

Status Update on PR1410 – Hydrogen Fluoride Storage and Use at Petroleum Refineries



SCAQMD REFINERY COMMITTEE

April 28, 2018
Torrance, California

SUMMARY OF JANUARY 20TH 2018 REFINERY COMMITTEE MEETING

- SCAQMD staff presented initial rule concepts
- Approximately 100 speakers testified with almost an equal number of people supporting or opposing a ban of MHF
- Refinery Committee direction to staff:
 - ❑ Return to the Refinery Committee in 75 days
 - ❑ Work with key stakeholders to reach consensus
 - ❑ 8 year implementation timeframe is too long
 - ❑ If consensus cannot be reached, the Refinery Committee will direct staff on how to proceed

SCAQMD MEETINGS SINCE THE LAST REFINERY COMMITTEE

Torrance Refining Company (TORC)

SCAQMD staff
February 7, 2018

SCAQMD technical staff
March 7, 2018

SCAQMD staff
April 5, 2018

Valero

SCAQMD staff
February 1, 2018

SCAQMD staff
March 8, 2018

Dr. Parker and SCAQMD
staff April 4, 2018

Torrance Refinery Action Alliance

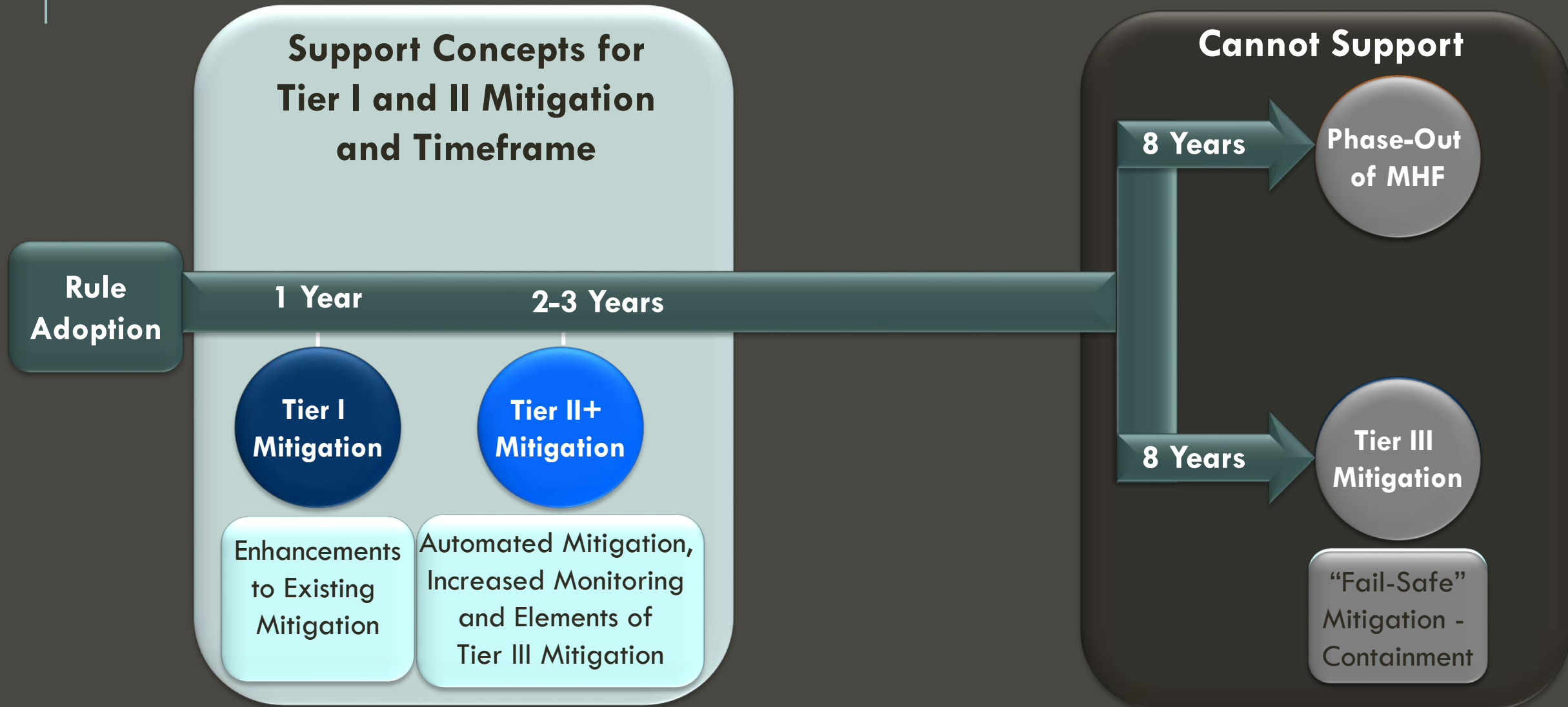
SCAQMD staff
March 23, 2018

Dr. Parker and SCAQMD
staff April 4, 2018

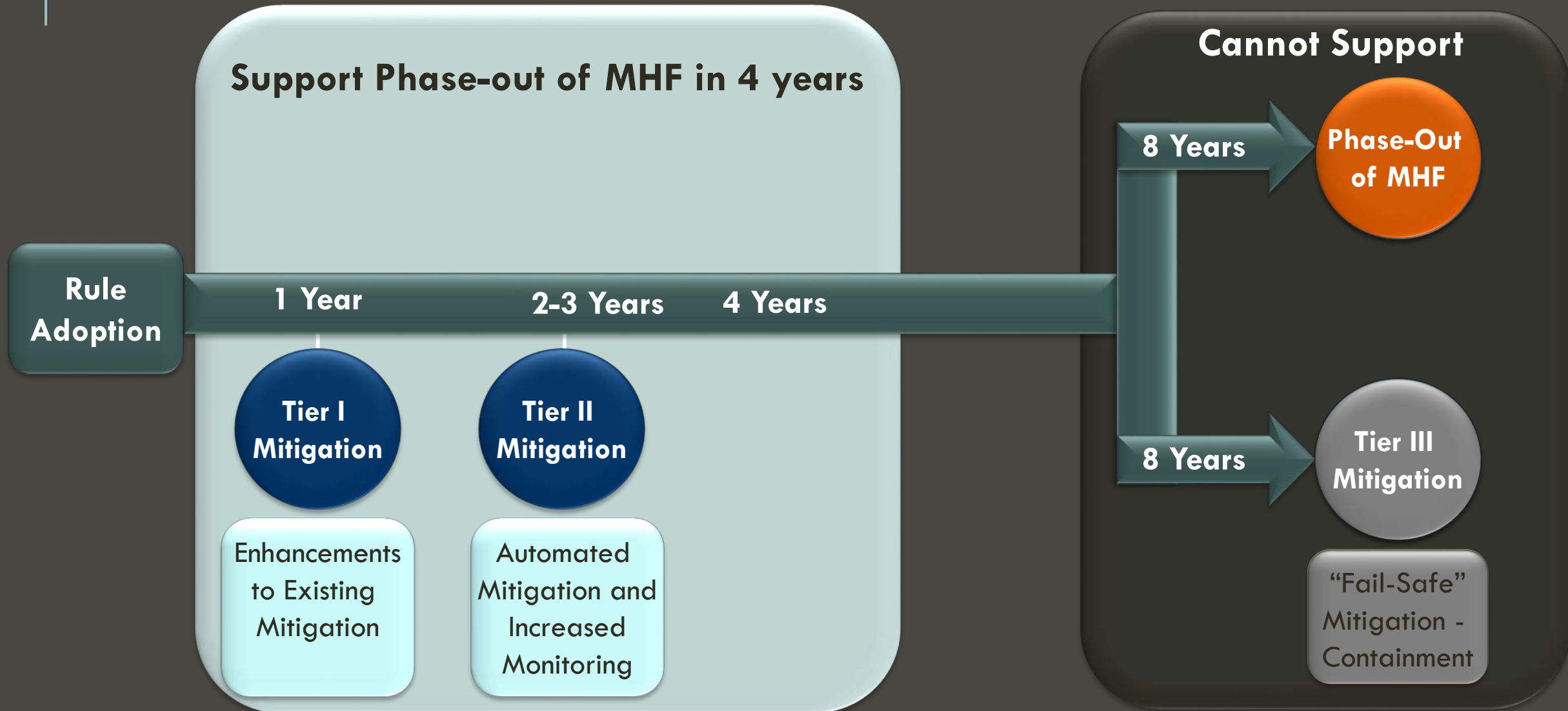
SUMMARY OF STAFF'S INITIAL RULE CONCEPT



REFINERIES' RESPONSE TO INITIAL RULE CONCEPT



TRAA'S RESPONSE TO INITIAL RULE CONCEPT



KEY ISSUE #1
REFINERIES ASSERT THEY
CANNOT CONVERT TO
EMERGING TECHNOLOGIES
BECAUSE THEY ARE NOT
COMMERCIALY AVAILABLE
AND PROVEN

RESPONSE:

- Sulfuric acid alkylation is commercially available
- Further demonstration of emerging technologies at scale is desirable
- Proposed Rule 1410 can include phase-out with:
 - Technology assessment
 - Participation of refineries in demonstration projects

STATUS OF TECHNOLOGIES

- Sulfuric acid alkylation currently available
 - ❑ Approximately 50 refineries in the nation use sulfuric acid alkylation units
 - ❑ With the exception of TORC and Valero, all other California refineries use sulfuric acid
