Written Testimony of U.S. Chemical Safety Board Chairperson Rafael Moure-Eraso at March 6, 2014, Senate Environment and Public Works Committee Hearing Entitled "Preventing Potential Chemical Threats and Improving Safety: Oversight of the President's Executive Order on Improving Chemical Facility Safety and Security"

Chairman Boxer, Senator Vitter, and distinguished Committee members – thank you for inviting me today. I am Dr. Rafael Moure-Eraso, Chairperson of the U.S. Chemical Safety Board.

The incidents that we are discussing – Chevron, Tesoro, Freedom Industries, West Fertilizer, and Williams Olefins – are tragedies of the kind that were preventable.

The United States is facing an industrial chemical safety crisis. As we near the one-year anniversary of the West Fertilizer Explosion that fatally injured fifteen, I view my goal as Chairperson of the CSB as ensuring that progress is made to prevent similar catastrophes from occurring.

I wish every American could hear the frustration and heartbreak that the CSB encounters – at accident sites and at public meetings following these accidents. Workers, emergency responders, and the public continue to die and suffer injuries in horrendous explosions and fires.

Estus Ken Powell, who lost his daughter Kathryn in the 2010 fire at Tesoro's refinery in Washington State, stood up at a recent CSB public meeting to demand action to stop these horrible accidents. Mr. Powell said, "My life was forever changed. All I want to know is, does anybody care? It seems we can get nobody to have any teeth in anything, to get anything done."

Of course, we all do care. And we want to get something done, something with teeth. And I believe what we need is comprehensive regulatory reform. But achieving safety reforms is complicated and time-consuming. In the interim, I advocate that the Environmental Protection Agency (EPA) step in and use its authority under the Clean Air Act's general duty clause to encourage chemical facilities to take steps to make their operations inherently safer where it is feasible to do so.

The law assigns owners and operators of these facilities a general duty to identify hazards, design and maintain safe facilities and minimize the consequences of leaks. But most importantly, the EPA should follow up by adopting specific regulations to meet those goals, so that there are clear requirements on the books.

My testimony includes a number of examples where companies could have used available, feasible, safer technologies to prevent disastrous accidents, but chose not to do so.

After the West, Texas, explosion, President Obama issued an executive order requiring federal agencies to review safety rules at chemical facilities. I am encouraged by the leadership of the White House on this issue, and I hope that regulatory agencies respond in kind. The EPA is working with other agencies to comply, but in the meantime, the agency has the authority to act now, on its own, to require inherently safer design, equipment and processes which would significantly aid in preventing more catastrophes.

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Refinery Safety

In a draft report released to the public on December 16, 2013, the CSB proposed recommendations for substantial changes to the way refineries are regulated in California. Entitled "Regulatory Report: Chevron Richmond Refinery Pipe Rupture and Fire," the CSB draft report calls on California to replace the current patchwork of largely reactive and activity-based regulations with a more rigorous, performance-based regulatory regime – similar to those successfully adopted in the aerospace and nuclear sectors in the U.S. and overseas throughout the European Union including countries such as the United Kingdom, Norway, and Australia – known as the "safety case" system.

The draft report is the second part of three in the CSB's investigation of the August 2012 process fire in the crude unit at the Chevron refinery in Richmond, California. That fire endangered 19 workers and sent more than 15,000 residents to the hospital for medical attention.

In response to the incident, the State of California established an Interagency Working Group on Refinery Safety, an initiative undertaken by Governor Jerry Brown.

I would like to take this opportunity to heartily applaud the findings and recommendations contained in the working group's final report entitled "Improving Public and Worker Safety at Oil Refineries."

This report is an important milestone for improving refinery safety across the State of California and effectively addressing many of the CSB's safety recommendations contained in our Chevron refinery accident report released in April 2013.

The working group's final report includes a number of strong recommendations which are in alignment with the CSB's recommendations: that refineries should implement inherently safer systems to the greatest extent feasible; use formal techniques to evaluate the effectiveness of process safeguards to drive risk to as low as reasonably practicable (ALARP); and perform damage mechanism hazard reviews to ensure corrosion hazards are accurately identified before accidents occur.

