PR 1410 Working Group Meeting #2

MAY 18, 2017

Wilmington Senior Citizens Center, California

Working Group Meetings

- Purpose of working group meeting is to provide an opportunity for stakeholders to participate in the rulemaking process including valuable input from working group members
- Format of working group meeting different than Town Hall style meeting
- To ensure input from working group members is heard
  - Take comments from working group members before general comments from the public
  - Working group members can “stand” tent cards when they want to speak

SCAQMD Activities Since Last Working Group Meeting

- SCAQMD staff met with Torrance Refinery on May 4, 2017 to discuss modified HF (MHF) and mitigation measures
  - Torrance Refinery provided a presentation to SCAQMD staff on MHF (working with Torrance Refinery to make presentation available to the public)
  - Torrance Refinery also provided SCAQMD staff with additional information on MHF, most information is marked "business confidential"
  - SCAQMD staff reviewing information provided by Torrance Refinery

Site Visit at Valero Refinery

- SCAQMD staff visited Valero Refinery on May 12, 2017
- Valero presented information on their overall approach to safety
- Valero is a Cal OSHA Voluntary Protection Program (VPP) Star site
  - Demonstrated exemplary achievement in the implementation and management of occupational safety and health programs and practices
  - Cal OSHA VPP program applies to the **entire** refinery but does not have specific separate requirements for HF alkylation units
- Valero stated they implement API RP 751 - *Safe Operation of Hydrofluoric Acid Alkylation Units*
- Valero discussed current MHF mitigation systems and areas they are currently working on to further enhance existing mitigation systems
- SCAQMD and CUPA staff saw alkylation unit and central command center
- Observations from the site visit are incorporated into the proposed concepts for interim mitigation measures (*later in presentation*)

Site Visit at Torrance Refinery

- SCAQMD staff visited Torrance Refinery on May 16, 2017
- Torrance Refinery presented an overview of the refinery, safety protocols and specific information on the alkylation unit
- Torrance Refinery highlighted the various MHF safety measures
- Torrance Refinery stated they implement API RP 751 - *Safe Operation of Hydrofluoric Acid Alkylation Units*
- SCAQMD and CUPA staff were provided a tour of the alky unit and central command center
- Two water cannons (remotely operated) were tested and different water spray pattern capabilities were demonstrated

Interim Control Measures

- Interim control measures are measures that would be required when using MHF
- Since SCAQMD staff is still reviewing information on MHF, MHF will be viewed as needing the same level of control as HF
- Purpose of interim control measures are to:
  - Seek additional safety improvements in the use of MHF
  - Ensure all safety measures in place
  - Minimize off-site impacts from a potential release of MHF
- Incorporating interim control measures in PR 1410 ensures facilities adhere to requirements

Proposed Interim Control Measures for PR 1410

- Presentation today will focus on:
  - HF Detection Systems
  - Visual Inspections
  - Active Mitigation
- Next Working Group Meeting will cover:
  - Passive Mitigation
  - Inspections
  - Audits

General Approach to Identifying Interim Control Measures

- Staff looked at interim measures in:
  - Suspended Rule 1410
  - American Petroleum Institute Recommended Practices 751 (API RP 751)
  - Papers discussing scientific tests regarding mitigation measures
  - Information from Chemical Safety Board
  - Observations from site visits at Torrance and Valero refineries
  - Input received from comments made at Investigative Hearing and Working Group Meeting #1

API Recommended Practice 751 (API RP 751) - Safe Operation of Hydrofluoric Acid Alkylation Units

- API publications facilitate broad availability of proven, sound engineering and operating practices
- API RP 751 is an industry document that communicates proven industry practices to support the safe operation of an HF acid alkylation unit
- API RP 751 includes “recommended practices”– viewed as industry standard
- Includes HF acid leak prevention, detection and mitigation, operating procedures and worker protection, material inspection and maintenance, transportation and inventory control, relief and utility systems, and risk mitigation
  - For the purpose of PR 1410, focused on detection, mitigation systems, inspection, and audits

HF Detection Systems – Background Information

- Objective of HF detection systems is to provide timely information of a leak to assist in activation of mitigation systems
- An effective HF detection system provides early and reliable indication of an HF release – *critical to activate mitigation*
- Two general categories of HF detection systems: Point Sensor and Open Path
  - **Point Sensors** respond to HF only at their specific location – *the response signal is usually proportional to the HF concentration*
  - **Open Path Sensors** respond to the presence of HF anywhere along a line-of-sight path between a transmitting device and a receiver – *does not provide point concentrations but provides a signal that there is HF release in the open path*

HF Detection Systems at Torrance and Valero Refineries*

HF Detection System	Torrance Refinery	Valero Refinery
Does Facility Have Point Sensors	Yes	Yes
What Alert Level Point Sensors Set	2 ppm for internal notification	4 ppm for internal notification
How Many Point Sensors	27	33
Does Facility Have Open Path Sensors	Yes	No