 - ❑ Valero's refineries in Louisiana and Texas are completing installation of new sulfuric acid alkylation units
- Emerging technologies
 - ❑ Solid acid catalyst alkylation being used at a petrochemical plant in China – Application is 2,700 bpd in 2015
 - ❑ Ionic liquid catalyst at Chevron Salt Lake City refinery in Utah – 5,000 bpd HF Alkylation conversion 2017 to 2020

KEY ISSUE #2
REFINERIES CANNOT
SUPPORT A PHASE-OUT
BECAUSE CONVERSION TO
SULFURIC ACID WILL NOT
GENERATE ANY RETURN ON
INVESTMENT

RESPONSE:

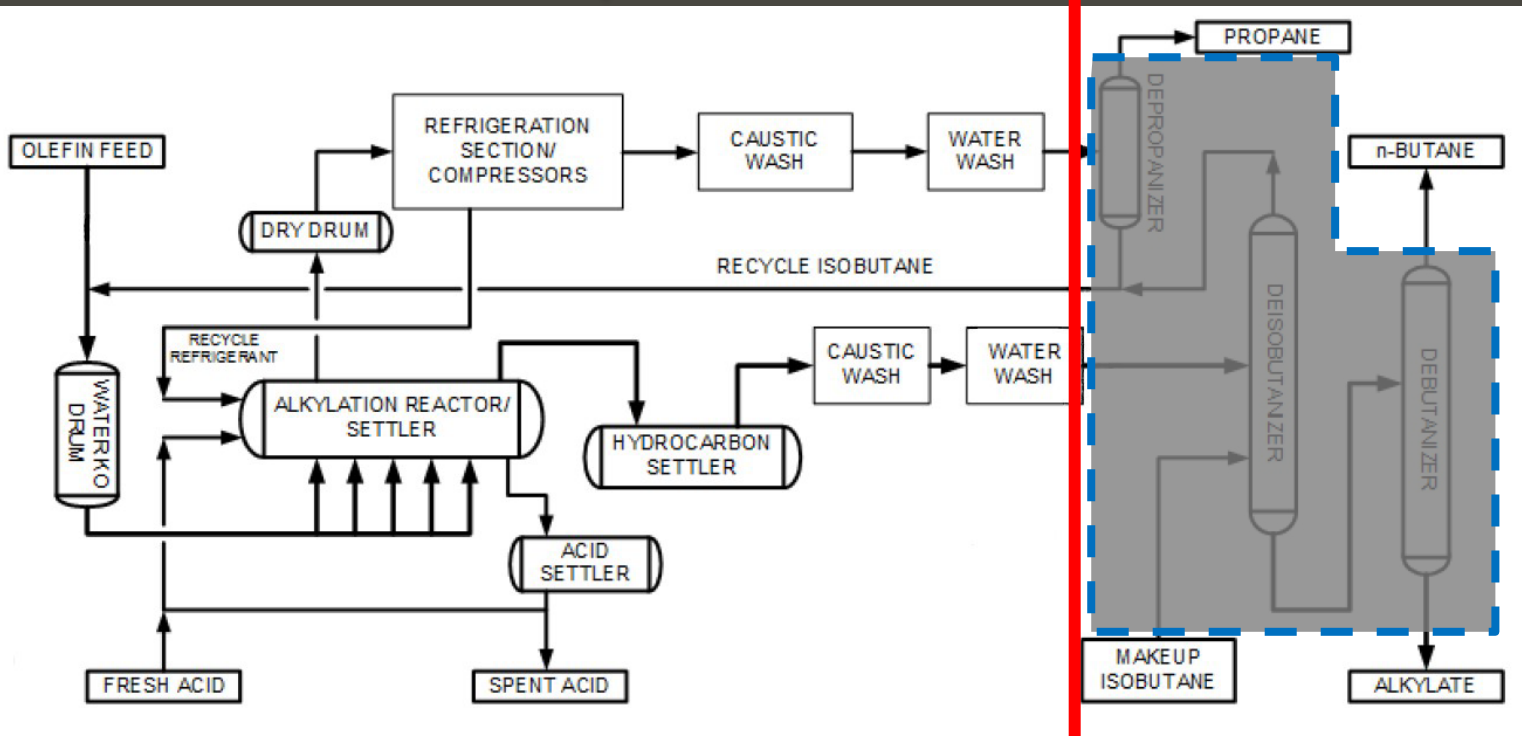
- In addition to capital and operating costs, the decision to phase-out MHF should consider public safety and health effects
- Difficult to quantify the financial impact of the risk associated with an off-site release of MHF
- TORC's Burns and McDonnell study¹ estimated the conversion cost of a sulfuric acid alkylation unit of \$600 million with an additional \$300 million for acid regeneration

