From: Jim Eninger [mailto:jeninger@earthlink.net]
Sent: Monday, September 2, 2019 1:36 AM
To: COB <COB@aqmd.gov>
Subject: Update: Comment on the Friday, September 6, 2019 SCAQMD Governing Board Meeting

Kindly use the updated attachment. An error in the last link of the attached document was corrected.

Clerk of the Board,

Please accept, and make part of the record of the Friday, September 6, 2019 SCAQMD Governing Board Meeting, the 10-page attached comment on Agenda Item 17 - Refinery Committee.

The attachment is "A Rule 1410 Performance Standard to Protect the Community," with important revisions on August 27, 2019.

Respectfully,
Jim Eninger
Member
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https://traa.blog/

A Rule 1410 Performance Standard to Protect the Community

By the **Torrance Refinery Action Alliance Science Advisory Panel**
Posted on the TRAA Science Advisory Panel Blog: **www.TRAA.blog**
Revised August 27, 2019

A Performance Standard Must Be Designed to Protect the Community, Not Tailored to What the Refineries Are Able to Meet with Enhanced Mitigation

Executive Summary

A Performance Standard, with hydrogen fluoride (HF) phase-out if it cannot be met, has become the central approach adopted by the South Coast Air Quality Management District Staff for either a regulation or a memorandum of understanding (MOU) with Valero in Wilmington and PBF's Torrance Refining Company, the only two refineries in California that use HF. SCAQMD welcomes community input, and the TRAA Science Advisory Panel of six South Bay scientists and engineers is providing expert professional advice with *A Rule 1410 Performance Standard to Protect the Community*. Its three parts are: 1) A **Benchmark**, which must be met to ensure the community remains safe if a major HF release occurs, 2) **Release Scenarios**, which could be caused by Earthquakes, Accidents, or Terrorists (EAT), and 3) Ground rules for the refineries' attempt to **Demonstrate** by analysis, modeling, and testing that they can meet the Benchmark. Interim measures are also specified to increase community protection until HF is phased out.

The Performance Standard is summarized below and given with full rationales in the following sections.

- **BENCHMARK TO PROTECT THE COMMUNITY**
  The general population, including susceptible individuals, shall not experience "irreversible or other serious, long-lasting adverse health effects, or an impaired ability to escape," as proscribed by the Acute Exposure Guideline Level 2 (AEGL 2). All points from the refineries' fenceline **and beyond**, shall not exceed **any** of the AEGL 2 threshold concentrations for exposure durations of 10 minutes, 30 minutes, 60 minutes, 4 hours, and 8 hours.

- **RELEASE SCENARIO**
  A rupture of any of the refinery's HF Containment Subsystems releasing the entire amount of HF: 1) in any duration from 5 seconds to 4 hours or, 2) from the break of any size subsystem pipe.

- **DEMONSTRATION BY ANALYSIS & MODELING**
  Only passive mitigation measures, defined by the EPA as "equipment, devices, or technologies that function without human, mechanical, or other energy input," shall be allowed in the demonstration attempt. In accordance with the EPA's RMP Guidance for Offsite Consequence Analysis for worst-case releases, active mitigation measures such as water spray shall not be allowed because they can be deactivated by the same calamitous event that causes the rupture.

  No proprietary data shall be allowed in the analysis or modeling. If after six months the refineries can show they have a creditable plan that can meet the Benchmark, three years shall be allowed for the refineries to carry out a full-scale experimental demonstration to validate their analysis and modeling. Failure of the modeling or experimental verification shall mean all HF shall be removed from the refinery grounds within four years from the initial approval of Rule 1410.

- **INTERIM ENHANCED MITIGATION**

1. To protect the public from HF releases in the interim, the refineries shall enhance their mitigation system as much as feasible as determined by the SCAQMD.
2. The refineries shall have a SCAQMD-approved emergency plan in place within six months, and then institute it, at their expense, to remedy the shocking lack of medicine and facilities to treat victims of a major HF release.
3. The refineries shall certify within six months, to the satisfaction of SCAQMD, that their operations are safe from a cyber-attack.
4. The refineries shall demonstrate within six months that they have financial resources in place — through liability insurance, bonds, or corporate resources — to cover claims against them from 15,000 deaths (the estimated fatalities in the 1987 Bhopal, India catastrophe, which released a similar amount of toxic chemical found in one Torrance refinery settler tank). Bankruptcy is not an acceptable response.

