PR 1410 Working Group Meeting #1

APRIL 19, 2017

TORRANCE, CALIFORNIA

Proposed Rule 1410 Working Group

- First Working Group meeting for Proposed Rule (PR) 1410
- Throughout rulemaking process, series of Working Group meetings – generally monthly
- Purpose is to provide an opportunity for stakeholders to participate in the rulemaking process
  - Stakeholders can provide input early to help shape staff's proposal
  - Roundtable approach to encourage a dialogue
  - Provides an opportunity to discuss technical details of the proposed rule
- For PR 1410, Working Group meetings will be held in the affected communities in the evening or at the SCAQMD Headquarters
- Working Group meetings are open to the public

Rule Making Process

- Working Group meetings - *includes all stakeholders such as industry representatives, environmental and community groups, and agencies*
- Public workshops/consultation meetings
- Environmental analysis pursuant to the California Environmental Quality Act (CEQA)
- Socioeconomic analysis
- Public Hearing for Governing Board to consider proposed rule

How Can You Participate/Stay Informed Throughout the Rulemaking Process

Working Group Meetings

Public Workshops/Consultation Meetings

Commenting
Written, Email or Call Staff Contacts

Schedule an Individual Meeting

SCAQMD Website – Proposed Rules
http://www.aqmd.gov/home/regulations/rules/proposed-rules

Investigative Hearings - April 1 & 8, 2017

- In February 2017, after a fire and a series of repeated problems at the Torrance Refinery, Chairman Burke asked for an investigative hearing
- Investigative hearing was led by SCAQMD's Refinery Committee (four Governing Board Members)
- Hearings were conducted on April 1 and 8 in the city of Torrance
  - April 1st included a variety of panels representing elected officials, government agencies, the refinery, and community representatives and some public comments
  - Topics included identifying alternative alkylation technologies, transitioning from HF to other alkylation technologies, monitoring, and mitigating
  - Hearing continued on April 8th for remaining public comments not heard on April 1st

General Summary of Public Participation

- Approximately 150 attendees on April 1st with 109 people submitting cards to comment
- Approximately 60 attendees on April 8th
- Over the two days, 58 people provided comments
- Comments generally covered:
    - Flaring
    - Use of Modified HF
    - Overall safety
    - Monitoring
    - Community alerts
    - Jobs

Key Public Comments Received During SCAQMD Investigative Hearing Related to Proposed Rule 1410

- Concerns with potential Hydrogen Fluoride (HF) release and impact to nearby communities
- Safer alternatives available but some new potential technologies not widely used yet
- Refinery emergency community communication (e.g., alert system, notification process, disaster drill)
- Uncertainty as to what to do if accidental release
- Effectiveness of Modified HF (MHF) as mitigation method in preventing vapor cloud
- Need for more monitoring and availability of data
- Safety mechanisms (e.g., barriers, water cannons) in place at refineries
- Staff highly trained in safety protocols
- HF in use at Torrance since 1966 and no release past the fence line
- Keep refinery in business

Hydrogen Fluoride (HF)

- HF is a chemical compound used in petroleum alkylation
- The product, alkylate is used for high octane gasoline for “anti-knock” properties
- Upon contact with moisture, HF converts to hydrofluoric acid, which is highly corrosive and toxic
- Adverse impacts from HF release:
  - National Fire Protection Association (NFPA) Rating – Health of 4 (potentially lethal)
  - U.S. Chemical Safety Board – severe damage to skin, respiratory system, and bones
  - National Research Council – severe irritant to the eyes, skin and nasal passages
- Upon release, the acid vaporizes and forms a toxic cloud that can travel close to the ground with potentially lethal concentrations

Rule 1410

- In 1991, SCAQMD Governing Board adopted Rule 1410 to phase out HF by January 1, 1998 with interim control measures
- Ultramar Refinery (Valero) filed a lawsuit challenging the SCAQMD's authority to adopt the rule and compliance with CEQA
  - The SCAQMD's authority to adopt the rule was upheld (next slide)
  - A procedural error in circulating the CEQA document resulted in the court invalidating the rule
- Rule was not further pursued because:
  - Mobile Refinery (Torrance Refinery) entered into a court consent decree that required the phase out of HF by 1997 but permitted to commit to modified HF by December 31, 1994 only if demonstrated that it would not form a dense vapor cloud upon release
  - SCAQMD signed an MOU with Ultramar to phase out pure HF by 2005

