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Baker Hughes

February 13, 2023

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
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Re: Proposed Rulemaking Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review (Docket ID No. EPA-HQ-OAR-2021-0317)

Baker Hughes (NASDAQ: BKR) is pleased to offer our response to the United States Environmental Protection Agency (EPA) solicitation on November 11, 2022, regarding the supplemental notice of proposed rulemaking, *Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review*.

Baker Hughes is a leading energy technology company providing solutions for energy and industrial customers worldwide. We offer a range of products and services to help our customers reduce methane emissions from oil and gas exploration, production, and transmission, including flare optimization and flare gas processing solutions, 'low-bleed' valves to control fugitive emissions and leakage, and a production optimization platform that can reduce liquids unloading events. Our goal is to ensure that natural gas continues to play a valuable role in the clean energy transition by helping customers keep more natural gas in the pipeline and put less methane into the atmosphere.

Baker Hughes supports the objectives of the Paris Climate Agreement. We believe that U.S. natural gas is helping to achieve the world's carbon-reduction goals and will remain an important part of a sustainable energy future. However, failure to meaningfully address oil and gas sector methane emissions threatens to undermine the utility of natural gas in a low-carbon future.

The private sector has a crucial role to play in limiting the global temperature rise to 1.5 degrees Celsius. We applaud the commitments of many oil and gas operators around the world to voluntarily reduce methane emissions, and such efforts should be recognized in the policy development process. However, voluntary actions are not enough to fully address the issue. We support the development of well-designed policies that directly reduce methane emissions from

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global oil and natural gas operations. We believe policies that drive meaningful methane emission reductions can be designed to be cost-effective, performance-based to facilitate future technological developments, comprehensive to cover all sources of operator emissions, and paced to allow for transition.

Key Messages

Alternative Test Method (§60.5398b(d) and §60.5398c(d)): Baker Hughes supports the alternative test method as defined in the proposed in NSPS Subpart OOOOb and EG Subpart OOOOc, believing these provisions will stimulate continuous improvement and innovation in emission detection and control technologies.

Innovation will be the key to cost-effectively reducing venting and fugitive emissions from the oil and gas sector. While technology and practices exist today to begin managing this issue, continued progress is necessary to drive the emission reductions necessary to make a material impact. EPA should ensure that regulations do not stand in the way of that innovation.

Methane regulations must be designed to both foster and accommodate future innovative technologies and practices. Therefore, it is imperative that the approval process for new emission monitoring, quantification and mitigation technologies be efficient, flexible, well-defined, and open to a broad range of potential applicants including technology providers.

We believe the statement meets the mark in §60.5398b

> "Any entity meeting the requirements in paragraph (d)(2) of this section may submit a request for an alternative test method."

As well as the requirements in §60.5398b(d)(2) defining the eligibility for entities wishing to submit an alternative test method for consideration. These provisions support innovation from the range of potential companies and organizations developing commercial solutions to methane emission detection and measurement.

Pneumatic Controllers (§60.5390b and §60.5394c): EPA should adopt a 6 standard cubic feet per hour (scfh) emission threshold for pneumatic controller affected facilities rather than zero emission threshold proposed in NSPS Subpart OOOOb and EG Subpart OOOOc as a backstop to address safety and production considerations.

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Baker Hughes recommends against adopting the proposed requirements in Subparts OOOOb and OOOOc that operators design and operate each pneumatic controller affected facility with zero methane and volatile organic compound (VOC) emissions to the atmosphere. We believe there are valid safety and production considerations associated with such a requirement that justify a non-zero emission threshold for these devices. We recommend EPA adopt an emission rate for natural gas-driven pneumatic controllers of less than or equal to 6 scfh, as included in the 2016 Subpart OOOOa rule. Such a threshold will serve as a backstop to operator performance.

Other incentives including the Inflation Reduction Act Methane Emission Reduction Program, the emerging market for certified low-carbon natural gas, and operator ESG commitments will continue to drive operators to adopt zero-emission controller technology in a manner that does not sacrifice safety for regulatory compliance.