Background

The South Coast Air Quality Management District (SCAQMD) has proposed Rule 1410 to address the threat of a catastrophic major release of highly toxic hydrogen fluoride (HF) into the community from two refineries in the South Bay— Valero in Wilmington and PBF's Torrance Refining Company in Torrance. The Torrance Refinery Action Alliance (TRAA) — a volunteer, grassroots, community group — is seeking a ban on the use of HF. TRAA's goal is to have HF removed from the two South Bay refineries within four years from the time SCAQMD finalizes its rule-making process. It may take longer for the refineries to transition to one of the vastly safer alkylation processes; but no longer than four years into that process, the last of the HF must be removed from the refineries.

The Performance Standard approach, along with other approaches, was first presented by the SCAQMD Staff to the SCAQMD Board's Refinery Committee on September 22, 2018. Since then, a Performance Standard, with HF phase-out if it cannot be met, has become the central approach adopted by the Staff for either a regulation or a memorandum of understanding (MOU) with the refineries. TRAA has a policy of not taking a position on a particular approach. However, given that the SCAQMD has adopted an approach based on a Performance Standard, TRAA's Science Advisory Panel of six South Bay scientists and engineers with extensive and applicable academic training and career experience, while not endorsing this approach, has a vital interest in providing expert professional advice to ensure the approach is scientifically sound and leads to the elimination of HF from the refineries. The TRAA Science Advisory Panel's Performance Standard was written with the Torrance refinery in mind; however, it also applies to Valero. The hyperlinks add important content — they should not be skipped over.

The February 1, 2019 Southern California AQMD Staff presentation to the full Governing Board reviewed the background and need for Rule 1410, gave a status on the Staff's recommended approach, and sought guidance from the Board on the direction they wanted the Staff to take. The SCAQMD's Deputy Executive Officer for Planning, Rule Development & Area Sources, Dr. Phillip Fine, made the presentation. The video of the presentation can be viewed here and the charts can be viewed here. The SCAQMD Staff was directed by the Board to work on MOUs with the refineries as well as a regulation; both based on Performance Standards that will lead to a ban of HF if the Benchmark in the Performance Standard cannot be met.

What Is a Performance Standard?

The **Performance Standard** concept for Rule 1410 is summarized in the February 1, 2019 PowerPoint Staff presentation, where it is explained in three charts in the section *What is a Performance Standard?* starting on chart 34. Note for clarity in the section below, key terms are bolded and capitalized.

There are three key elements of a **Performance Standard**:

I. A **Benchmark,** or Threshold, which must be met by the refineries, ensures the community remains safe if a major HF release occurs. The **Benchmark** is set to what is needed to protect the community, not to what the refineries are capable of with **Enhanced Mitigation**. If the refineries cannot demonstrate they can meet the **Benchmark**, HF must be phased out.

II. Realistic, major **Release Scenarios** are specified, which could be caused by Earthquakes, Accidents, or Terrorists (EAT), as past SCAQMD Board Member Dr. Joseph Lyou commented.

III. If the refineries cannot **Demonstrate**, by analysis, modeling, and testing, that they can meet the **Benchmark** under the prescribed **Release Scenarios**, then HF would have to be phased out. This section also sets ground rules for the demonstration and interim measures to help protect the community until the HF is gone.

The TRAA Science Advisory Panel proposes the following **Performance Standard** to protect the public from catastrophic death and injury after a major release of hydrogen fluoride.

I. Benchmark to Protect the Community

In the event of a release of hydrogen fluoride, the general population, including susceptible individuals, shall not experience "irreversible or other serious, long-lasting adverse health effects, or an impaired ability to escape," as proscribed by the Acute Exposure Guideline Level 2 (AEGL 2) for hydrogen fluoride.