Furthermore, the Working Group report recommends requiring companies to complete root cause analyses after significant accidents or releases, to explicitly account for human factors and organizational changes, and to perform periodic safety culture assessments.

Finally, the report indicates California will continue to pursue broader regulatory reforms, including the "safety case" system.

California is also in the process of tripling its force of specialized refinery safety inspectors, an initiative that is essential for the success of any regulatory system. We have made similar recommendations to federal OSHA, but they have taken only small steps.

On January 30, 2014, the CSB released a draft final report on the April 2010 fatal explosion and fire at the Tesoro refinery in Anacortes, Washington. The report found that the incident was caused within a heat exchanger, by a damage mechanism known as "high temperature hydrogen

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attack" or HTHA, which severely cracked and weakened carbon steel tubing leading to a rupture.

The draft report proposes far-reaching recommendations to the federal Environmental Protection Agency, the Governor, and State Legislature of the State of Washington to more rigorously protect workers and communities from potentially catastrophic chemical releases.

The accident at Tesoro could have been prevented had the company applied inherent safety principles and used HTHA-resistant materials to prevent the heat exchanger from cracking. This accident is very similar to the one that occurred at the Chevron refinery where corroded piping failed catastrophically. The company was made aware of the corrosion, but didn't take the necessary steps to replace piping with inherently safer, corrosion-resistant materials. Companies must do a better job of preventing refinery accidents, which occur all too frequently.

At both Tesoro and Chevron, warning signs were ignored over many years, and opportunities to prevent accidents by implementing inherently safer designs were missed.

Our investigations have concluded that fundamental changes are needed. Our board tracked 125 significant refinery incidents in 2012 alone.

Chemical Safety Board investigations show state and federal regulators are not able to ensure safety at refineries. They are under-resourced, outgunned by a powerful industry that seeks to blunt and sometimes even roll back the already inadequate regulatory system in the U.S.

Freedom Industries

I will now discuss the CSB's activities in Charleston, West Virginia – specifically in relation to the release of hazardous chemicals into the water supply of about 300,000 residents in nine counties.

First, I think it is important to discuss the history that the CSB has had investigating accidents in West Virginia's Kanawha Valley, a center of the state's chemical enterprise. This is our third deployment to a major chemical incident in the valley. In 2008 two workers were fatally injured at the Bayer CropScience chemical plant in Institute, West Virginia, when a waste tank containing the highly toxic pesticide methomyl violently exploded. Then in 2010, three incidents occurred in a thirty-three hour period at the DuPont facility in Belle. There was a release of highly toxic phosgene, which exposed a veteran operator and resulted in his death less than one day later.

Following the CSB's investigation into the Bayer and DuPont incidents the board recommended that the county, working with the state, establish a hazardous chemical release prevention program to enhance safety and optimize emergency response. The CSB recommended that the health department establish an industrial safety authority, paid for using fees assessed on the companies processing or handling potentially dangerous chemicals. As an example, we cited the program in California's Contra Costa County, which has an equally dense industrial/chemical base. Although this was not immediately adopted in West Virginia, the legislature there is now considering this approach in the wake of the Freedom Industries incident.

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The CSB's previous recommendations in West Virginia were aimed at empowering a government agency to determine just what posed a high hazard. Perhaps qualified inspectors would have considered pre-World War II vintage chemical storage tanks, located just one and one-half miles upstream from the intake of a public drinking water treatment plant, to be potentially "highly hazardous" and worthy of a closer look.

All of us here today are all too aware of the recent events that occurred at Freedom Industries. On January 9, 2014, a 48,000-gallon steel tank experienced a leak of up to 10,000 gallons of crude 4-methylcyclohexane methanol (MCHM) with an estimated 5.6% PPH, a poly glycol ether. A significant amount of the chemical was released into the Elk River, a tributary to the Kanawha River.

The CSB's preliminary research indicates that there is a gap in the regulatory framework covering aboveground chemical storage tanks.