As an oilfield technology provider, we have experience as to how our customers will likely address these regulations, with the simplest solution being to replace pneumatic actuators with fully electric actuators. Key concerns that have been expressed with this approach are:

- A power failure in a singular electrical source could cause failures in any valves drawing from that power supply, including potentially both the primary and backup valves in a single station.
- Electric actuators have specific power requirements that often go beyond standard supply, such as three-phase power. This means that the cost to switch to electric actuators may also involve bringing in dedicated power supplies, which can be cost-prohibitive, especially in remote locations.
- Electric actuators on the market today are not intended for continuous use and may not be suitable for applications where continuous modulation is required (pneumatic actuators are suitable for this service).
- In the absence of backup power supplies, electric actuators could be designed to fail closed in the event of a power loss, but this goes against traditional design philosophy for gas pipelines/ distributors in the US, where the goal in the past has been to avoid shutting off the gas supply in any but the most extreme circumstances.

So far, we have encouraged our customers who are switching to electric actuation to keep pneumatic actuators on their backup devices to address these issues. Such an option would be prohibited by the proposed regulations.

Should the EPA choose to adopt the zero-emission threshold, we offer the following recommendations:

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- Pneumatic controllers/positioners should be allowed as long as they do not bleed continuously at steady state. Bleed to atmosphere may be allowed only if the valve is in motion.
- Regardless of whether the above alternative may be permitted for primary equipment, pneumatic controllers/positioners should be allowed on backup/monitor systems, provided the controllers bleed only when the backup system is engaged (e.g., in the event of a power failure to a primary electric actuator).
- Pneumatic controllers/positioners that capture natural gas, either for reinjection into the pipeline or for use by ancillary equipment, should not be restricted. Such systems may require a provision whereby they may be allowed to bleed gas to maintain function when conditions do not allow gas to be reinjected into the pipeline, though reasonable guidelines/limitations may be applied here.

The rationale for these allowances is the same as listed above, including risk of failure in the event of electrical power loss, and cost burden associated with a dedicated power supplyin remote locations.

EPA must clarify that the pneumatic controller requirements in NSPS Subpart OOOOb and EG Subpart OOOOc apply after startup of production and to stationary equipment only.

We recommend EPA include in the definition of a pneumatic controller affected facility[1] an exemption for:

- Natural gas-driven pneumatic controllers on temporary use equipment that is skid mounted or permanently attached to a platform that is mobile (such as trucks, railcars, barges, or ships) and intended to be located at a site for less than 180 consecutive days,
- Pneumatic controllers associated with drilling and completion equipment.

This approach is consistent with language describing applicability of temporary storage vessels under NSPS OOOO, NSPS OOOOa, NSPS OOOOb, and EG OOOOc.

The zero-emissions requirements are not justified for short term controller usage related to non-stationary sources.[2] Retrofitting controllers contained to temporary equipment requires significant engineering design that has not been adequately evaluated to identify if these options are even possible. Pneumatic controllers located on temporary or portable equipment should be allowed to

[1] NSPS Subpart OOOOb §60.5365b(d) and EG Subpart OOOOc §60.5386c(d)
[2] Exemption of controllers on temporary equipment is consistent with state regulations in New Mexico and Colorado.

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operate as low-bleed or intermittent as needed for proper functioning of the temporary equipment.

Some examples of temporary equipment or activities include the following:

- Temporary Equipment (such as compressors): Operators may utilize a small injection compressor to assist in ramping up production for new wells that have recently ended flowback. These compressors are typically skid mounted and located on site for as few as 30 days after the startup of production. These compressors contain a handful of pneumatic controllers to assist in proper function on the unit and may sometimes be leased from a third party. Another example is the use of a temporary compressor at a wellsite that is needed in anticipation of gathering system high line pressure during new gathering system infrastructure build-out, which may occur for a few months.
- Drilling and Completion Activities: As EPA is aware, drilling and completion activities require specialized temporary use equipment that is often contracted by third-party operators. Pneumatic controllers associated with drilling and completion equipment should be excluded from the zero-emitting controller requirements, which can be accomplished by clarifying that the requirements for pneumatic controllers are not applicable until after the startup of production. This approach would be consistent with other provisions within the proposed standards.