Benchmark: All points from the refineries' fenceline **and beyond**, shall not exceed **any** of the AEGL 2 threshold concentrations for hydrogen fluoride (CAS: 7664-39-3):

- 95 ppm at any time during a 10-minute exposure duration
- 34 ppm at any time during a 30-minute exposure duration
- 24 ppm at any time during a 60-minute exposure duration
- 12 ppm at any time during a 4-hour exposure duration
- 12 ppm at any time during a 8-hour or longer exposure duration

Application of the thresholds:

The predicted HF concentration transient under worse-case wind speed and atmospheric stability as defined in the *EPA's RMP Offsite Consequence Analysis Guidance* shall not exceed the threshold HF concentrations given above for the predicted exposure duration, defined as the duration between the first detectable (1 ppm) arrival of the HF cloud at the point in question to when the HF cloud subsides below 1 ppm as shown in *Figure 1*.

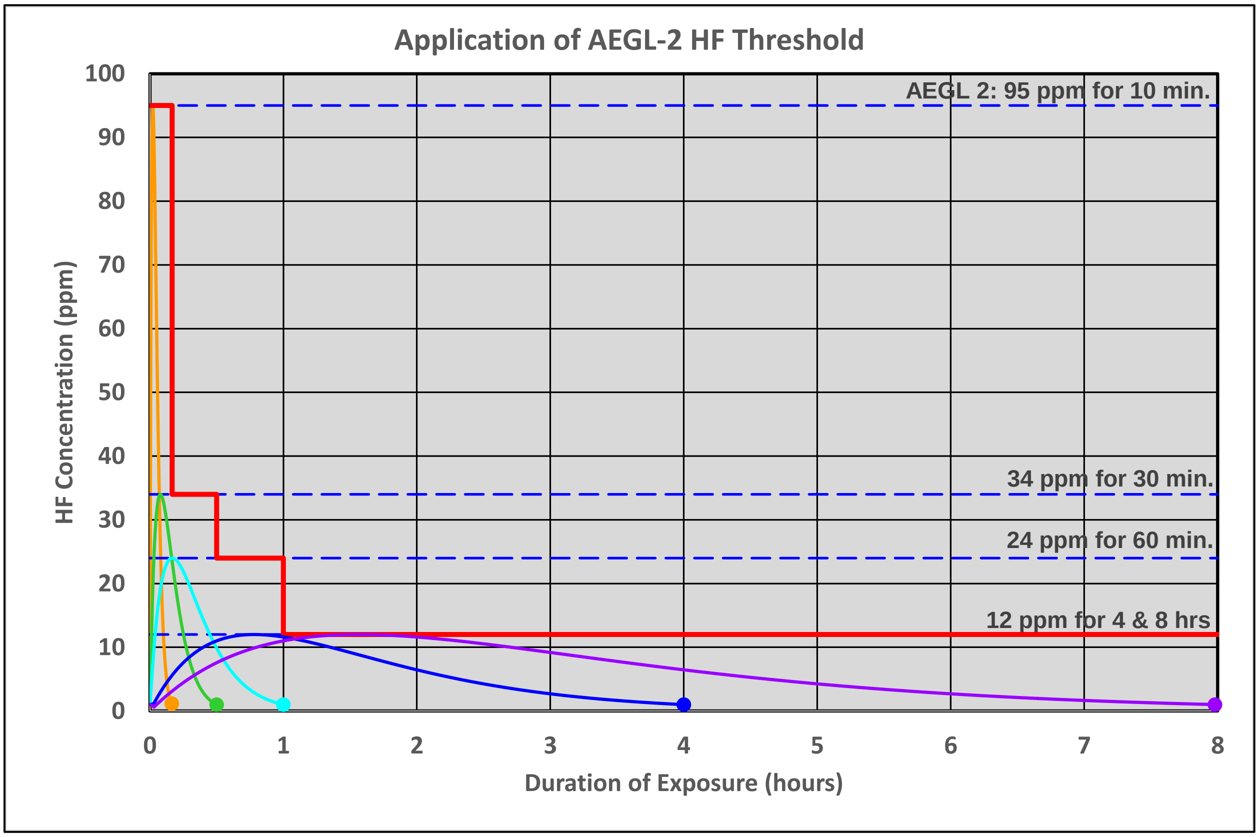

Figure 1 — HF Threshold vs Exposure Duration. The HF concentration at the refinery fenceline and all points beyond shall remain below the threshold value given by the red line. Examples of several hypothetical concentration transients just satisfying the threshold are shown.

Rationale:

It is self-evident that the public must be protected from irreversible or other serious, long-lasting adverse health effects.

