EPA
United States
Environmental Protection
Agency

Overview Briefing of the Final Petroleum Refinery Risk and Technology Review and NSPS

Public Presentation

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Overview

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  - Rulemakings: MACT Risk and Technology Review and New Source Performance Standards
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- Risk Assessment
- Final Requirements
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Background on Petroleum Refinery Sector

- Based on EPA's 2011 ICR there are 142 refineries that are major sources
- 18 MMbbls/day crude throughput, refining ~20% of world crude production
- Data collected by EPA in 2011 and other information on this rulemaking is available at:

  http://www3.epa.gov/ttn/atw/petref.html

Background: Rulemakings

- Proposal published June 30, 2014
  - Public comment period extended until October 28, 2014
- Final rule consent was signed by Administrator McCarthy on September 29, 2015
- Refinery maximum achievable control technology (MACT) standards
  - Proposed and final risk acceptable, but additional controls for storage vessels are necessary to provide an ample margin of safety
  - We proposed and finalized requirements for:
    - Flare combustion efficiency
    - Fenceline monitoring
    - Delayed cokers
    - Storage vessels
    - Removal of startup, shutdown and malfunction (SSM) exemptions
    - Testing, monitoring and reporting amendments
- No change in risk from proposal to final
- New Source Performance Standards
  - Proposed and finalizing technical amendments in response to a 2008 American Petroleum Institute (API) petition

Emission Reductions and Costs

- This final rulemaking, when fully implemented in 2018, will reduce toxic emissions from refineries, improve air quality and significantly reduce the risk to public health in those communities that surround these facilities; this rulemaking will:
  - Result in a reduction of 5,200 tons per year of toxic air pollutants, and 50,000 tons per year of volatile organic compounds (VOC), including:
    - Requirements for **flaring** will result in reductions of 3,900 tons per year of HAP and 33,000 tons per year of VOC
    - Requirements for **delayed cokers and storage tanks** will result in 1,300 tons per year HAP and 17,000 tpy of VOC
    - Also, as a co-benefit of these standards EPA projects to eliminate emissions of greenhouse gases equivalent to approximately 660,000 tons per year of CO_2
- EPA estimates that the capital cost of this final rulemaking to be approximately $283 million, with an annualized cost of approximately $63 million; EPA estimates that these final standards will have a negligible impact on the cost of petroleum products

Risk Assessment

- In the proposed rulemaking EPA found the risk to be acceptable
  - Highest maximum individual risk (MIR) is approximately 60 in 1 million (actuals) and 100 in 1 million (allowables)
  - Sector-wide population at risk greater than 1 in 1 million is 5,200,000
  - Maximum hazard index (HI) of 0.9 (hydrogen cyanide from fluidized catalytic cracking unit)
  - Proposed amendments for delayed coking units and storage tanks would lower population at risk to 4,000,000; reduce incidence 20%
- In the final rulemaking, EPA did not rerun the risk model for the final rule, but we did conduct a sensitivity analysis to:
  - Evaluate the impact of facility-specific changes to the emissions inventory submitted by companies during the comment period
    - Could reduce MIR to 40 in 1 million
  - Account for releases from PRD and emergency flares
    - Could increase the acute risk from benzene to a hazard quotient (HQ) of 14 based on the reference exposure level (REL) [note: HQ still <1 based on the acute exposure guideline level (AEGL)] and increase MIR by 2 in 1 million
  - MIR remains approximately the same: 60 in 1 million (actuals); 100 in 1 million (allowables)
    - Therefore, rule's incidence or population risks are not revised

Flare Combustion Efficiency

- Proposed flare operating requirements to maintain minimum-specified levels of heat content in the combustion zone (NHVcz) and to monitor and regulate flow, composition and the amount of steam or air added to the flare
- Final Flare Operating Requirements – as proposed with a few changes
  - Simplifies requirements to a single NHVcz operating limit of ≥ 270 British Thermal Units per standard cubic foot (Btu/scf)
  - Allows refiners to take advantage of higher hydrogen (H_2) heating values provided they have a system to monitor for H_2
  - Refiners can choose between either a 15-minute feed forward or 15-minute block average to demonstrate compliance
  - Allows refiners to use limited sampling to demonstrate compliance for non-variable flare gas compositions
  - Exempts flaring events less than 15 minutes in duration
    - Incentivizes efficient use of flare gas recovery systems