In October of 2013, at the request of the company, Tank Engineering and Management Consultants performed a review of the tank terminals located in Charleston and Nitro. The evaluation was conducted and approved by an API-653 and 570 certified inspector, who also was credentialed as a National Association of Corrosion Engineers (NACE) Certified Corrosion Technologist. The review notes that the substances stored in tank 396 are considered "non hazardous" by the Environmental Protection Agency and are therefore not regulated by the federal Spill Prevention Control and Counter Measure Program, or SPCC rule. The review further notes that the tanks have "been maintained to some structural adequacy but not necessarily in full compliance with API-653 or EPA standards." API-653 is considered the prevailing voluntary good practice for aboveground storage tank (AST) inspection, repair, alteration and repair, and was developed to establish a uniform national program that assists state and local governments in AST regulations.

API 653 covers basically every age related damage mechanism known, including but not limited to corrosion, brittle fracture and improper fabrication.

While EPA's SPCC rule outlines requirements for prevention and preparedness of oil discharges such regulations do not apply to tanks containing "non hazardous substances" like those found at Freedom Industries. Under existing state and federal laws these tanks, including tank 396, were not regulated by the state or federal government.

Moving forward the CSB will closely examine tank 396. We plan to complete a thorough internal inspection of the tank to determine the tank's condition and wall thickness at the time of the incident. We will also examine tank design, materials of construction, inspection practices, state and federal oversight of similar tanks as well as existing industry best practices. The tanks in use at Freedom Industries were over one-half century old. Considering the best way to improve the safety of tanks at facilities that have similar tanks in use is an important issue that needs to be addressed.

In addition to looking at the causes of the tank failure itself, the CSB team will also examine the response to the leak once it was discovered. We are particularly interested in the adequacy of information on MCHM and PPH hazards since the manufacturer's material safety data sheet

repeatedly says "no data available" for numerous toxicological properties, especially chronic toxicity.

Having information readily available for the public is an issue we will be further examining in regard to ongoing reform of the Toxic Substances Control Act.

Emergency responders, local officials, regulators and public utilities must be provided the proper information in order to protect the community from potential risks, and more than providing information, there needs to be an obligation to require preventative measures.

I would like to also take this opportunity to strongly commend Senator Manchin, Senator Rockefeller and Senator Boxer for promptly introducing legislation aimed at safeguarding water supplies from chemical leaks. Modern standards are strongly needed in this area. I encourage any effort, any legislative reform to follow the basic framework of accident prevention, known as the hierarchy of controls – which is an effectiveness ranking of techniques used to control hazards and the risk they represent. The further up the hierarchy, the more effective the risk reduction achieved. In brief, the most effective accident prevention measures typically involve what is called inherent safety. I realize this is a term that has drawn some controversy, but it is really just a well-established industry-developed concept that focuses on prioritizing the elimination of a hazard, or minimizing it. And, it looks to inherently safer chemical processing and equipment design. For chemical storage tanks like this, the first question that should always be asked is, do they need to be near the water supply for some reason? Unfortunately in the case of Freedom Industries, the answer would have been "no." The facility was simply a truck terminal, and its position alongside the Elk River just upstream of the water intake had tragic consequences. The facility just did not need to be where it was. And although relocating it would have had some costs, those pale beside the costs that hundreds of thousands of West Virginia residents and businesses are now paying for this disaster.

Another form of inherent safety, or safety in design, is using corrosion-resistant materials for tank construction. That is something we will need to explore further, as we determine the failure mode for this particular tank.

Moving down the hierarchy are engineering solutions that don't eliminate the risk of an accident but make it far less likely. These may include double-walled tank designs, leak detection systems, and secondary containment structures like dikes and liners. A large segment of the industry has moved in this direction over the many decades since the Freedom Industries tanks were constructed.

