

Greg Karras, CBE  
Re: Chevron Richmond Refinery Fire  
19 April 2013

**Testimony of  
Greg Karras, Senior Scientist  
Communities for a Better Environment (CBE)  
1904 Broadway, Suite 600  
Oakland, CA 94612**

**Before the  
U.S. Chemical Safety and Hazard Investigation Board (CSB)**

**Regarding the  
INTERIM INVESTIGATION REPORT  
CHEVRON RICHMOND REFINERY FIRE  
PUBLIC HEARING OF THE CSB BOARD on  
19 April 2013 at Memorial Auditorium,  
Civic Center Plaza, Richmond, California**

Thank you for demonstrating support for environmental justice by including local community and worker expertise on this panel.

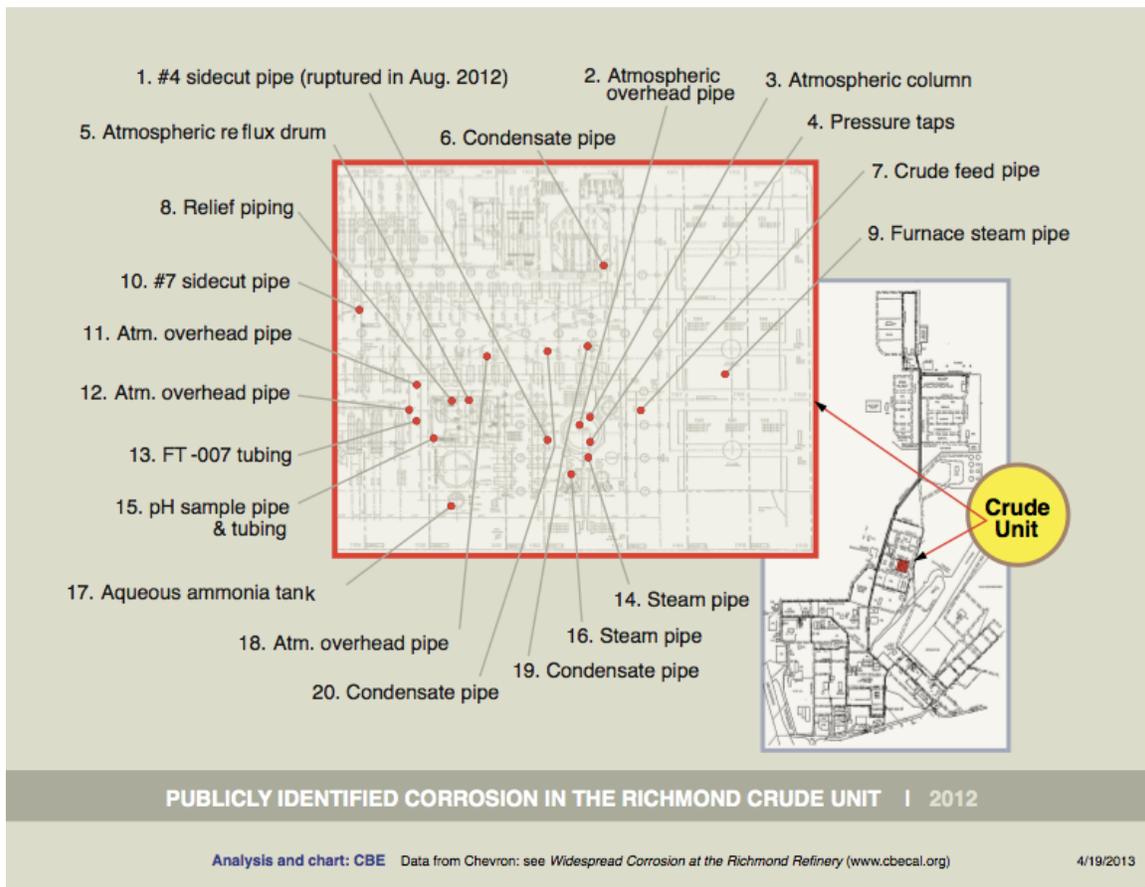
My name is Greg Karras. I have thirty years of practical experience in pollution prevention engineering and industrial-environmental investigation focused in the energy sector and oil refining in particular; have published peer reviewed work in this field; and will submit my CV with the emailed copy of this testimony.

