Attachment-Additional Questions for the Record

The Honorable Earl L. "Buddy" Carter

1. **Outside of RMP requirements, you mentioned at the hearing that industry has developed its own standards for promoting safety at refineries.**

   a. **Can you briefly discuss the technical details of these standards, including the continuing improvements and increasingly mandatory nature of some of these standards?**

   Jatin Shah: There are multiple industry standards developed by the National Fire Protection Association (NFPA), Guideline books by the Center for Chemical Process Safety, and Recommended Practices by the American Petroleum Institute that promote safety and that are used by industry for this purpose. An example of one such standard is the American Petroleum Institute (API) Recommended Practice (RP) 751 "Safe Operation of Hydrofluoric Acid Alkylation Units". After implementing measures in the alignment with the API 751 document, these refineries are audited for compliance with the document every three years.

   The API reviews and updates Recommended Practices periodically, and the current edition of API RP 751 is the fifth version, released in August 2021. Recommended Practices, which are written by a committee of subject matter experts who volunteer their time to develop them, are widely used by operators to promote safe operations. The goal of each revision to a Recommended Practice is to incorporate learnings from industry experience on how best to safely operate the process so as to improve industry safety practices.

   I have participated in the development of Versions 4 and 5 of API RP 751. Numerous "should" statements (i.e., opportunities for improvements) in Version 4 were converted to "shall" statements (i.e., mandatory requirements to be compliant with the document) in Version 5. I am currently serving on the committee reviewing and revising Version 5 of this Recommended Practice to be released as an upcoming Version 6.

   Similar to API RP 751, there are API RPs 752,753,756 that help guide industry on how best to conduct facility siting studies to protect occupants of on-site structures (Buildings, Trailers, Tents).

   b. **Does the law of diminishing returns play a factor in the ability to achieve continuous improvement?**

   Jatin Shah: Yes. As multiple mitigation systems are implemented, there is a point where little to no additional benefit is gained from adding more mitigation. Facilities use a toolbox approach to manage risks and, for the 97% of facilities with no incidents, they have implemented most if not all of the feasible tools and are now left with only infeasible or inefficient tools.

c. Does the EPA recognize or align with any of these existing strategies when it comes to this rule?

Jatin Shah: The RMP requirement of implementing at least one new mitigation measure every PHA cycle means that the risk reduction from the previously implemented safety measures are discounted and unfairly punishes those owner operators who may have proactively implemented numerous safety measures already. Facilities use a toolbox approach to manage risks, and for the 97% of facilities with no incidents, they have implemented most if not all of the feasible tools and are left with only infeasible or inefficient tools.

d. If the focus is about managing risk, why is it problematic to treat well-trained and well-run facilities the same as poorly operated facilities?

Jatin Shah: The requirement to implement at least one new mitigation measure unfairly punishes those owner operators who may have proactively implemented numerous safety measures already (i.e., have already managed the risk). This is extremely problematic in that such facilities will bear significant cost for little or no actual risk reduction. Conversely, a poorly operated facility (e.g., one not in compliance with API Recommended Practice 751) needs to implement risk mitigation measures to reach the same level of safety as well run facilities.

2. Please discuss the concept of risk tradeoffs.

a. Does the final RMP rule properly analyze the impacts of trading one risk for a similar or worse risk?

Jatin Shah: The final RMP rule is silent on the impact of risk trade-offs. I believe the expectation is that each owner operator will develop and demonstrate the risk trade-offs of alternative technologies. The regulatory burden on owner operators is significantly increased by forcing them to repeat this type of evaluation every 5 years rather than once at the beginning of the capital project cycle (i.e., when the facility is built or significantly modified).

b. When it comes to gasoline refinery operations, what are the realistic alternatives to using hydrofluoric acid and is it easy, cheap, or risk-free to switch to them?

Jatin Shah: The only commercially demonstrated alternative to Hydrofluoric Acid (HF) alkylation presently available is Sulfuric Acid alkylation. Both technologies are used across the United States and provide a secure supply of alkylate blend stock for the gasoline market. Contrary to what has been publicly stated, it is not a simple exercise to replace an HF alkylation unit with a Sulfuric Acid alkylation unit. It is also not cheap nor is it a risk-free exercise. There are many challenges to making this conversion and they differ based upon site-specific configurations. One of the biggest challenges comes with the need to regenerate vast amounts of sulfuric acid. On-site sulfuric acid regeneration requires a sulfuric acid plant that generates toxic SO2/SO3 gases, which can also pose offsite risks. Many sites with Sulfuric Acid alkylation units have chosen to acquire their fresh sulfuric acid from an offsite facility and then ship their spent sulfuric acid back to these facilities for regeneration. Often these facilities are hundreds of miles away, and the risk of regenerating the sulfuric acid is transferred from the refinery site to the sulfuric plant. An additional risk is also created along the transportation routes as hundreds of times more volume of fresh and spent sulfuric acid are shipped back-and-forth than what is

required for HF alkylation units, which regenerate the HF acid onsite and require a much lower replacement volume.

c. How does hydrofluoric acid alkylation with existing layers of mitigation compare from a safety perspective to alternative refining methods?