The **Benchmark** does not protect workers inside the refineries' fenceline, only because this is the jurisdiction of the Occupational Safety and Health Administration OSHA. Similarly, the **Benchmark** does not protect people in broad corridors along the highways from Louisiana to the South Bay used multiple times each week to truck in 33,000 lbs of HF per truckload to the two South Bay refineries, only because this is the jurisdiction of the Department of Transportation DOT (see *HF Boil-Off from an MHF Spill on Hot Highway Pavement*). However, it is not lost on the TRAA Science Advisory Panel that refinery's failure to meet this **Benchmark** will lead to the inevitable ban of HF, which will safeguard refinery workers and people along the HF transportation corridor. TRAA is not turning its back on them.

At first glance it may appear odd that long HF exposures are included in the benchmark when worst-case releases are typically short-duration. However, a ground-hugging cloud emitted from a short-duration release would expand enormously both laterally and longitudinally as it is convected through the community by the wind while turbulently entraining air. It can take considerable duration to pass over a downwind location.

Consider, for example, the plausible case where the 50,000 lbs of HF from a Torrance-refinery settler tank were released by a major rupture in 5 seconds. By the time the toxicity of the cloud has dissipated to, say, 24 ppm, its volume would have grown to 1.14 cubic km — a calculation that a high-school chemistry student can make. Envisioning a cloud shape of an expanding hockey puck with a ground-hugging constant height of 6 meters, we calculate a cloud diameter of 15.4 km (9.6 miles). At a wind speed of 4 miles per hour, it would take 2.4 hours to pass over a downwind location, which greatly exceeds the AEGL 2 duration of 60 minutes for 24 ppm.

This idealized simple example shows that for any release, both short- and long-time exposures must to be considered both at the fenceline and at all points beyond it.

There is an even starker scenario arguing against a Benchmark of only the 10-minute short-duration AEGL 2 condition of 95 ppm at the fenceline. A slow release resulting in, for example 80 ppm for several hours would be lethal in the vicinity of the refinery, but would pass a 10-minute AEGL 2 Benchmark.

II. Release Scenarios

For several reasons, the past focus of concern at the Torrance refinery has been on the settler tanks, even though there is far more HF distributed elsewhere in the refinery that is largely overlooked. The reasons for past focus on the settler tanks are:

- The EPA's mandated Risk Management Plan and "Offsite Consequence Analysis" is based on the single vessel in a plant that contains the most toxic substance, which for the refineries are the settler tanks.
- The settler tanks contain high-pressure, superheated HF that dramatically flash atomizes on release into a ground-hugging cloud.
- The February 18, 2015 explosion at the Torrance refinery hurled an 80,000 lb piece of hardware from 12-stories high that almost hit the settler tanks.

The total HF at the Torrance refinery is 250,000 lbs, which means that with 50,000 lbs of HF in each of the two settler tanks, 150,000 lbs are distributed elsewhere in the refinery. It may not be under superheated conditions that results in flash atomization. However, for volatile liquids like HF with boiling points near room temperature, molecules are weakly bound to the liquid state. An additive used by the refineries to raise the boiling point is at such a low level, the effect is inconsequential. Hydrogen fluoride molecules are weakly bound to the liquid state, and there are several other paths for HF to go airborne into the community besides flash atomization:

- Boil-off of HF from a spill or from a ruptured tank by heat conduction from the refinery grounds, by direct solar heating, or a concurrent refinery fire.
- Boil-off from heat of reaction with a water spray.
- Wind-driven evaporation from the surface of a massive HF spill.
- Gasdynamic-induced breakup and evaporation of a subcooled HF jet emitted under pressure from a rupture.

For the reasons stated above, it is imperative to address the threat to the community from HF stored at all locations at the Torrance and Valero refineries. Thus, the following definitions:

- The **HF Containment System** comprises all hardware that contains HF in a refinery and isolates it from the environment. This hardware includes storage and settler tanks, reactors, reprocessers, interconnecting pipes and valves, and HF transportation trucks on the refinery grounds.

- An **HF Containment Vessel** is any HF tank or component within the **HF Containment System**, which typically has a dedicated purpose in the alkylation process.
- **HF Containment Subsystem** is one or more **HF Containment Vessels** that are connected by pipes with isolation valves that are simultaneously open at any time.

For example, an HF delivery truck on refinery grounds is one subsystem. When it is transferring its HF to a storage tank, the truck's tank and the storage tank constitutes another subsystem.

