Assoc. report to RWQCB, submitted by CBE 6/30/08). Concentration/mass estimates related at 243,000 Bbl/d (Chevron; EIR) and 781,000 Bbl/d (5 Bay Area refineries; CEC, RWQCB) at 0.86 specific gravity.

The 27 ppb estimate far exceeds other estimates in the table. It is more than six times (667%) the current level supported by publicly available evidence reported by CBE on May 29, 2008. It is more than five times (574%) the estimate reported to EPA's Toxics Release Inventory, as Chevron reported to the City in its April 9, 2008 response to CBE's proposed oil quality limits. At 27 ppb, about 327 kilograms of mercury would enter the Refinery in crude each year. Total regional refinery inputs are about 218 kg/yr based on recent measurements.[5] Thus, if Sahu's 27 ppb estimate is correct, *Chevron's mercury input exceeds the total reported for all five Bay Area refineries combined.*

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[2] Sahu at I(c); CBE 5/29/08 at 8, 9 and Att. 5-A.
[3] CBE 5/29/08 comments and attachments 1-G, 1-H, 1-I, 1-J, 4-A through 4-L, 5-B and 5-C.
[4] Sahu at I(e); Staff-proposed Condition C17(b)(ii). These conclusions of the Sahu Report for mercury, nickel and vanadium are narrative and reference other documents for quantitative results. It provides no results for levels of other Refinery crude or gas oil input characteristics.
[5] WSPA 3/20/08 crude monitoring report to the RWQCB. See CBE's 6/20/08 attachments.

Sahu's oil estimates need verification. They could be verified easily: the crude oils or blends processed are measured for these pollutants; the volume and mass of Refinery runs are known, and the calculations are straightforward. They should be readily verifiable by everyone: The exact same type of data is publicly reported by Chevron and other oil companies to public agencies and on the Internet. They are not verifiable only because the data Sahu relies upon for conclusions that contradict public evidence have been kept secret.[6] Nondisclosure in this context raises questions of data suppression, and of scientific freedom and responsibility.

The Committee on Scientific Freedom and Responsibility of the American Association for the Advancement of Science, a prestigious group of scientists and others including the late Chief Justice Earl Warren, published a report in the journal *Science* that is appended hereto as Attachment 7-A. Its relevance is clear from the case studies on page 690:

- Two scientists who blew the whistle on lax standards that allowed human exposures to toxic amounts of radioactivity subsequently reported harassment, then left their jobs, but the under protective standards were eventually strengthened.
- Three project engineers who exposed flaws in an inherently hazardous transportation system project were fired, and the system later experienced failures so dangerous that it could not be used.
- Scientists operating under a confidentiality agreement "kept quiet and gave no warning" that toxicity data were suppressed over a period of years while tens of thousands of workers were exposed to toxic levels of vinyl chloride.

The report is clear on the need for access to all relevant information. Att. 7-A at 687. "There have been attempts to suppress important scientific information that appeared unfavorable to the policies of some powerful organizations." Id. Secrecy claims, "as we have good reason to know from recent experience, often serve to cover up governmental ineptitude or corruption." 689. "[W]e know from experience that regulatory agencies often become the subservient allies of the organizations that they are supposed to regulate and may collaborate with the commercial organization in concealing the hazards." 690. Yet free dissemination of information and open discussion are essential to the scientific process, which requires free disclosure of results, general dissemination of findings and "widespread verification and criticism of results and conclusions." 689.

In applied science and technology, secrecy "frequently permits hazards to develop that could be eliminated if information were publicly available … the multiple repercussions of new technology need to be critically evaluated before they are introduced." Id. Because the entrenchment of industrial systems becomes so powerful after they are established, "the need for foresight in technology assessment is overwhelming." 691.

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[6] 7/3/08 letter from Elena K. Saxonhouse to Adrienne Bloch ("Dr. Sahu also reviewed an excel spreadsheet provided by Chevron under a confidentiality agreement [which] contains data on the following parameters for blended cued oil, by month, for a period of roughly the last ten years: API gravity, sulfur, acid number, viscosity, nickel, vanadium, selenium, and mercury.")

Attachment 7-A is also clear, in its discussions of whistle-blowing, that scientists have both rights *and* responsibilities. 688. It notes professional guidelines suggesting that a scientist should protect the public and his/her employer by speaking out, or even by withholding cooperation, "where the adequacy of a process or product is involved … [and plans] do not meet accepted professional standards." 691.