As a Senior Scientist with Communities for a Better Environment—“CBE”—I have the honor of working for and with the disproportionately impacted, deeply motivated and highly organized communities of Richmond and West Contra Costa County. We know that the latest disaster at the Richmond refinery that sent more than 15,000 of us to area hospitals could have killed many of us if the weather or the specific evolution of the fire happened to be different. We know that, after ignition, it did not do so by accident. But we also know what caused this incident was not an accident and could happen again. In fact, we know that without positive change, it will happen again.

In my view, the findings of the CSB’s draft interim report are accurate and strongly support each of your recommendations. CBE believes each recommendation is urgently needed and respectfully urges you to adopt all of them tonight.

However, I hope you will consider two additional actions as the CSB completes its ongoing investigation and final report regarding this incident.

**First**, the CSB’s interim findings support an urgent need to require *inherently safer systems based on a hierarchy of controls*<sup>1</sup> at the Richmond refinery. Additional evidence, from Chevron’s post-incident repair permits summarized in this chart,<sup>2</sup> further supports this urgent need at the Richmond refinery and industry wide.



Note points 1, 2, and 12 in this chart. Point 1 indicates the 4–sidecut pipe section that failed in this incident, where your findings demonstrate that the inherently hazardous

<sup>1</sup> Herein generally, this italicized phrase is called “Inherently Safer Technology” or IST.

<sup>2</sup> An 8.5 x 11” copy of this chart, *Publicly identified corrosion in the Richmond crude unit*, and a CBE fact sheet that provides additional information and specific references for the data summarized in this chart will be attached to the emailed copy of this testimony.

**Greg Karras, CBE**  
**Re: Chevron Richmond Refinery Fire**  
**19 April 2013**

combination of more corrosive feedstock and less corrosion-resistant piping metal involved in this incident was at best extremely difficult to manage.

Points 2 and 12 in this chart indicate sections of atmospheric overhead piping where Chevron reported finding internal corrosion pitting severe enough to indicate a failure risk before the next scheduled maintenance shutdown (5-year intervals for this unit at this time) was found only after fire-damaged pipe was cut out and removed, and extensive internal checking was done.<sup>3</sup> Chevron suggests the need to monitor thousands of pieces of equipment and thousands of miles of piping at Richmond.<sup>4</sup> Thus, new information suggests that, at least in some cases, inherently hazardous refinery technology might, as a practical matter, be impossible to manage.

The CSB's proposed findings indicate that no U.S., state, or local officials require inherently safer technology in high-hazard industries. This indicates a fundamental failure of safety policy here and nationwide that warrants adopting your proposals that would require inherently safer systems based on a hierarchy of controls as urgent recommendations tonight.