¹ Burns and McDonnell - Alkylation Study & Estimate, 2017

SULFURIC ACID ALKYLATION COST ESTIMATES

Alkylation Unit

Post Processing



- Burns & McDonnell estimate included alkylation unit and post processing equipment
Estimated Cost: **\$600 Million**
- Post processing replacement may not be needed for conversion¹
Staff Estimated Cost: **\$300 Million²**
- Installation at Valero more challenging than TORC due to space constraints

¹ Conversion of a HF Alkylation unit to a Sulfuric Acid Alkylation unit must include a thorough review of the entire unit in order to determine if any equipment can be re-used. It is expected that the Fractionation section of the HF Alkylation Unit may be able to be re-used, but further evaluation, especially of metallurgy requirements between the two technologies would need to be conducted (Norton Engineering, Alkylation Technology Study, 2016).

² Based on cost of post-processing equipment included in the Burns & McDonnell Alkylation Study & Estimate, 2017.

POTENTIAL BENEFIT OF NEW TAX CUT AND JOBS ACT

- New Tax Cut and Jobs Act – “full expensing” provision allows the deduction of 100% cost of investments from taxable income in every year for up to five years
- Estimated cost of sulfuric acid alkylation approximately \$300 million dollars – Amortized over 5 years:

	Millions of Dollars	
	Capital Expenses	Tax Savings
Annual Average	~\$70	~\$15
Five-Year Total	~\$350	~\$75

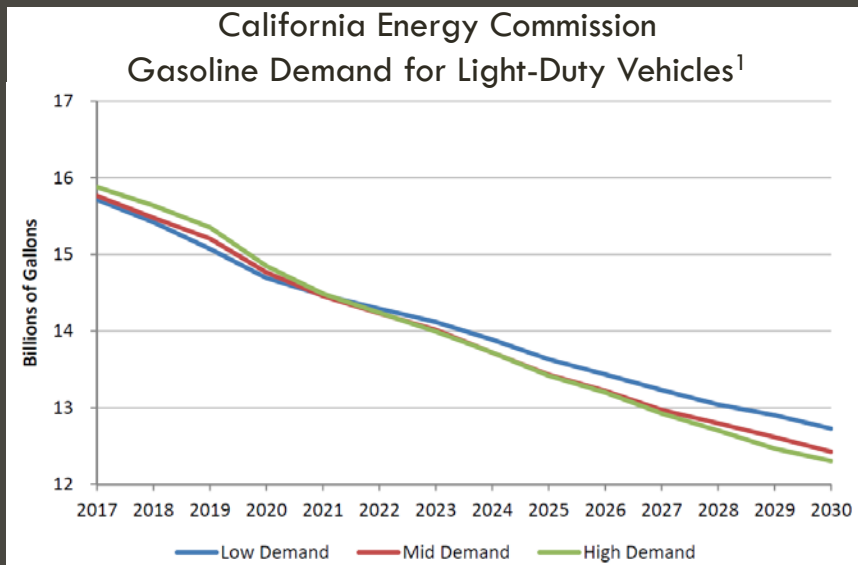
- TORC’s most recent turnaround cost was more than \$250 million – Extraordinary turnaround that included the majority of its refinery process units