Jatin Shah: The answer depends upon multiple site-specific technology specific parameters. On October 19, 1990, Mobil Oil and the City of Torrance arrived at a settlement involving a Consent Decree agreed to by Judge Harry Peetris. The court appointed a Safety Advisor (SA) to investigate, evaluate, and make safety recommendations related to the Torrance Alkylation unit. The SA recommendations become binding on the City and Mobil Oil unless objected to or modified by the Court. After four years, in December of 1994, the SA concluded that the modified HF unit with the additive (MHF) used at Torrance is no worse, and in fact poses slightly less risk, than a comparably sized Sulfuric Acid unit (without accounting for sulfuric acid regeneration or transportation risk). Hence, it is certainly possible to reduce risks from an HF alkylation unit (i.e., following the guidance provided by API RP 751) to levels that are comparable, if not lower than, those posed by a Sulfuric Acid alkylation unit.

d. What are the risks that come with both a switch to and use of sulfuric acid alkylation?

Jatin Shah: The risks in switching to and using sulfuric acid alkylation are discussed in the responses provided above. Sulfuric acid is also a strong acid and poses personnel exposure risks as well as being highly corrosive to plant equipment. There are risks from the process of regenerating sulfuric acid; SO2/SO3 gases generated in this process, if released, can pose toxic hazards to workers and the community. If the sulfuric acid is regenerated offsite, then the regeneration risk is transferred to another location but is not eliminated. In addition, this involves the transport of fresh and spent sulfuric acid catalyst at hundreds of times the comparable volume of HF. Sulfuric acid transport is primarily via truck or rail, which can pose additional risks to communities along the route.

3. In the past, the RMP rule was aligned with other regulatory agencies like OSHA, as well as industry-led standards to maximize safety. Please expound on how regulatory alignment was before the RMP rule compared to how it is now?

Jatin Shah: Prior to SCCAP, a facility compliant with API RP 751 was generally compliant with OSHA PSM and EPA RMP requirements. The new EPA RMP rule goes beyond existing standards, which will increase compliance costs and require additional analysis by the regulated facilities. Because of the requirement to perform STAA, a Process Hazards Analysis (PHA) that is compliant with OSHA PSM would not satisfy the new EPA RMP requirement.

The Honorable Dan Crenshaw

1. **As an industrial risk management consultant, does hydrofluoric acid pose a disproportionate risk compared with other hazardous materials that are present throughout the manufacturing sector?**

   Jatin Shah: Because of the many risk mitigation strategies utilized by facilities that are compliant with API RP 751, the risk from Hydrofluoric (HF) acid alkylation is comparable to risks posed by a number of other hazardous materials present throughout the manufacturing sector. As I had stated in my oral testimony, the risk of a member of the public sustaining a life-threatening injury from HF in refining is extremely low - 480,000 times lower than dying in a car wreck.

2. **In your testimony you mentioned the high cost in both time and money required for facilities to conduct multiple and often duplicative Safer Technology Alternative Assessments. Are you worried that this requirement could shift resources away from more effective ways of reducing risks like increased staff or training?**

   Jatin Shah: I am concerned that the increased regulatory burden of complying with the new RMP requirements will divert resources that could otherwise be devoted to effective risk reduction and safety improvement opportunities. The reality is that there is only so much capital available for risk mitigation efforts, and my expectation is that the approach mandated by the new EPA RMP rule will misallocate this capital away from more effective risk mitigation efforts.

3. **The only viable alternative for refineries to replace hydrofluoric acid is sulfuric acid. What are some of the challenges and risks for refineries that might be pressured to switch?**

   Jatin Shah: In my answers to questions earlier in this request, I have answered this question. In summary, the challenges are complex and site-specific and there is no simple way of swapping out an HF Alkylation unit with a Sulfuric Alkylation unit. The costs can be substantial, it is not risk-free, and often the risks are transferred to other parts of the supply chain.