//

//

//

//

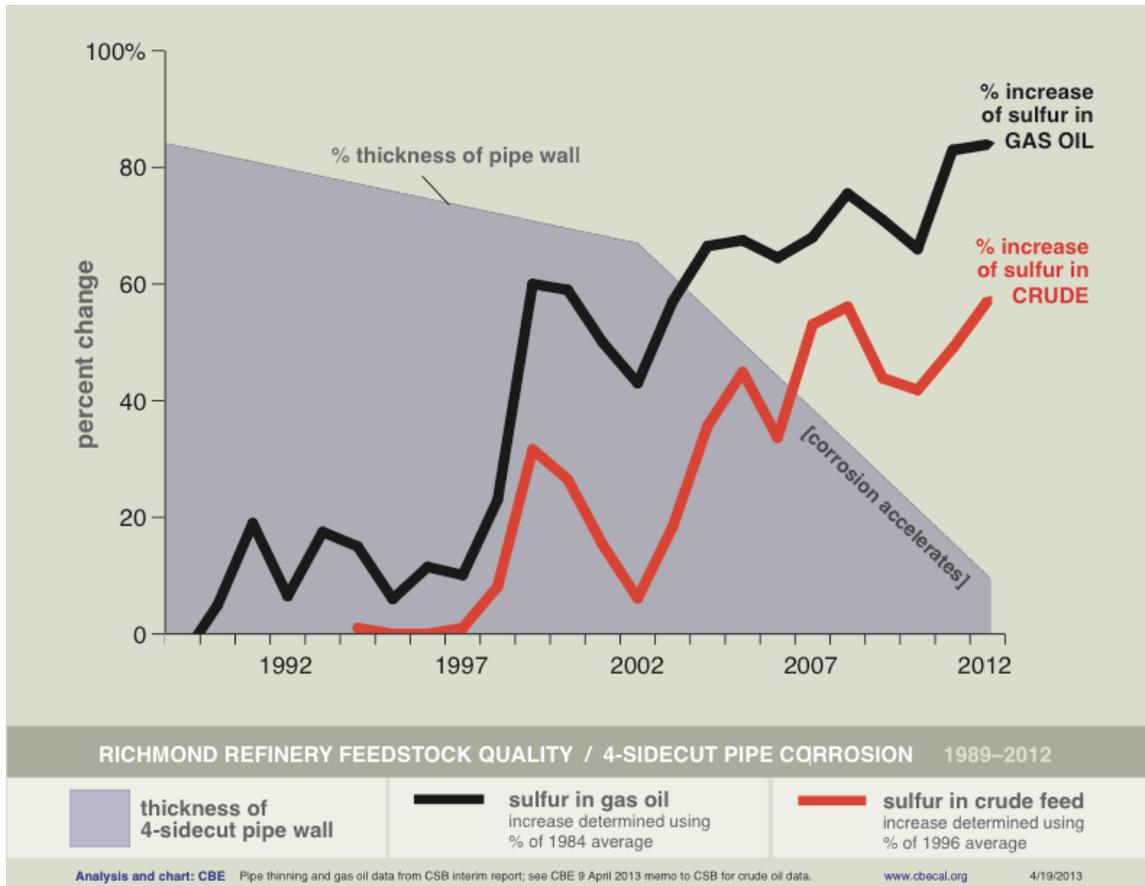
//

---

<sup>3</sup> See Chevron's "Scope Tracking-Additional Work" documents 18111 and 18096, submitted to the City of Richmond for Planning Dept. permit number 120568.

<sup>4</sup> *Richmond Refinery 4 Crude Unit Incident, August 6, 2012*. Prepared by the CUSA Richmond Investigation Team. 12 April 2013. See page 27.

**Second**, in its ongoing investigation and final report regarding this incident, the CSB should complete its analysis of material input substitution. Data on corrosion in the pipe section that ruptured in the incident, sulfur in the gas oil running through this pipe, and sulfur in the refinery crude feed supplying that gas oil, are shown in this chart.<sup>5</sup> The percent change from baselines is shown.<sup>6</sup>



As sulfur increased in the crude, it increased in the gas oil distilled from that crude and running through the 4-sidecut pipe section, and sulfidic corrosion began to thin the wall of this pipe more than four times faster than before that dramatic sulfur increase. Thus Chevron's feedstock switch played a key role in this incident.

<sup>5</sup> An 8.5 x 11" copy of this chart, *Richmond refinery feedstock quality / 4-sidecut pipe corrosion*, and CBE's 9 April 2013 memo will be attached in an email of this testimony.

<sup>6</sup> For example, sulfur increased by more than 50% in crude based on crude sulfur content > 1.5% wt. (Aug 2011–Jul 2012 average) versus a baseline of sulfur content < 1% wt. (1996 avg).