KEY ISSUE #3

A RULE THAT AFFECTS ONLY 2 REFINERIES GIVES A MARKET ADVANTAGE TO THE OTHER REFINERIES AND WILL INCREASE GASOLINE PRICES

RESPONSE:

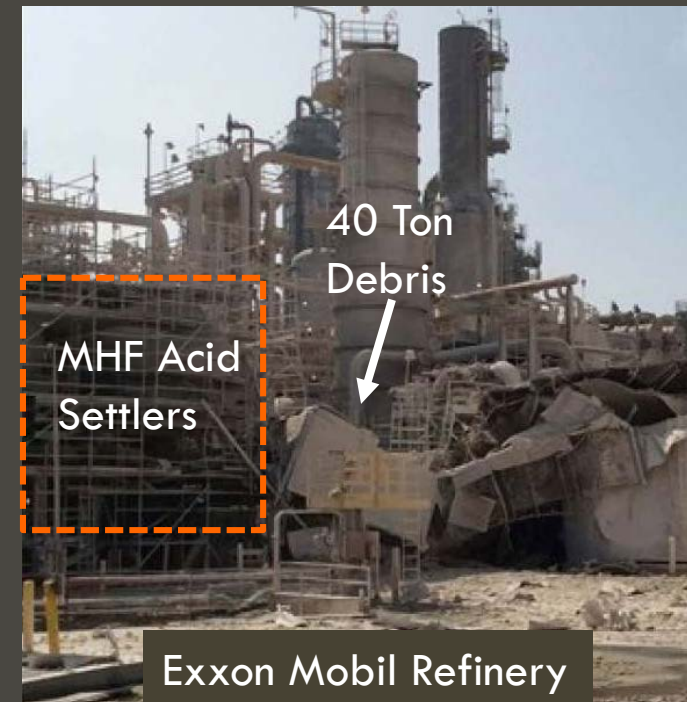
- Any impacts would be temporary
- Can incorporate a staggered implementation schedule to reduce supply impacts, if any
- Planned phase-out is different than an unplanned shutdown – less disruptive
 - Refineries can stockpile or purchase alkylate to minimize downtime
- Future California gasoline demand projected to decrease¹ minimizing potential supply impacts, if any



¹ California Energy Commission, Transportation Energy Demand Forecast 2018-2030, November 2017

ACCIDENTS HAPPEN

- “Near-miss” accident at Exxon Mobil in 2015¹
 - ❑ 40 ton piece of electrostatic precipitator landed within 5 feet of the MHF acid settler
- Sulfuric acid alkylation accident at Tesoro Martinez in 2014²
 - ❑ Released 84,000 pounds of sulfuric acid injured two employees
- HF Release at Marathon Petroleum Corporation, Texas City in 1987³
 - ❑ Vapors emitted under pressure for over 2 hours
 - ❑ More than 1,000 people injured
- Explosion at Valero Texas City April 19, 2018⁴
 - ❑ Early reports stated fire erupted in refinery's depropanizer tower
 - ❑ Uncertain at this time if HF was released from alkylation unit



¹ Chemical Safety Board - ExxonMobil Torrance Refinery Investigation Report, 2017

² Chemical Safety Board - Tesoro Martinez Refinery Process Safety Culture Case Study, 2016

³ Texas City Journal; Where a Chemical Leak Seems an Acceptable Risk, 1987

⁴ San Antonio Business Journal; Fire at Valero's Texas City Refinery Remains Under Investigation, 2018