* *Based on information provided by Torrance Refinery and Valero Refinery at SCAQMD site visit on 5/16/17 and 5/12/17 respectively*

API RP 751 HF Detection Systems

- Detection system should provide coverage for all process areas that contain significant quantities of HF
- Detection system should be located to likely detect any potential HF release under varying weather conditions, release rates, potential leak sources, and elevation
- Key design issues for an HF detection system include:
  - Detector type – Point Sensor and Open Path
  - Detection range – Primary detection devices typically operate over a range of 0 to 20 ppm
  - Detection set points – Alarm set points should be selected to provide an early warning of an HF release

API RP 751 HF Detection Systems

- Selectivity – Reliable HF detection system should be selected
- Response time
  - Capable of responding effectively under all conditions likely to occur at site
  - System response time, which is the length of time from a significant HF release until the mitigation procedure is activated which includes system deployment, device response time, and activation strategy
- Stability of the detector to minimize inaccurate readings and false alarms
- Reliability
  - Able to withstand weather and refinery environment - to ensure detector elements do not deteriorate
  - Reliability of entire system and detector should be high – uninterruptible power supply should be considered
- Deployment
  - Detection system using more than one technology type will be found to be more reliable
  - Potential for elevated HF release should be addressed in detector layout

Initial Concepts for HF Detector Systems

- Refinery must utilize a combination of point sensors and open path detectors in all high volume HF areas (acid settler, acid coolers, MHF storage and unloading areas)
- Point sensor must be specific to detecting HF and designed to withstand a refinery environment
- Set point thresholds for point sensor detector
  - Notification level to operator set at certain concentration (e.g., 4 ppm)
  - Activation level set at higher level to initiate certain mitigation measures such as water curtain
- Point sensors and open path detectors must be maintained and tested based on manufacturer specifications
- Point sensors and open path detectors must have uninterruptible power supply
- Must have a sufficient number of point sensors and open path detectors to:
  - provide the appropriate coverage of high volume MHF areas; and
  - detect a potential leak, including the potential for an elevated HF/MHF leak

Visual Detection – Background Information

- Visual detection systems are useful tools for alerting operators of an HF leak or other emergency situations
- Visual detection in combination with HF detector systems can improve the operator's ability to assess a leak and determine its exact location and scope
- Video cameras can also help direct and observe the effects of mitigation measures
- Types of visual detection approaches
  - Video cameras and monitors – *Video cameras covering strategic portions of the alkylation unit and HF unloading with video monitors located in unit control room*
  - HF detection paint – *HF detecting paint changes color for easy visual indication of a leak*
  - On-site visual surveillance – *visual inspection of alkylation unit and unloading area for leaks*

Visual Detection at Torrance and Valero Refineries*

HF Detection System	Torrance Refinery	Valero Refinery
Does Facility Have Video Cameras on Alkylation Unit (#)	Yes (8)	Yes (3+)
Does Facility Have Video Cameras HF Unloading	Yes	Yes
Does Facility Use HF Paint	Yes	Yes
Does Facility Have a Video Monitor in Control Room	Yes	Yes
On-site Surveillance	Yes	Yes

* Based on information provided by Torrance Refinery and Valero Refinery at SCAQMD site visit on 5/16/17 and 5/12/17 respectively

API RP 751 Recommendations for Video Cameras

- Video cameras should have:
  - Remote pan and zoom capability
  - Record/playback capability
  - Located to cover strategic portions of the unit including the HF unloading station - elevated locations provide an overview of the alkylation unit
- Camera placement should take into account
  - Glare from the sun
  - Thermal load, and
  - Moisture
- Video monitors should be located in the unit control room where operators can readily see them
- Long-term camera operation considerations should include maintenance access and protection of components, such as glass lenses, from long-term low-level HF background exposure

API RP 751 Recommendations for HF Detecting Paint

- Typical application of HF detecting paint for all flanges in HF service
- Other areas where HF paint may be considered include threaded fittings, compression fittings, pump seals, leak repair clamps, sample transportation containers, and HF-containing process connections and vessels
- Must review manufacturers instructions regarding:
  - paint's limitations to heat and sunlight
  - durability in terms of reapplication frequency needed
  - associated potential health effects of the paint – certain HF detecting paints may contain lead compounds
- A regular maintenance program should be established to ensure adequate visual indication of leaks