With these definitions, the Release Scenario I is (see below for the Release Scenario II based on hole size):

Release Scenario I: The rupture of the refinery's **HF Containment System** that releases the entire amount of HF from any of its **HF Containment Subsystems** over any duration from a 5 seconds to 4 hours. The thermodynamic state of the released HF is the worst case (highest temperature and pressure, lowest additive) that exists in the subsystem. The velocity of the release is set by the pressure. The rupture location is any point on the subsystem, with no attempt to discern which points are more likely. All paths for HF to go airborne, as noted above, shall be evaluated.

Rationale:

It is easy to imagine countless realistic release scenarios. **The release scenario above, however, is based solely on releases that have happened or have nearly happened.** The amount of the HF release is well defined by the maximum amount in a subsystem; however, the duration of the release would depend on the nature of the rupture. It can range from very short to very long. All rupture durations must be considered.

First, consider a release based on the terrifying near miss that occurred at the Torrance Refinery on February 18, 2015. An 80,000 lb object, hurled by an explosion from 12-stories high, rips off a feed pipe from the bottom of a settler tank.

At its March 22, 2019 Community Group Meeting, SCAQMD Staff presentation gave the Bernoulli's formula for the rate of HF release as a function of tank pressure and rupture diameter. The presentation gave the pressure of the settler tank of 225 psig for the Torrance Refinery. By scaling from a photo of the 13-foot-diameter settler tank (Figure 2), we determined that the pipe at the bottom of the tank was about 18 inches in diameter. A simple calculation showed that the pipe ripped off the bottom of the tank would release all HF (the bottom 10-15%) in less than 5 seconds, which coincidentally is the typical time for a toilet to flush. This example sets the shortest duration of the release scenario.

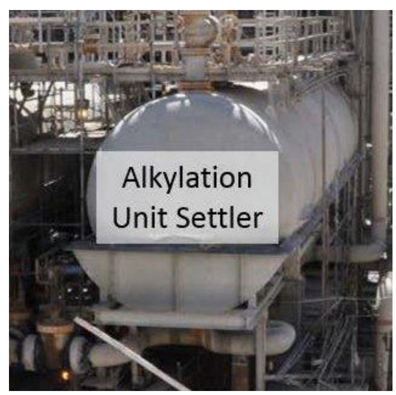

Figure 2 — 18-inch pipe diameter is scaled from the image of 13-foot-diameter acid settler tank at the Torrance Refinery.

Second, consider the release of 84,000 pounds of sulfuric acid over two-and-a-half hours from an alkylation-unit settler tank at the Tesoro Refinery in Martinez, California, on February 12, 2014. The release was onto the refinery grounds and into a process sewer system. Because the refinery used vastly safer sulfuric acid in its alkylation process, there was no vapor cloud or offsite consequences to the community. The release was the result of a failure in the coupling of a ¾-inch pipe from the bottom of the tank. This example is an intermediate duration of the release scenario.

Third, consider the release of HF from the Marathon Petroleum Refinery in Texas City, Texas on October 30, 1987. A crane carrying a 50-foot section of a convection heater dropped its load onto an anhydrous hydrogen fluoride tank within the HF alkylation unit, shearing two lines leading to the top of the tank. One line was a 4-inch acid truck loading line, and the other was a 2-inch tank pressure relief line. The tank was at the normal operating pressure of approximately 125 psi, so that when the incident occurred a cloud of HF was produced that moved with the prevailing wind. The tank originally contained 35,700 gallons of HF, of which about 6,548 gallons was released over a 44 hour period, although the majority of the release took place during the first two hours as the tank depressurized. Approximately 4,000 people were evacuated from the residential areas and the three area hospitals treated 1,037 patients, of which nearly 100 were hospitalized. There was extensive damage to trees and vegetation in the residential area. This example sets the longest duration of the release scenario.

Alternative Release Scenario

The Valero and PBF's Torrance Refining Company, as well as the SCAQMD Staff, have defined release scenarios in terms of a rupture hole size (see page 11of the June 22 Staff Presentation — *Staff Recommendations for Release or Hole Size*). Alarmingly, they assert that **only very small piping can break** (Refineries: 1-inch hole, SCAQMD Staff: 1-to-2 inch hole). Their preposterous assertion not only defies common sense (see *Figure 3*) given calamitous events such as earthquakes[*], terrorism, operator errors, and the terrible history of refinery explosions, which in more than one instance have hurled massive objects at high velocities, but also flies in the face of an actual major HF release, where a 2-inch and a 4-inch pipe simultaneously broke off an HF tank (see third example, above).