Fenceline Monitoring

- Proposed fenceline requirements (monitoring and corrective action) as a development in practices, processes and control technologies under Clean Air Act section 112(d)(6) technology review to better manage refinery fugitive HAP emissions:
  - Refinery perimeter monitoring using 2-week passive samplers and compare a rolling annual average against a benzene concentration trigger (2.8 parts per billion by volume (ppbv))
  - Upon exceeding trigger, must do root cause analysis (RCA) and corrective action until below fenceline concentration
- Refiners conducted a pilot study that shows the proposed approach can be implemented with relative ease
- Final requirements are as proposed with a few changes:
  - Includes specifications for alternative monitoring if they can detect benzene at the fenceline concentration trigger level
  - Provides incentive to reduce fugitive emissions with option for less monitoring for refineries that consistently remain below the fenceline benzene concentration trigger
  - Reduces implementation time from 3 years after promulgation to 2 years
  - Requires reporting on quarterly rather than on a semiannual basis

Delayed Cokers

- Proposed work practice standard that would not allow a facility to open vent on coke drum to atmosphere until depressured to closed blowdown system and drum reaches pressure of 2 pounds per square inch gauge (psig)
  - Final requirements as proposed with additional flexibility:
    - Allows averaging to meet 2 psig across coke drums within all delayed coking units at a facility
    - Sets new source MACT floor of 2.0 psig on a per-coking cycle basis (i.e., no facility-wide coke drum averaging)
    - Revises costs to account for additional information received from commenters

Elimination of Malfunction Exemptions

- Proposed to eliminate SSM exemptions and require refineries to comply at all times
- Final rule establishes work practice standards for pressure relief devices (PRDs) and emergency flaring that include proactive requirements (e.g., improved process control, instrumentation, operator training, staged relief) and RCA and corrective action:
  - First atmospheric emissions release from a PRD or first exceedance of the velocity or visible emissions (i.e., opacity) standard at a flare during an emergency would trigger RCA and corrective action
  - Second event at the same PRD or flare for the same root cause within a 3-year period would trigger an immediate violation
  - Third event from any PRD or third event from any flare regardless of root cause within a 3-year period would be an immediate violation
    - Prevents a facility from specifying a different root cause to avoid a violation
  - Causes attributable to careless operation or failure to maintain equipment would be an immediate violation
  - Force majeure or events out of the control of the operator (loss of power) would not be included in the facilities “event” count
- Incentivizes facilities to make changes in operations and practices to prevent PRD releases and emergency flaring, rather than to build more flares to control the releases

Appendix

Inhalation Risk Assessment Results

	Individual Cancer Risk		Max Chronic Individual Non-Cancer Risk		Worst-case Max Acute Non-cancer HQ	Population Risk		
	MIR (in 1 million)	Risk Driver	HI (TOSHI)	Risk Drivers		Cancer Incidence (cases per year)	Pop. with risks > 1 in 1 million (facilities)	Pop. with risks >10 in 1 million (facilities)
Actual Emissions								
MACT 1 and MACT 2 Source Categories (142 facs)	60	Naphthalene, Benzene from process equipment leaks and storage tanks	0.9 (neuro)	Hydrogen Cyanide from FCCU	Max HQ(REL)=2 Acetaldehyde - 2 Acrolein - 2 Arsenic compounds – 2 Benzene – 2 (4 facs with HQ > 1)	0.34	5,200,000 (111) [1]	109,000 (48) [1]
Post-Control Emissions – MACT 1 and MACT 2 Source Categories (142 facs)	50	Naphthalene, various PAHs from process equipment leaks	0.9 (neuro)	Hydrogen Cyanide from FCCU	Max HQ(REL)=**2** Acetaldehyde - 2 Acrolein - 2 Arsenic compounds - 2 Benzene – 2 (4 facs with HQ > 1)	0.28	3,800,000 (108) [1]	78,000 (43) [1]
Whole Facility (142 facs)	70	Naphthalene, Chromium VI, Arsenic compounds from storage tanks, fugitive dust, coking units	4 (resp) 5 facilities - 1300 people >1	Chlorine from catalytic reforming units and cooling towers	NA	0.5	8,800,000 (115) [1]	280,000 (52) [1]
Allowable Emissions								
MACT 1 and MACT 2 Source Categories	100	Benzene from tank farms and wastewater treatment	1.0 (neuro)	Hydrogen Cyanide from FCCU	NA	0.6	NA[2] (131) [1]	NA[2] (82) [1]

[1] Number of refineries contributing to population risk.
[2] Population numbers are not available due to the post processing approach used for estimating allowable risk.