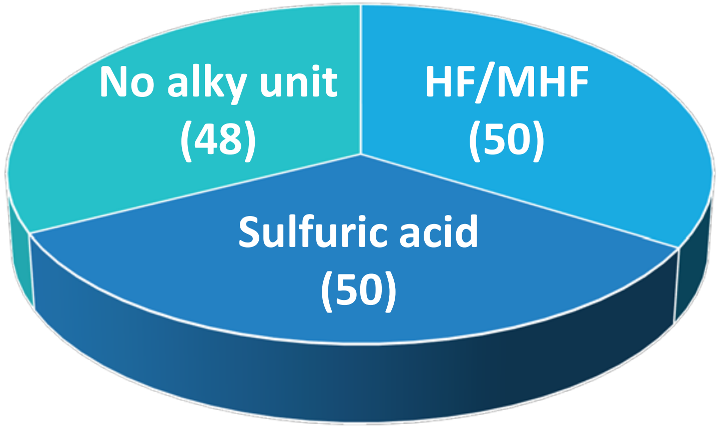
SCAQMD's Regulatory Authority to Regulate Hydrogen Fluoride (HF)

- "[L]ocal and regional authorities have the primary responsibility for control of air pollution from all sources, other than emissions from motor vehicles." California Health and Safety Code § 40000.
- "[R]ules and regulations may . . . provide for the prevention and abatement of air pollution episodes which, at intervals, cause discomfort or health risks to, or damage to property of, a significant number of persons or class of persons." California Health and Safety Code § 40001(b).
- SCAQMD has the authority to adopt a rule to phase out the use of HF. *Ultramar, Inc. v. South Coast Air Quality Management District*, 17 Cal. App. 4th 706-12 (1993). "[T]he Legislature clearly intended to vest AQMD with the authority to adopt preemptive measures designed to prevent air pollution episodes . . .." *Id.* at 707.

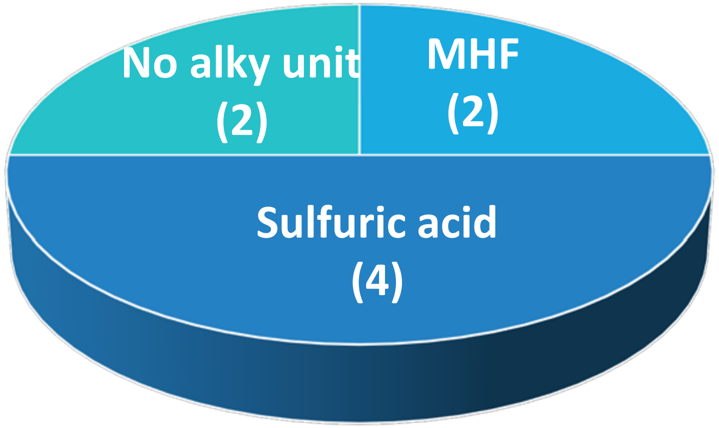
Petroleum Refineries Operation

- HF/MHF is used in their alkylation unit to make high octane gasoline

Refineries in the US (148 total)



Refineries in the Basin (8 total)



Use of Hydrogen Fluoride at Refineries in the South Coast Air Basin

- Currently two refineries that use MHF
  - Torrance Refining Company
    - 88 years operation
    - 151,300 bpd crude oil and 24,200 bpd alkylate production (~16% of total capacity)
  - Valero Wilmington Refinery
    - 48 years operation
    - 85,000 bpd crude oil and 22,000 bpd alkylate production (~26% of total capacity)
- Other refineries in the Basin use sulfuric acid in their alkylation unit

In-Basin Alkylate Production Capacity[1]

Refinery Name	Crude Oil Operating Capacity (bpd)	Alkylate Production Capacity (bpd)	% of total capacity
Chevron El Segundo Refinery	269,000	32,200	12
Tesoro Carson Refinery	256,830	17,000	7
Torrance Refining Company	151,300	24,200	16
Phillips 66 Wilmington Refinery	139,000	16,000	12
Tesoro Wilmington Refinery	98,340	12,500	13
Valero Wilmington Refinery	85,000	22,000	26

[1] As of January 1, 2016 (AFPM US Refining and Storage Capacity Report)