Material input substitution, a technical term for this causal factor, is central to IST and is at or near the top of pollution prevention and safety hierarchies of controls. This evidence demonstrates specifically for this incident the universally applicable principle that feedstock quality must be considered if we hope to drive catastrophic incident risk as low as reasonably possible.<sup>7</sup>

In this regard it may be important to respond to a concern I have often heard from oil industry representatives informally. The idea that any serious investigation of crude feed quality could leave refineries with no other choice but to shut down, destroying jobs and our economy, is like saying the world is flat—if we go check we will fall off the edge. In my opinion, if the industry believed this claim it would have no reason for calling cheaper, lower quality refinery feedstock “opportunity crudes.” Instead, substantial evidence suggests that preventing catastrophic climate disruption may require leaving much of the recoverable oil resource in the Earth,<sup>8</sup> leading to a question this community has raised explicitly and repeatedly—why not refine the least polluting and least hazardous part of the remaining oil resource?

---

<sup>7</sup> Background on three details of the oil quality and pipe corrosion evidence shown in the second chart may help to explain and support this additional evidence. The chart shows that the pipe wall thinned 4.4 times faster after the sulfur content of the crude and atm. gas oil feeds increased dramatically. This is a conservative estimate based on publicly available data that show a pipe wall loss of ~33% by 2002 and of an additional ~57% by 2012. It is possible that more than 57% of the original pipe wall thickness was lost after the dramatic gas oil sulfur increase (1998–1999) because of accelerated sulfidation corrosion that began to occur before the first pipe thickness measurement was reported (in 2002). This possibility may be hard to confirm or reject: based on discussions with CSB and USW staff I understand that Chevron may not have obtained, kept, or reported pre-2002 thickness measurements for this pipe section.

The chart also shows that the percent increase in gas oil exceeds that in crude. I expected to see this for two reasons. One is that this refinery shifted to a crude feed dominated by Persian Gulf crudes with atmospheric gas oil cuts that are proportionately higher in sulfur (as a percentage of sulfur in whole crude) than the Alaska North Slope crude stream that dominated its crude feed earlier in the 1990s. The other reason is that an increase in atmospheric gas oil temperature in the Richmond crude unit (noted in the CSB interim report) indicates that a cut-point change sent denser gas oil, which generally has higher sulfur content, through this 4-sidecut pipe circuit.

Data sources and methodological details of the crude feed estimate shown in the chart were provided previously and will be attached to the emailed copy of this testimony.

<sup>8</sup> See: Meinshausen et al., 2009. *Nature* 458: 1158-1162. DOI: 10.1038/nature08017; and Allen et al., 2009. *Nature* 458: 1163–1166. DOI: 10.1038/nature08019.

**Greg Karras, CBE**  
**Re: Chevron Richmond Refinery Fire**  
**19 April 2013**

Flat-world theories did not stop us before: we investigated, and among other things, Columbus “discovered” the Americas. Similarly, when Bay Area refiners claimed it would be unsafe to curb their then-routine flaring, community and labor leaders here worked together to investigate flaring prevention, and the landmark regional flare policy that was implemented here with our help has helped make refineries safer and has begun to spread nationwide.

Now Bay and LA area community groups and refinery workers’ labor leaders have begun working together more closely. Based on information and belief, I can testify that we are doing so because we are stronger together, and largely because we believe this will be necessary to get the CSB’s recommendations implemented. Our success in this likely will depend in part upon our ability to nurture trust among workers and other residents of our communities. We cannot duck the feedstock quality question. The CSB can help us by joining us in investigating this question.

In my opinion, in its ongoing investigation and final report regarding this incident, the Chemical Safety Board should consider completing its analysis of inherently safer chemical inputs for refineries.

Respectfully submitted on 19 April 2013

**Attachments (transmitted with electronic copy of this testimony)**

Curriculum vitae and publications list

Publicly identified corrosion in the Richmond crude unit (8.5 x 11” chart version)

Widespread corrosion at the Richmond Refinery (CBE fact sheet)

Richmond refinery feedstock quality / 4–sidecut pipe corrosion (8.5 x 11” chart version)

CBE’s 9 April memorandum to the CSB (supporting the crude data discussed herein)