

**AVAILABLE NON-DISASTER ALKYLATION CATALYSTS -- ALTERNATIVES  
TO DISASTER-POTENTIAL HYDROGEN FLUORIDE [HF] -- NOW USED IN 50 US OIL REFINERIES  
May 2018**

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**BEST SUCCINCT OVERVIEWS OF THE WELL-KNOWN HF TOXIC GAS DISASTER RISKS**

CPI series "Fueling Fears" 2011-2014 on HF /refinery risks:

<https://www.publicintegrity.org/2011/02/24/2118/use-toxic-acid-puts-millions-risk> Fueling Fears

<https://www.publicintegrity.org/environment/health-and-safety/fueling-fears>

USW oil workers union study: "A Risk Too Great" [2013] <https://www.prnewswire.com/news-releases/usw-study-warns-public-about-dangers-of-hydrofluoric-acid-use-in-refinery-alkylation-process-to-produce-clean-burning-gasoline-203247471.html>

History channel Mega disasters Toxic gas cloud url YouTube 43mins Koopman 2008 HF refineries

<https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=mega+disasters+toxic+cloud>

HF Needless Risk US PIRG Aug 2005 30pp

[http://www.uspirg.org/sites/pirg/files/reports/Needless\\_Risk\\_USPIRG.pdf](http://www.uspirg.org/sites/pirg/files/reports/Needless_Risk_USPIRG.pdf)

Duluth Mayor Larson's statement demanding Husky conversion from HF 5 1 18

<http://duluthmn.gov/media/WebSubscriptions/31/20180501-31-4958.pdf>

**The US Chemical Safety Board [CSB] has investigated serious refinery accidents caused by facility carelessness and voiced concern at near-miss disasters at refineries using HF for alkylation. 50 US refineries still use HF, a few use Modified HF, 50 others use non-disaster sulfuric acid, 50 others do not use alkylation.**

- MODIFIED HF [MHF] IS THE PREFERRED [CHEAPEST] ALTERNATIVE FOR REFINERIES TO MEET DEMANDS FOR NON-DISASTER ALTERNATIVES TO HF. Only it is not safe. The technical advisory board of the Torrance Refinery Action Alliance says that MHF reduces the worst case offsite cloud by only perhaps 30%, and the Torrance refinery and city officials have lied about what percentage of pure HF remains in the MHF being used. <https://www.dailybreeze.com/2016/07/20/south-bay-lawmaker-activists-claim-aqmd-study-of-toxic-acid-used-at-torrance-refinery-is-flawed/>

**Refinery equipment conversions to non-disaster alkylation alternatives vary in cost:**

SULFURIC ACID CATALYST HAS FOR DECADES BEEN USED FOR ALKYLATION IN 50 US OIL REFINERIES. Contrary to oil industry assertions, research has shown that it cannot produce an offsite toxic gas cloud and HF refinery releases can.

[http://www.dupont.com/content/dam/dupont/products-and-services/consulting-services-and-process-technologies/consulting-services-and-process-technologies-landing/documents/H2SO4\\_vs.\\_HF.pdf](http://www.dupont.com/content/dam/dupont/products-and-services/consulting-services-and-process-technologies/consulting-services-and-process-technologies-landing/documents/H2SO4_vs._HF.pdf)

DuPont™ STRATCO® ALKYSAFE® STRATCO® “has determined that both Phillips, and UOP designed HF alkylation units can be converted and expanded into H2SO4 alkylation units with minimum capital expense. Although the converted units will not employ STRATCO® Contactor reactors, the alkylate octane will be higher than that of the original HF units in many cases.”  
[http://www2.dupont.com/Clean\\_Technologies/en\\_US/assets/downloads/Alkysafe.pdf](http://www2.dupont.com/Clean_Technologies/en_US/assets/downloads/Alkysafe.pdf)

- SOLID ACID CATALYST AlkyClean® Solid Acid Catalyst Alkylation Technology McDermott and Albemarle <https://www.cbi.com/getattachment/91e3061d-6e77-46fd-9b5b-c2deaf8d04c7/AlkyClean-Solid-Acid-Catalyst-Alkylation-Technolo.aspx> Used in Shandong China <https://www.prnewswire.com/news-releases/cbis-alkyclean-technology-wins-kirkpatrick-chemical-engineering-award-300548813.html> Kashima Oil opts for UOP's InAlk process 03 April 2000 00:00 Source:ICIS Chemical Business <https://www.icis.com/resources/news/2000/04/03/110300/kashima-oil-opts-for-uop-s-inalk-process/>
- LIQUID IONIC CATALYST Award-winning alkylation risk reduction technology: [https://www.uop.com/?press\\_release=honeywell-uop-and-chevron-win-2017-platts-breakthrough-solution-award-for-ionic-liquids-alkylation-technology](https://www.uop.com/?press_release=honeywell-uop-and-chevron-win-2017-platts-breakthrough-solution-award-for-ionic-liquids-alkylation-technology) - for usage contact John Simley 847-391-2278 [https://www.uop.com/?press\\_release=honeywell-uop-introduces-ionic-liquids](https://www.uop.com/?press_release=honeywell-uop-introduces-ionic-liquids)