* There are 2 other refineries in the Basin that have no alky units

Technical Study

- SCAQMD contracted with Norton Engineering in 2016 to evaluate 8 alkylation technologies as an alternative to HF
- 4 alkylation technologies currently in use:
  - Modified HF – *use of an additive as a safety enhancement for existing HF alkylation units*
  - Sulfuric Acid – *well established*
  - Solid Acid – *used in one China location starting in 2015*
  - Ionic Liquid – *successful pilot program in Utah, and seeking to retrofit operation starting this year*
- 4 alkylation technologies not commercially viable at this point
  - Solid Onium Poly – *add polymer to reduce vapor pressure*
  - Fixed Bed – *modified reaction process but not in use*
  - Slurry Catalyst – *modified reaction process but not in use*
  - Soluble Catalyst – *no literature references found, not in use*

Modified HF Alkylation

- Reduced Volatility Alkylation Process (ReVAP) that was developed jointly by Mobil and Phillips in 1990 and successfully commercialized in 1997
- Employed at Torrance and Valero Wilmington refineries
- Use of a proprietary additive for existing HF alkylation units
  - Additive is blended with the HF acid
  - ReVAP was developed to suppress HF aerosol formation at ambient conditions and thus reduce the offsite impact from a potential leak
- Typical Unit Composition – 80 wt% HF, 7 wt% additive, 3 wt% acid soluble oil, 3 wt% water, 7 wt% hydrocarbons (*TRC Refinery*)
- Lower MHF consumption (4 truck trips/month for a 25,000 bpd alkylation unit) than sulfuric acid (1,300 truck trips/month)

“Enhanced” Modified HF Alkylation

- MHF aerosol formation and dispersion are dependent on release conditions, additive concentration, mitigation measures, and ambient conditions (e.g., wind direction and speed)
- Control effectiveness increases with more additive coupled with mitigation:
  - water deluge system
  - physical barriers
  - HF detectors and analyzers
  - acid evacuation system
  - leak detection paint
  - laser sensors
  - alarms
  - trained workforce

Sulfuric Acid Alkylation

- The most mature technology with widespread use and commercialization
  - Additional reactor and settler vessels would be required
  - Significant increase in acid consumption and transportation (up to **1,300 truck trips/month** for a 25k bpd alkylation unit)
  - Onsite acid regeneration would reduce transportation but increase plant space needed
  - Transportation and regeneration create criteria pollutant emissions
  - Higher boiling point and lower volatility than HF
  - Higher operating costs than MHF units due to higher acid and power consumption
  - Concentrated sulfuric acid is a corrosive and hazardous material, and can cause serious burns to exposed tissue
  - Controls to contain acid leak must be in place
- Conversion cost estimates
  - Norton Study: ~$120 million (for a 25,000 bpd alkylation unit; Sulfuric acid regeneration plant: ~$45 million)
  - UK refinery: $120 million (for a 31,200 bpd alkylation unit; without regeneration)
  - Industry perspective: multiple times higher

Solid Acid Alkylation

- Relatively new technology – requires new reactor to be installed
  - U.K. refinery – retrofitted a 26,000 bpd HF alkylation unit in 2003
  - China chemical plant – a new 2,700 bpd alkylation unit in December 2015
- Solid acid catalyst
  - A fixed bed of zeolite with an active species impregnated into the crystalline structure
  - Consists of a noble metal (e.g., platinum or palladium)
  - Eliminates the hazards of acid handling, transportation, and storage
  - Does not form a vapor or aerosol when exposed to the atmosphere
  - A significant catalyst cost; licensor may offer lease option
  - In-situ regeneration and replace after its useful life
- Promising but in early stages of commercialization
- Conversion cost estimates (for a 25,000 bpd alkylation unit)
  - Install: ~$25 million and Capital cost for catalyst: ~$95 million (*Norton Study*)
  - Install and capital: $160 million (*Glyn Jenkins, Bastleford Engineering and Consulting, UK*)

Ionic Liquid (IL) Alkylation

- Relatively new technology
  - Requires new reactor to be installed
- Commercialization status
  - Utah Chevron (UOP ISOALKY™) – *retrofit of a 4,500 bpd HF alkylation unit commencing this year*
  - China Deyang Chemical Co. (CUP Ionikylation) – *commissioned a new 2,000 bpd alkylation unit since 2013*
  - China PetroChina Co. (CUP Ionikylation) – *retrofitted a 65,000 tpy sulfuric acid alkylation unit by 2006*
- Ionic liquid catalyst
  - Composite-IL is an ionic, salt-like material that exists in the liquid phase
  - Eliminates the hazard of acid handling, transportation, and storage
  - Has negligible vapor formation
  - Moisture sensitive; may become more corrosive or unstable if exposed to water
  - Onsite regeneration is possible
- Conversion cost estimates
  - Utah Chevron: ~$87 million install (for a 4,500 bpd alkylation unit)

Other Alternatives to Use of HF

- Purchase alkylate
  - ❑ Could be considered from suppliers and manufacturers (e.g., in Asia, U.S., and Europe)
  - ❑ Expensive but viable alternative
- Choose to not refine high octane fuel?
- Other?