Figure 3 — Calamitous Events: Earthquakes, Accidents, and Terrorism (EAT). Left-to-Right: 1) The magnitude 6.7 Northridge Earthquake on January 17, 1994, 2) Torrance refinery explosion on February 18, 2015, 3) Alfred P. Murrah Federal Building after the Oklahoma City truck-bomb explosion on April 19, 1995.

[*] In their Final Technical Report of the 2017 USGS-funded study *"Activity and earthquake potential of the Wilmington blind thrust, Los Angeles, CA: The largest earthquake source not on current southern California hazard maps? Collaborative Research with Harvard University and the University of Southern California,"* Principal Investigators Professors John H. Shaw (Harvard), James F. Dolan (USC) and their research team assert, "the Wilmington blind-thrust is a tectonically active fault capable of generating large damaging earthquakes . . . This overturns the long-held view that the fault became dormant in the Late Pliocene, barring its inclusion in state-of-the-art regional earthquake hazard assessments. . . . The size of the fault suggests that it is capable of generating moderate-magnitude earthquakes (M 6.2-6.3), while potential linkages with other nearby faults (e.g., Huntington Beach, Torrance, Compton) pose the threat of larger, multi-segment events (M > 7)."

Consider that the same February 18, 2015 explosion at the Torrance refinery that nearly ripped an 18-inch-diameter pipe off the bottom of a settler tank, also caused other ruptures reported (page 43) by the Chemical Safety Board (see *Figure 4*). One of those ruptures has the same flow area as a 3.65-inch-diameter hole, which has over 13 times the flow area of a 1-inch-diameter hole.

In the recent April 26, 2018 Husky Superior Refinery Explosion in Superior, Wisconsin, which was startlingly similar to the February 18, 2015 Torrance refinery explosion, a huge piece of debris was hurled through an asphalt storage tank and created an enormous hole — several feet in diameter (see *Figure 5*).

These real-life examples show that limiting the Release Scenario to small one-or-two-inch diameter holes would leave the communities surrounding the Torrance and Valero refineries at risk of a catastrophic disaster.

The TRAA Science Advisory Panel provides Release Scenario II so it can be compared directly to the Release Scenarios recommended by the refineries and by SCAQMD Staff. The fundamental difference is that, unlike the hubris they display in predicting only small pipes would break, the TRAA Science Advisory Panel has the humility, based on decades of cumulative professional experience and actual ruptures, to acknowledge it cannot predict which pipes would break in the face of uncertain calamitous events (see *Figure 6*).

Release Scenario II: The rupture of the refinery's **HF Containment System** that releases the entire amount of HF from any of its **HF Containment Subsystems** from the break of **any size pipe** in the subsystem. The thermodynamic state of the released HF is the worst case (highest temperature and pressure, lowest additive) that exists in the subsystem. The velocity of the release is set by the pressure. The rupture location is any pipe, with no attempt to discern which is more likely. A break in every pipe of every subsystem shall be analyzed. All paths for HF to go airborne, as noted above, shall be evaluated.

Figure 4 — Rupture of tank resulting from February 18, 2015 explosion at the Torrance refinery. The rupture shown in the lower-left image ***has the same flow area as a 3.65-inch-diameter hole****, which has over 13 times the flow area of a 1-inch-diameter hole.*

Figure 5 — Enormous hole several feet in diameter in an asphalt storage tank resulting from the April 26, 2018 Husky Superior Refinery Explosion in Superior, Wisconsin.