Initial Concept for Visual Detection

- Video Cameras and Monitors – incorporate recommendations from API RP 751 with the following additions:
  - Require a sufficient number of video cameras at multi-angle positions and multiple locations to cover strategic portions of the alkylation unit and HF unloading station
  - Placement and number of video cameras should take into account potential obscured views from smoke or other elements in the event of an emergency
  - Video cameras should have high-resolution, record/playback capability, and remote pan/zoom capability
  - Central command center should have high-definition monitors of a sufficient size to more easily monitor any potential leak or emergency
- HF Paint – incorporate recommendations from API RP 751
- API RP 751 does not have specific recommendations for on-site visual surveillance, but both refineries use this technique

Active and Passive Mitigation Systems

- Active mitigation systems require human or mechanical function to initiate mitigation – examples include:
  - Water mitigation systems
  - Rapid acid transfer system
  - Remotely-operated block valves
- Passive mitigation systems do not require human or mechanical interaction to function
  - Examples: barriers, catch-pans, settler compartments, vessel design to minimize HF inventory, vessel baffles to segment HF inventory, modified HF
  - Theoretically no failure-to-activate mechanisms associated with passive mitigation systems
- Presentation will only cover active mitigation systems – passive mitigation will be discussed at the next Working Group Meeting

Water Mitigation Systems for HF – Background Information

- Applying high volumes of water to any HF release will reduce airborne fraction of HF
  - Water droplets absorb HF and rain-out, thereby removing HF from released cloud
  - Enhanced turbulence adds air, reducing the concentration of HF in the cloud
- Different types of water mitigation systems
  - Fixed spray water curtains: A line of closely spaced nozzles that are designed to cover and rain-out the HF release
  - Aim and shoot water cannons: High volume water delivery system designed to be directed onto the source of HF release or HF cloud

* *API RP 751, 2013*

** *Effectiveness of Mitigation Systems in Reducing Hazards of Hydrogen Fluoride Leaks, Quest Consultants Inc., 1995*

Water Mitigation Systems for HF – Background Information *(Continued)*

- Water mitigation systems
  - Do not reduce the rate at which HF or MHF is released
  - Efficiency of water mitigation is dependent on may factors, such as puncture hole size and location, release orientation, distance between HF release point and water, water droplet size, water application, and ratio of water mass flow to HF mass release rate*
  - An active mitigation, requiring someone to initiate water mitigation
  - The longer the response time to activate the water mitigation, the less effective the overall water mitigation system
  - Could be an issue if event that caused release also damages water mitigation system

* *Effectiveness of Mitigation Systems in Reducing Hazards of Hydrogen Fluoride Leaks, Quest Consultants Inc., 1995*

Water Mitigation Torrance and Valero Refineries*

Water Mitigation	Torrance Refinery	Valero Refinery
Does Facility Have Water Mitigation System	Yes	Yes
Type of Water Mitigation	• Water cannons • Fire sprays • Water deluge (major pumps)	• Water curtain • Water cannons • Water deluge systems (unit pumps)
Activation of System Location	Control room or on-site	Control room or on-site
How System Activated	Active (manual)	Active (manual)

* Based on information provided by Torrance Refinery and Valero Refinery at SCAQMD site visit on 5/16/17 and 5/12/17 respectively

Efficiency of Water Spray Mitigation

- Removal efficiency is based on a number of variables: leak size, leak location, curtain location, and water to HF ratios – no single efficiency for a given water spray curtain
  - Laboratory tests such as the Hawk tests have focused on small-scale releases – unknown if a large fast release would have the momentum to “blow through” the curtain
  - A leak flow above the water curtain makes the water spray mitigation is ineffective
  - The further the separation distance between the unit and water curtain, the less efficient mitigation and more water required

Efficiency of Water Spray Mitigation *(Continued)*

- Industry Cooperative Hydrogen Fluoride Mitigation Assessment Program (ICHMAP) conducted series of efficiency water spray tests mitigating an HF cloud in Nevada in late 1980's – "Hawk test series" *
  - Key findings:
    - 90% removal efficiency achieved with at least 40:1 water to HF ratio (0.166 inch orifice)
    - Smaller droplet size improves removal efficiency (160 µm instead of 320 µm droplets)
    - HF release elevation at same level as spray header caused severe bypassing of water spray, substantially lowering efficiencies
- Additional study showed 80% removal efficiency with 50:1 water to HF ratio (1 ¾ inch orifice)**

*   *Water Spray Mitigation of Hydrofluoric Acid Releases, Schatz and Koopman, 1990*

** *Effectiveness of Mitigation Systems in Reducing Hazards of Hydrogen Fluoride Leaks, Quest Consultants Inc., 1995*

API RP 751 Water Mitigation System Design Considerations

- Coverage to all areas of the unit containing relatively high volumes of HF (e.g., reaction loop, HF regeneration system, fresh HF storage/unloading), both elevated and at grade
- Allow continued mitigation of an HF release until the release area has been secured
- Incorporate a variety of methods (e.g., fixed spray curtains, aim and shoot cannons, water deluge, etc.), either by themselves or in combination
- Droplet size is important