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#### **MORE RESOURCES: RECENT CONCERNS THAT US REFINERY EXPLOSIONS WERE NEAR-DISASTERS FOR HF CLOUD RELEASE FROM NEARBY HF TANKS**

US CSB says Torrance explosion could have released HF cloud disaster CBS News 9 30 15

<https://www.cbsnews.com/news/exxonmobil-explosion-could-have-been-much-worse-reports-say/>

<https://www.csb.gov/exxonmobil-refinery-explosion-/>

[https://www.csb.gov/assets/1/20/exxonmobil\\_presentation\\_2016.01.pdf?15595](https://www.csb.gov/assets/1/20/exxonmobil_presentation_2016.01.pdf?15595)

How catalysts in oil refineries work: animated 7 min video from US CSB re 2015 Torrance CA ExxonMobil Refinery accident <https://www.csb.gov/exxonmobil-refinery-explosion-/>

HF Torrance fight 100k doorhangers Truth Sci Adv Comm TRAA 11 28 17 Press Telegram

<http://www.presstelegram.com/2017/11/28/who-is-telling-the-truth-about-the-torrance-refinery/>

HF Husky Superior HF risk is not acceptable Mayors push to end HF use St Paul Pioneer Press

<http://www.startribune.com/legislators-push-to-end-st-paul-park-refinery-s-use-of-highly-toxic-chemical/481980541/> 5 1 18

HF WI Superior Husky explosions KBJR6 news TV Alfini 4 28 18

<http://www.kbjr6.com/story/38065467/hydrogen-fluoride-tank-spared-in-refinery-fire-deadly-chemical-concerns-linger> Hydrogen Fluoride tank spared in refinery fire, deadly chemical concerns linger

#### **APPENDIX: Sulfuric Acid is the predominant alkylation catalyst in worldwide use:**

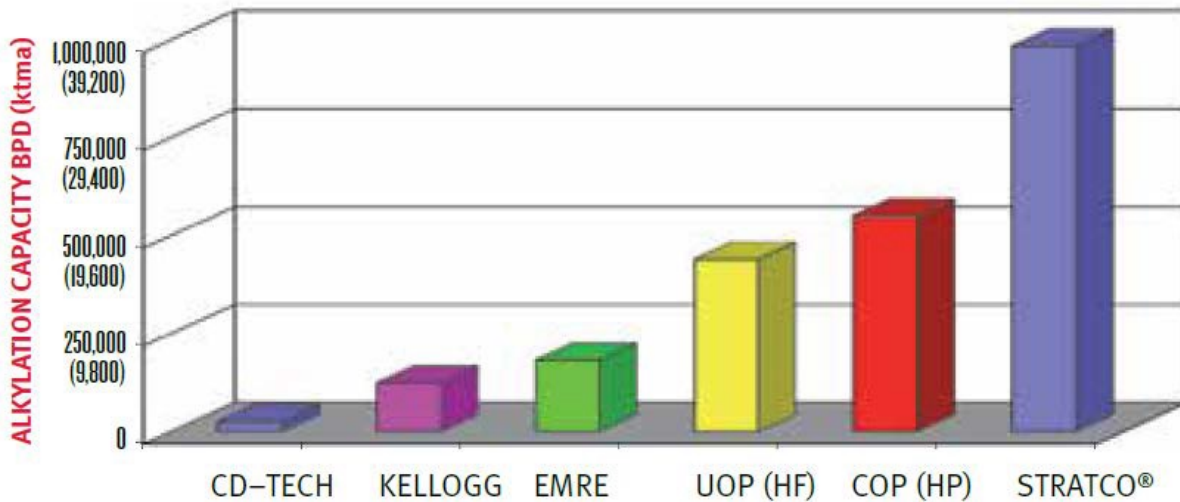
CA Energy Commission slide presentation: "Transportation Fuel Issues"

[http://www.energy.ca.gov/2017\\_energypolicy/documents/2017-07-06\\_workshop/2017-07-06\\_presentations.php](http://www.energy.ca.gov/2017_energypolicy/documents/2017-07-06_workshop/2017-07-06_presentations.php)