Sahu's conclusions contradict the evidence in the public record, are asserted based on secret data that are the same type of data otherwise available to the public, and are presented as relevant to an important measure to protect public health and the environment. Dr. Sahu's reliance on these secret data is a serious error. The City's failure—thus far—to provide for public review of the data is also a serious error.

Sahu describes evidence inaccurately. His discussion of impacts quotes comments on *current levels* of oil input characteristics, ignoring CBE's comments on the Project's *future impacts* from increased levels of the characteristics.[7] This error is related to his failure to analyze interactions of the characteristics, which the comments Sahu ignores address.[8] In another error, related to his failure to analyze the inherently hazardous conditions caused by such interactions, Sahu's discussion of acidity suggests that CBE assumes Chevron's motives instead of showing evidence for incident risk.[9] The suggestion is false. CBE's analysis, which Sahu ignores, is based among other things on the tenet of Inherently Safer Systems in the Industrial Safety Ordinance, and evidence that the interactions of acids and other oil quality factors could create inherently hazardous conditions.[10] These errors affect the Sahu Report's analysis of oil gravity, total acidity, nickel, vanadium, selenium, mercury, and process throughputs.

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[7] CBE's descriptions of individual oil characteristics that the Sahu Report quotes at I(a) through I(e) are from our 5/29/08 comments on the *current levels of individual characteristics* in Refinery oil inputs, and do not represent *future impacts of interactions* between characteristics and the processing changes. As we informed Dr. Sahu before his report was released, interactions and impacts of these characteristics are addressed in CBE's separate comments on impacts.

[8] See esp. 3/20/08 Part 2 CBE comments, "Refinery Feedstock Switch Impacts," at 2-4 through 2-7, 2-12 through 2-16, Figure 11 and notes 69, 81; 2/20/08 Part 1 at 4-10; CBE-A Att. 16 at 3; and 6/5/08 Exp. Rpt. of G. Karras at 6-8. See also 3/20/08 Part 2 at 2-9 through 2-11, 2-17 through 2-19 and notes 16, 65 and 66; 2/20/08 Part 1 at 1-3 and note 17; 4/4/08 Part 3 at 3-2, 3-5; 6/5/08 Exp. Rpt. of G. Karras at 1-5; CBE-A at 3-13 and 15-17; and CBE-A Att. 16 at 1 and 3.

[9] "It assumes that equipment designers are insensitive to materials compatibility issues [and] that it is in Chevron's economic interests to allow additional malfunctions and thereby longer periods of shutdown. Both of these assumptions are incorrect. I could not determine any factual basis for these assumptions." Sahu at I(b). CBE does not assert or imply analysis based on these assumptions. See CBE-A Att. 16 at 1-5; CBE-A at 12-13; 2/20/08 Part 1 at 1 and note 1; 3/20/08 Part 2 at 2-5, 2-6, Table 8, 2-12 through 2-6, 2-19 and note 79; 4/4/08 Part 3 at 3-1, 3-5 and 3-6, figures 14, 15 and notes 10, 14, 15; 5/29/08 Part 5 comments; and 6/5/08 Exp. Rpt. of G. Karras.

[10] See CBE-A Att. 16 at 2; CBE-A at 12-13; 3/20/08 Part 2 (esp. 2-5, 2-12 through 2-16, Figure 11, Table 6, and notes 28, 65, 66, 69, 70, 74, 81); and 2/20/08 Part 1 at 1, 2, 4-9.

Sahu's failure to note that Condition C12 allows more heavy gas oil that is higher in contaminants into the TKC unit[11] exacerbates these errors. This larger amount of heavy gas oil requires more cracking; its higher pollutant content needs more decontamination; because the oil is also heavier this decontamination also requires more cracking, and the TKC cracks and decontaminates the oil. Note the interaction. For example, if oil volume increases by a factor of two and a pollutant's concentration in the oil increases by a factor of three, the pollutant mass put under high temperature and pressure in the TKC increases by a factor of six (2 x 3 = 6). CBE presented evidence that this interaction could increase catalyst fouling and corrosive acids loading to the TKC and TKN hydrocrackers by 9 times and 22 times, respectively. 3/20/08 Part 2 comments at 2-13 and Figure 11.