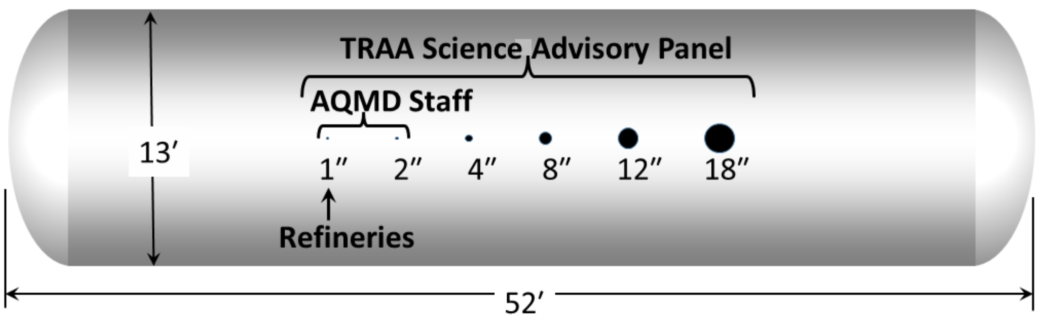

*Figure 6 – **A Torrance Refinery HF settler tank.** Both refineries and the SCAQMD Staff assert that major releases would be limited to breaks in small 1- or 2-inch-diameter pipes. In the face of unknown calamitous events, the TRAA Science Advisory Panel asserts the only prudent assumption to safeguard the community is any pipe could break.*

III. Demonstration by Analysis, Modeling, and Testing

This section sets the ground rules for the refinery's attempt to show by analysis, modeling, and testing they can meet the **Benchmark** to protect the community from the **Release Scenario**.

A. Only Passive Mitigation Measures Shall Be Allowed in the Demonstration

Passive mitigation is [defined by the EPA]() as "equipment, devices, or technologies that function without human, mechanical, or other energy input. Passive mitigation systems include building enclosures, dikes, and containment walls. Measures such as fire sprinkler systems, water curtains, valves, scrubbers, or flares would not be considered passive mitigation because they require human, mechanical, or energy input to function." These measures are considered active mitigation.

There are compelling reasons that the EPA Risk Management Plan's required "Offsite Consequence Analysis" allows only passive mitigation in determining the worst-case releases of toxic liquids and gases:

- **Calamitous events that can cause major toxic chemical release — large earthquakes, accidental or deliberate explosions, or fire — could very likely also incapacitate active mitigation no matter how many redundancies are designed into it.**
- Active mitigation is prone to intentional disengagement as part of an onsite or cyber-attack.

Transition to a vastly safer catalyst is an acceptable passive mitigation.

B. No Proprietary Data Shall Be Allowed

All data and reports used by the refineries shall be available to the public. All analysis, modeling, and data reduction shall be done with well-documented Excel workbooks or SCAQMD Staff-approved commercial computer codes. The Excel workbooks, computer codes, input sheets, and documentation shall be made available at no cost to qualified members of the public, as determined by SCAQMD Staff, for overview.

C. Schedule

At the completion of writing Rule 1410 and approval by the SCAQMD Board of Directors:

1. Six months shall be allowed for the refineries to attempt to show by analysis and modeling that they have a creditable plan for enhanced mitigation that can meet the Benchmark.
2. Three years shall be allowed for the refineries to carry out a full-scale experimental demonstration with the Release Scenario flow rates to validate their analysis and modeling results. This phase shall be undertaken only if modeling and analysis show a creditable possibility that enhanced mitigation could meet the Benchmark.
3. Failure of 1 or 2 above shall mean all HF shall be removed from the refinery grounds within four years from the initial approval of Rule 1410.

D. Interim Enhanced Mitigation

1. To protect the public from HF releases in the interim, the refineries shall enhance their mitigation system as much as feasible as determined by the SCAQMD.
2. The refineries shall have a SCAQMD-approved emergency plan in place within six months, and then institute it, at their expense, to remedy the shocking lack of medicine and facilities to treat victims of a major HF release.
3. The refineries shall certify within six months, to the satisfaction of SCAQMD, that their operations are safe from a cyber-attack.*
4. The refineries shall demonstrate within six months that they have financial resources in place — through liability insurance, bonds, or corporate resources — to cover claims against them from 15,000 deaths (the estimated fatalities in the 1987 Bhopal, India catastrophe, which released a similar amount of toxic chemical found in one Torrance refinery settler tank). Bankruptcy is not an acceptable response.

* In their August 2019 assessment *Global Oil and Gas Cyber Threat Perspective*, leading industrial cybersecurity company Dragos, Inc. concludes "Oil and gas remains at high risk for a destructive loss-of-life cyberattack due to its political and economic impact and highly volatile processes."