4. **The EPA's own estimate for this rule is more than $250 million a year. You highlight that the EPA has previously recognized that implementing an alternative to HF alkylation can cost a single refinery up to $900 million. In your professional opinion do you think the EPA has significantly underestimated the cost of this rule?**

Jatin Shah: I am not an economist, nor am I a financial analyst. I am an engineer and a risk professional by trade. But I do know that converting a refinery HF Alkylation unit to a Sulfuric Acid alkylation unit is not a simple task and is an expensive proposition. The cost of this conversion is dependent upon many factors, but one site had an external firm perform an analysis to determine the financial cost to convert their HF unit and the estimate was $900 million, and this was in the 2018/2019 time frame. With inflation over the past few years, I would expect the conversion cost for this one facility unit to be even higher. It is one of the reasons that to date, there has been no refinery HF Alkylation unit converted to Sulfuric Acid. Based upon this, I agree with you that the EPA has likely underestimated the compliance cost at being around $250 million annually.

5. **As a result of this final rule refineries that use hydrofluoric acid will be required to implement at least one safety measure every five years. Is it reasonable to expect facilities to have an infinite number of practical new safety measures to implement?**

Jatin Shah: As I have stated in my previous response to similar questions above, I do not think it is reasonable. Facilities use a toolbox approach to manage risks, and for the 97% of facilities with no incidents, they have implemented most if not all of the feasible tools and are left with only infeasible or inefficient tools. This requirement unfairly punishes facilities that already have implemented multiple risk reduction measures and have a good safety record.

The Honorable Russ Fulcher

1. **Can you please discuss the concept of risk tradeoffs? Does the final RMP rule properly analyze the impacts of trading one risk for a similar or worse risk? When it comes to gasoline refinery operations, what are the realistic alternatives to using hydrofluoric acid and is it easy, cheap, or risk-free to switch to them? How does hydrofluoric acid alkylation with existing layers of mitigation compare from a safety perspective to alternative refining methods?**

   Jatin Shah: My responses to these questions were addressed under Honorable Earl L. "Buddy" Carter's questions, however, will be repeated here for clarity.

   The final RMP rule is silent on the impact of risk trade-offs. I believe the expectation is that each owner operator will develop and demonstrate the risk trade-offs of alternative technologies. The regulatory burden on owner operators is significantly increased by forcing them to repeat this type of evaluation every 5 years rather than once at the beginning of the capital project cycle (i.e., when the facility is built or significantly modified).

   The only commercially demonstrated alternative to hydrofluoric acid (HF) alkylation presently available is sulfuric acid alkylation. Both technologies are used across the United States and provide a secure supply of alkylate blend stock for the gasoline market. Contrary to what has been publicly stated, it is not a simple exercise to replace an HF alkylation unit with a sulfuric acid alkylation unit. It is also not cheap nor is it a risk-free exercise. There are many challenges to making this conversion and they differ based upon site-specific configurations. One of the biggest challenges comes with the need to regenerate vast amounts of sulfuric acid. On-site sulfuric acid regeneration requires a sulfuric acid plant that generates toxic SO2/SO3 gases, which can also pose offsite risks. Many sites with sulfuric acid alkylation units have chosen to acquire their fresh sulfuric acid from an offsite facility and then ship their spent sulfuric acid back to these facilities for regeneration. Often these facilities are hundreds of miles away, and the risk of regenerating the sulfuric acid is transferred from the refinery site to the sulfuric plant. An additional risk is also created along the transportation routes as hundreds of times more volume of fresh and spent sulfuric acid are shipped back-and-forth than what is required for HF alkylation units, which regenerate the HF acid onsite and require a much lower replacement volume.

With regard to how hydrofluoric acid alkylation with existing layers of mitigation compares from a safety perspective to alternative refining methods, the answer depends upon multiple site-specific technology specific parameters. On October 19, 1990, Mobil Oil and the City of Torrance arrived at a settlement involving a Consent Decree agreed to by Judge Harry Peetris. The court appointed a Safety Advisor (SA) to investigate, evaluate, and make safety recommendations related to the Torrance Alkylation unit. The SA recommendations become binding on the City and Mobil Oil unless objected to or modified by the Court. After four years, in December of 1994, the SA concluded that the modified HF unit with the additive (MHF) used at Torrance is no worse, and in fact poses slightly less risk, than a comparably sized Sulfuric Acid unit (without accounting for sulfuric acid regeneration or transportation risk). Hence, it is certainly possible to reduce risks from an HF alkylation unit (i.e., following the guidance provided by API RP 751) to levels that are comparable, if not lower than, those posed by a Sulfuric Acid alkylation unit.