Finally near the bottom of the hierarchy are measures such as inspections for corrosion or other potential failure mechanisms. Now, inspections are absolutely essential in any sort of hazardous process operation or storage site. But I would caution that, according to the hierarchy of controls, they are among the least effective of safeguards. Hazards can be missed in inspections – we see that frequently at the CSB. The effectiveness of inspections totally depends on the skill and thoroughness of the inspector. And of course, there can be significant time intervals between inspections, and bad things can happen during those periods. So inspections are essential, but they are not a complete solution by any means. What is needed – and what I hope this legislation leads to – is a holistic approach to preventing these incidents.

West Fertilizer

The CSB has determined that ammonium nitrate fertilizer storage falls under a patchwork of U.S. safety standards and guidance – a patchwork that has many large holes.

These holes include: the use of combustible wooden buildings and wooden storage bins, sprinklers are generally not required, and no federal, state, or local rules restrict the storage of large amounts of ammonium nitrate near homes, schools and hospitals.

A joint chemical advisory issued in August of 2013 by OSHA, EPA and ATF entitled Safe Storage, Handling, and Management of Ammonium Nitrate is an excellent step forward in addressing the hazards associated with the storage of AN, but the current regulatory coverage is still in need of reform.

Fire codes have some useful provisions for ammonium nitrate. But they need significant revision to strengthen the storage requirements for AN. Even if they were revised, we note that Texas and most of its counties have no fire code. So at West, these fire code provisions were strictly voluntary, and West Fertilizer had not volunteered. Almost a year later Texas and its rural counties have not adopted a fire code.

OSHA has some similar provisions for ammonium nitrate fertilizer in its Explosives standard, 1910.109. However, OSHA has not focused extensively on ammonium nitrate storage and hadn't inspected West since 1985. It appears that few if any retail fertilizer operations have ever been cited under this standard, and its provisions for fire protection are less rigorous than those followed overseas for AN.

Other nations have gone much further than the U.S. on ammonium nitrate safety. The UK recommends dedicated, noncombustible storage buildings and noncombustible bins. The U.S. manufacturer, CF Industries, recommends the same and urges sprinklers as well.

But the fertilizer industry tells us that U.S. sites commonly store ammonium nitrate in wooden buildings and bins – even near homes, schools, or other vulnerable facilities. This situation must be addressed.

Preventing the risk of fire essentially eliminates the potential for an explosion as we saw in West, by removing one of the preconditions for detonation.

Facilities like West fall outside existing federal process safety standards, which were developed in the 1990's and are list-based.

Ammonium nitrate would likely have been included, if the EPA had adopted our 2002 recommendation to cover reactive chemicals under its Risk Management Program.

Williams Olefins

The Williams Olefins plant has over a hundred workers, producing ethylene and propylene.

On June 13, there was a catastrophic failure involving a heat exchanger and associated piping

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which broke loose from a distillation tower. The ensuing explosion led to the deaths of two employees.

The CSB found that the 46-year old heat exchanger did not have adequate pressure relief and over-pressured, possibly due to problems with the materials of construction.

In collaboration with the company and OSHA the CSB has concluded its first round of metallurgical testing on the exchanger metal. We will be looking at whether inherently safer materials of construction should and could have been used in preventing this accident. The CSB plans to publicly release a report on this testing in the next few months.

The CSB investigation is also looking into potential failures of regulatory enforcement at the Williams plant as well as industry standards and regulations. Process safety management systems at Williams are being examined and will be included in the final report.

Concluding Remarks

The bigger picture in process safety is that EPA and OSHA resources are under duress. Regulations need to be modernized – but more inspection and prevention are needed as well.

In the meantime, I hope that the committee will find recent developments in California extremely encouraging.

California's decision to triple the number of dedicated process safety inspectors – funded by industry fees – is an extremely progressive and important step to ensuring a well funded regulator.

Another promising approach is the "safety case"– successfully used by the nuclear and aerospace sectors in the United States and by European countries in the refinery sector – which insurers say have much lower petrochemical accident rates than we do.

Many experts believe this is the best safety regime for complex, technological industries, rather than the U.S. system which calls upon a prescriptive and often outdated rule book that is incapable of adapting to new technology and identified hazards, until the next catastrophic incident occurs.

Thank you again for the opportunity to testify today.

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