TOP THREE U.S. REFINERIES USING HF/MHF ALKYLATION IN DENSELY POPULATED AREAS

#1

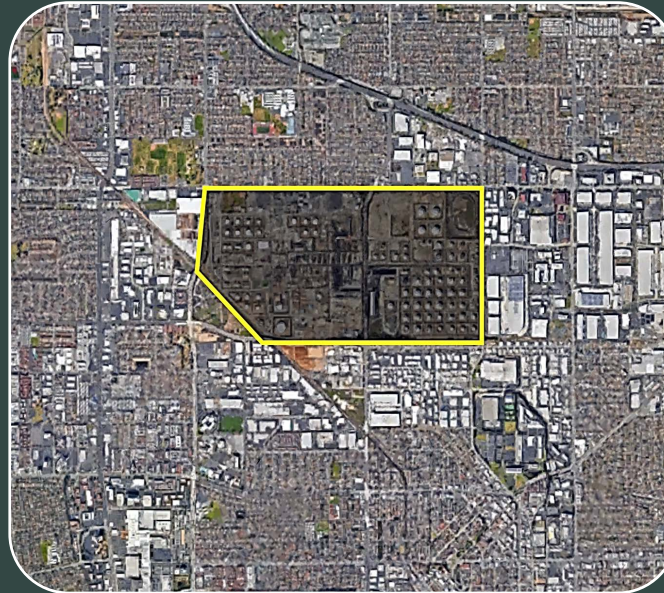
Philadelphia Energy Solutions



Alkylate: 26,500 BPD
298,000 People within 3 Miles
Nearest Residence ~3,200 Feet

#2

Torrance Refining Company



Alkylate: 25,500 BPD
245,000 People within 3 Miles
Nearest Residence 1,500 Feet

#3

Valero Wilmington Refinery



Alkylate: 20,000 BPD
153,000 People within 3 Miles
Nearest Residence ~4,100 Feet

RELATIVE RISK OF HF AND MHF

- MHF modestly increases rainout - HF exposure would still occur
- Material Safety Datasheets for HF and MHF list the same hazards

Honeywell

Material Safety Data Sheet

MODIFIED HYDROFLUORIC ACID

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Modified Hydrofluoric Acid

OTHER/GENERIC NAMES: MHF, Modified HF, Modified Hydrogen Fluoride, Modified HF Acid, Acidized HF

PRODUCT USE: Alkylation Catalyst

MANUFACTURER: Honeywell International
Industrial Products
101 Columbia Road
Box 1053
Morristown, New Jersey 07962-1053

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-4:30pm EST)
HF Technical Service Department
800-422-5902
Or visit the Honeywell HF website:
<http://www.HFacid.com>

IN CASE OF EMERGENCY CALL:
For Medical Emergencies
(24 Hour/Day, 7 Days/Week)
800-498-5701
For Transportation Emergencies:
800-424-9300 (CHEMTREC for US)
613-996-6666 (CANUTEC for Canada)

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
Hydrofluoric Acid	7664-39-3	85
Sulfuric Acid	126-33-0	15

Trace impurities and additional material names not listed above may also appear in the Regulatory Information Section 15 towards the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Clear, colorless, corrosive fuming liquid with an extremely acrid odor. Forms dense white vapor clouds if released. Both liquid and vapor can cause severe burns to all parts of the body. Specialized medical treatment is required for all exposures.

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CURRENT STAFF RECOMMENDATION FOR TWO POSSIBLE RULE APPROACHES

- Option A: Tier 1 + Mitigation with Phase-out in 5 years
 - ❑ “Tier 1 +” Mitigation: Enhancements to existing and some automated mitigation implemented within 1 year
 - ❑ Phase-out MHF no longer than 5 years
- Option B: Tier 1 and 2 Mitigation with Longer Phase-out
 - ❑ Tier 1 Mitigation: Enhancements to existing mitigation implemented within 1 year
 - ❑ Tier 2 Mitigation: Automated mitigation implemented within 2-3 years
 - ❑ Technology assessment in 2 years
 - ❑ Phase-out MHF no longer than 6 years
 - ❑ If technology assessment concludes additional time needed, phase-out MHF no longer than 8 years

TWO POSSIBLE RULE CONCEPTS TO CONSIDER

Option A



Option B