Initial Concepts for Water Mitigation Systems

- Must deploy at least two types of water mitigation systems around all high volume MHF areas (acid settler, acid coolers, MHF storage and unloading areas)
  - Quick deployment triggered with no manual initiation
- Specific criteria for water delivery rate
- Water system capable of generating smaller droplet size (e.g., 160 µm)
- Water system designed to account for elevated releases
- Spray overlap to minimize MHF bypass between the nozzles
- Procedures to address how to operate and optimize the water system under different MHF release scenarios and weather conditions

Initial Concepts for Water Mitigation Systems *(Continued)*

- Maintenance of water spray system to eliminate plugging
- Periodic testing of water system
- Blow-off protective covers for nozzles
- Adequate water supply and power for pumps to deliver water
- Protocol to ensure detection and activation time is minimized
- Sufficient number of activation points near alkylation unit

MHF Rapid Acid Transfer System

- Purpose of rapid acid transfer system is to reduce the amount of HF or MHF that might be released in an accident
- Shorter the de-inventory time, the greater the risk reduction
- Acid is transferred (dumped) to an empty storage vessel by available system pressure, gravity, or pumps
- Rapid Acid Transfer System (or Acid Evacuation System)
  - Can reduce duration of a potential release by removing HF inventory
  - Is an active mitigation, requiring someone to initiate the transfer
  - Could be an issue if event that caused release also damages transfer equipment

Rapid Acid Transfer Systems at Torrance and Valero Refineries*

Rapid Acid Transfer System	Torrance Refinery	Valero Refinery
Does Facility have Rapid Acid Transfer/Evacuation System	Yes	Yes
How Fed to Storage	Pressure	Gravity
Location of Storage	60–70 ft. from main unit (and behind blast wall)	Directly under settler
Activation of System Location	Control room or on-site	Control room or on-site
How System Activated	Active (manual)	Active (manual)
Estimated Time to De-inventory	7 minutes (80% in 2 mins)	< 10 minutes

* *Based on information provided by Torrance Refinery and Valero Refinery at SCAQMD site visit on 5/16/17 and 5/12/17 respectively*

API RP 751 Criteria for Rapid Acid Transfer Systems

- The total duration time from when a leak is first detected to when it is secure in a separate vessel(s) should not be more than 15 minutes
- 15-minute duration time includes:
  - noticing an HF leak has occurred
  - deciding to activate the system
  - activating the system
  - moving valves to proper position once the system is activated
  - transferring HF to a secure location
  - recognizing the de-inventory process is complete and closing valves

Initial Concepts for Rapid Acid Transfer System

- The total duration time must be less than 15 minutes from when leak is first detected to when it is secure in a separate vessel
  - Considering specifying a time that unit must complete acid transfer to add more specificity
- Pumps must have redundant power source in case of failure
- Protocol to ensure detection and activation time is minimized
- Sufficient size of vessel to accommodate de-inventory

Remotely Operated Block Valves – Background Information

- Remotely-operated block valves are a mitigation measure that can quickly isolate major HF inventories, reducing the magnitude of an HF release
- Enable large HF inventories and leak sources to be safely isolated from each other, interrupts flow, and ensures no over-pressure
- Active mitigation measure – needs to be activated
- Dependent on instrument air or electric power, thus back-up power is needed to be more fail safe
- SCAQMD staff is collecting information from facilities regarding remotely operated block valves

API RP 751 Remotely Operated Block Valves

- Identifies remotely operated block valves as a mitigation measure to be used with other measures
- Remotely-operated block valves should be located so that large HF inventories and credible potential leak sources can be isolated from each other
- Provisions for overpressure protection of equipment isolated by remotely-operated block valves should be included in the design
- Examples of locations for remotely-operated block valves include the HF unloading station, fractionator overhead accumulator HF boot return lines, the rerun/regeneration HF feed line, the rerun/regeneration overhead line (gravity circulated units), reactor feed lines, the stripping isobutane line, HF cooler HF draw lines (gravity circulated units), and the HF circulation pump suction and discharge (pump circulated units)

Initial Concepts for Remotely Operated Block Valves

- Remotely activate emergency isolation valves by switches or push buttons in central command room or safe locations which are accessible to use during MHF releases
- Automated activation may be considered for more rapid isolation
- Formal functional testing program and auditing are recommended to detect malfunction
- Fireproofing and protection measures are necessary for the valves, cables (power and control) and actuators per API RP 2218 – *Fireproofing Practices in Petroleum and Petrochemical Processing Plants*

Schedule

Activity	Targeted Date
PR 1410 Working Group Meeting #2 (Wilmington)	May 18, 2017
PR 1410 Working Group Meeting #3 (SCAQMD)	June 15, 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
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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