### Global Alkylation Technology & Capacity

Note: Alkylation technology provider firms UOP & COP use HF  
Other technology providers including STRATCO use sulfuric acid -

### 2014 WORLDWIDE ALKYLATION CAPACITY



Source: DuPont7/6/2017

- For refineries using HF, national experts say a potential terrorism attack is a major concern: <https://www.amazon.com/America-Vulnerable-Government-Failing-Terrorism/dp/0060571292>

"Terror's Next Target?" 11 19 07 US News and World Report by Stephen Flynn

*"In October 1987, a crane accident sent more than 40,000 pounds of hydrofluoric acid into the area around the Marathon Petroleum Plant in Texas City, Texas—the largest known hydrofluoric acid release. As a result of the release:*

*o More than 4,000 people were forced to evacuate their homes*

*o More than 1,000 residents were treated for eye and respiratory problems*

*o Almost 100 people were admitted to the hospital*

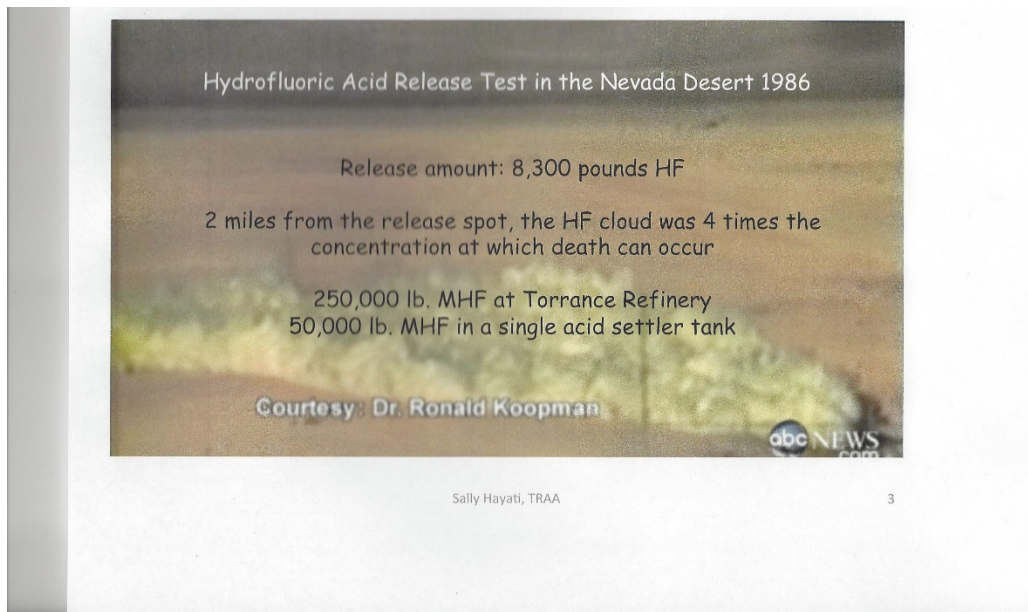
*o The day after the release, within 2 miles of the plant, foliage was brown, car windows were etched and car paint was streaked.*

*o A long-term study found that some people exposed to hydrofluoric acid still reported medical issues two years after their exposure to hydrofluoric acid, mostly breathing and eye problems."*

Experts pointed out the lucky aspect of the Texas City release: HF jetted directly upward, so the cloud jumped over the nearest at-risk neighborhood downwind. The local officials, uninformed about the 1986 HF release field test [below], botched the emergency response evacuations, ordering residents to a community center 1.5 miles directly downwind. The cloud soon reached it and chased them out.

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The dense gas cloud behavior of an HF refinery release has been known within the oil industry since the stunning \$2 million AMOCO 1986 field test in Nevada, directed by LLNL's Dr. Ron Koopman, sent HF downwind at a deadly 50-ppm concentration for 5 miles:



But the US chemical disaster Community Right to Know laws, enacted in 1986 and 1990 after the Bhopal India Union Carbide facility toxic cloud release killed 8000 overnight and injured 100,000, have been subverted by state and local officials who refuse to inform the at-risk citizens. HF-using oil refineries must provide Risk Management Plans including Worst Case Accident scenarios to US EPA and local emergency planners, who do not proactively and vividly inform the public as Congress intended. The public documents are in regional federal EPA reading rooms, e.g., Madison WI for all of MN/WI. The Husky Superior WI Refinery's 2017 RMP stated an HF release could produce a toxic gas cloud 22 miles long and the population in the Vulnerable Zone circle reaching into Duluth was 180,000. Who knew?