Summary

	Advantages	Potential Disadvantages	Examples	Cost
Modified HF	• Commercialized since 1990's • More efficient than sulfuric acid	• Effectiveness uncertainty • Need active mitigation system	• Torrance • Valero	n/a
Sulfuric Acid	• Widely used • Lower volatility than HF	• Significant increase in truck trips (criteria pollutants, risk of upset) or need to regenerate/pipeline • Still need mitigation system • Would require new equipment	• 50 US refineries (incl. the other California refineries)	~$120 million
Solid Acid	• Minimal hazardous risk or safety concern • No need to store or transport new materials	• Would require new equipment • Expensive periodic catalyst replacement (*but metals can be recycled*)	• U.K. refinery • China chemical plant	$120–160 million
Ionic Liquid	• Minimal hazardous risk or safety concern	• Would require new equipment • Corrosive if exposed to water	• Chevron (Utah) • China chemical plant • China refinery	~$87 million

Recent Legislative Efforts

Introduced by Assemblymember Al Muratsuchi

- **AB 1645: a ban on the use of hydrofluoric acid at refineries**
- AB 1646: a publicly accessible risk management plan which includes notification to residents for emergencies (reverse 911, text, email, PSAs, etc.) and public alerts (alarms, sirens, etc.)
- AB 1647: air quality monitors at both fence line and in the community; public data from the monitors in real-time
- AB 1648: increase in the number of refinery inspectors at Cal/OSHA
- AB 1649: codify the existing Interagency Task Force to ensure the Task Force created by Governor Brown will continue after 2018

Preliminary Thoughts for Rule Structure

- Use of HF or MHF – possible approaches
  - Performance-based standard (i.e., setting a level of performance, such as vapor pressure)
  - Ban on HF/MHF
  - Maintain technology neutral policy
- Implementation schedule
  - Progressive phase out
  - Definitive date
  - Timing
    - Engineering, design, purchase, commissioning, etc.
    - Operational interruption to install
    - Consider transition period for newer technologies, with additional interim measures
- Need for interim measures/safeguards
- Need for increments of progress/milestones

CEQA Process

- Legal requirement
- Public disclosure with mandatory minimum public review and comment periods:
  - Notice of Preparation/Initial Study – 30 day comment period
  - Draft Environmental Impact Report – 45 day comment period
- Requires detailed project description and Scoping Meeting
  - Need to analyze a variety of potential technologies
  - Preparation of CEQA document will be substantial
- Most, if not all, environmental impacts (17 topics) potentially significant
  - Need to evaluate impacts from construction, operation, maintenance
  - Impacts to air quality, hazards, transportation, solid waste, energy, etc.
- Requirement to respond to all comments received

Socioeconomic Impacts Analysis

- Need for detailed project description and Scoping Meeting
- Staff anticipates development of the socioeconomic impact analysis will be substantial
- Comprehensive analysis
  - Production/gasoline market impact
  - Job impact
- Cost impacts
  - Demolition, construction, and installation
  - Capital (equipment, catalyst regeneration, if applicable, pipeline) and operating & maintenance
  - Estimates may vary depending on source (*e.g., Norton Engineering study*)

Schedule

Activity	Targeted Date
PR 1410 Working Group Meeting #1 (Torrance)	April 19, 2017
Staff Site Visits	April–May 2017
PR 1410 Working Group Meeting #2	June 2017
Update to SCAQMD Refinery Committee	June/July 2017
Release of CEQA Notice of Preparation/Initial Study	July 2017
Public Workshops/CEQA Scoping Meeting	July–August 2017
PR 1410 Working Group Meeting #3 (SCAQMD)	September 2017
Release of CEQA Draft EIR	September 2017
SCAQMD Refinery Committee Meeting	October/November 2017
Governing Board consideration of PR 1410	December 2017

NOTE: Additional Working Group meetings as needed

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