Ignoring this interaction of dirty oil refining factors, Sahu says he "could find no basis for the suggestion that there would be more 'pollution intensive refining.'" Sahu at I(c). Yet evidence he also ignores shows that significant flaring occurred repeatedly, because of frequent shutdowns of the TKC to change out spent catalyst, and is expected to recur.[12] Ignoring all this, Sahu concludes he "could not determine any additional environmental value" in limiting the TKC and other cracking units to their current rates. Sahu at II. The Sahu Report's reliance on this failure to address evidence in the record to support its rejection of the comprehensive cap limits is an error. This error affects the Sahu Report's analysis of impacts from heavier oils, acidity, nickel, vanadium and cracking rates.

Finally, Sahu references potential increases in pollutants then concludes that he cannot substantiate them.[13] It is impossible to "substantiate" future impacts that have not yet occurred. Thus, failure to do so is not evidence. Therefore, reporting this failure as evidence is an error. This error affects the Sahu Report's analysis of impacts from nickel, vanadium, selenium and mercury.

The Sahu Report does not rebut publicly verified evidence that a comprehensive oil input quality cap is needed to ensure that significant potential impacts resulting from the Project's expansion of capacity to refine low quality oil will be lessened or avoided.

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[11] Sahu at I(a). Larger volumes of more contaminated heavy gas oil can bypass the SDA and be processed in the TKC. See 6/5/08 Exp. Rpt. of G. Karras at 3. Indeed, Chevron admits that the Project will enable this result. Chevron 4/9/08 Response to CBE comment from Van Buskirk to Finlay at 8. Chevron also admits that this "gas oil" input would include oils derived from tar sands. Chevron 3/5/08 Responses to 11/15/07 CBE Comments on DEIR at 28, 29.

[12] CBE 3/20/08 Part 2 at 2-12 through 2-16 and notes 69, 81. Chevron FMP (FEIR App. 2, B.1) at 24, 25, 37, 41, 46 and Table 5-1. See also BAAQMD Rule 12-11 and Rule 12-12 cause reports showing significant flaring caused by TKC shutdown for catalyst change-out/maintenance on 10/24/05; 2/24-25/06; 6/25/06; 6/29/06; 5/10/07 (and for possible catalyst-related maintenance on 10/31/04; 11/4/04; 2/24-27/05, 3/3/05). Rule 12-11/12-12 reports showing significant flaring upon TKN shutdown for catalyst change-out/maintenance on 3/8-21/06; 4/21-22/06, 4/25/06 (and for possible catalyst-related maintenance on 1/15/05, 2/23/05).

[13] "I have not been able to substantiate that there will be any additional nickel and/or vanadium increases in crude oil or gas oils beyond current levels after imposition of Conditions C12 and C13 and proposed Condition C17(a)." Sahu at I(c). Also, identical statements at I(d) and I(e).

Conclusions

• City staff and consultants have not addressed the evidence presented in parts 1, 2 and 3 of CBE's technical comments on the FEIR or in my June 5, 2008 report.

• Dr. Sahu's reliance on secret data for conclusions that contradict evidence in the public record is improper. Exactly the same type of data is reported publicly by Chevron, other oil companies, and the Internet. The data should be disclosed now.

• Comments by Chevron, City staff and Dr. Sahu addressed herein do not rebut the evidence in the public record that the comprehensive oil quality cap is needed to lessen or avoid significant potential impacts of the Project.

• Flaring has already increased substantially when the Refinery ran higher sulfur oil. Significant flaring occurred more than twice as often, with emissions that appear about five times as concentrated, when Chevron's crude oil inputs had 0.5% higher sulfur. CBE predicts a flare emissions increase of 4-12 times from the Project, which could enable a larger switch to heavier, dirtier oil than what has yet occurred. Larger increases in flaring were reported by Subra for Gulf Coast refiners that switched to dirtier oils.

What causes this: harder-to-refine oil with more of many contaminants; larger process runs to crack and decontaminate the heavier, dirtier oil; interactions of contaminants and/or process conditions; larger amounts of toxic and flammable gases created at high temperature and pressure—an *inherently hazardous* system.

Refinery flares are emergency safety devices, and should be limited to that; but we know from experience that flares have been used for routine disposal—and as a safety valve when something deeper is wrong. Some CBE members watch the flares for that reason. It is time the EIR did as well.

Respectfully Submitted

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Attachment: 7-A. Edsall, 1975. Report of the AAAS Committee on Scientific Freedom and Responsibility. *Science* 188(4189): 687-693.