Reciprocating Compressors (§60.5385b and §60.5393c): EPA should allow operators to adjust compressor performance to meet emission thresholds, should establish condition monitoring as best system of emissions reduction (BSER) and should ensure that a one-size-fits all emission threshold of 2 scfm does not lead to a net increase in emissions due to excessive compressor blowdowns during maintenance.

We agree that the proposed method of reciprocating compressor piston rod packing gas leakage reduction is considered effective in terms of process steps. Operators should be required to check the gas leakage of each piston rod packing on an annual basis and if it cannot be adjusted below an established threshold, then the entire piston rod packing should be replaced.

Alternative Compliance: In addition, we support the proposed alternative compliance option, §60.5411b(d), allowing operators to collect the methane and VOC emissions from a reciprocating compressor rod packing using a rod packing emissions collection system that is operated to

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route the rod packing emissions to a process through a closed vent system that meets the requirements of the final emission standard.

In addition to this approach to compliance, we recommend EPA allow operators to adjust compressor performance in order to bring the leak rate down below an established threshold. If performance of the compressor at a lower flowrate or lower pressure meets the needs of the operator, and by adjusting those performance parameters, the leak rate can be held down, this should be a viable mitigating action that allows the operator time to make repairs once seal wear leads to unacceptable performance.

Condition Monitoring as BSER: There are commercially available condition monitoring solutions for reciprocating compressors, considering performance parameters, that can be used to predict the need for seal replacement in a timelier manner than annual seal leak monitoring, and should be considered as a BSER for minimizing compressor seal leakage for new and existing reciprocating compressors. As one of the oldest compressor designs, reciprocating compressors enjoy unique capabilities such as broad capacity control ranges, interstage cooling, the flexibility to efficiently compress gas regardless of mole weight or k value, and extremely high compression ratios. Consequently, they are an ideal fit for selected applications such as hydrogen compression. However, reciprocating compressors suffer from one very serious drawback: higher maintenance costs. In fact, compared to similarly sized centrifugal compressors, reciprocating compressors can consume as much as five times the amount of maintenance dollars. Smart compression condition monitoring technology monitors performance and other analytics of the compressor to ascertain if maintenance is required and can adjust performance of the compressor to optimize performance when degradation has been sensed. Operators can optimize performance while operating below a prescribed emission threshold rather than relying on annual detection to signal the need to corrective action.

Emission Threshold: We recommend against the proposal to trigger rod packing replacement or repair based on a one-size-fits-all leak rate of 2 scfm, because frequent replacement of rod packing will lead to unnecessary compressor blowdowns and emissions. Rather, we recommend tuning the leakage threshold based on the operating parameters of the compressor, mainly flow and pressures.

Packing seals always leak some amount of the compressed media, even when newly installed. For larger applications, such as transmission compressors, historical data shows that newly installed packing leaks at a rate of approximately 1 scfm. The proposed actionable leak rate of 2 scfm will lead to a significant increase in packing replacement for large, transmission sector, compressors. This in turn will lead to a significant increase in compressor blowdowns with associated large

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volumes of emitted blowdown methane. Before adopting such a proposal, EPA should analyze the increased volume of methane emissions from more frequent blowdowns compared to increasing the actionable leak rate, especially for the larger transmission compressors.

Control Devices (§60.5412b(a)(3)and 60.5412c(a)(3)): EPA should set the degree of emissions limitation achievable at 98 percent for pressure-assisted flares given the availability of commercially solutions to help operators maintain flare efficiency.

Under NSPS Subpart OOOOb EPA is requiring owner and operators of enclosed combustion devices, vapor recovery or other non-destructive control devices, and flares to reduce the mass content of methane and VOC in the gases vented to these devices by 95 percent by weight or greater. Subpart OOOOc include this requirement for enclosed combustion devices and vapor recovery units but not for flares.

We recommend that EPA distinguish between pressure-assisted flares and flares "other than pressure-assisted flares" (i.e., unassisted flares) in these requirements. For pressure-assisted flare, we recommend that EPA set the degree of emissions limitation achievable at 98 percent. There are commercially available technologies, such as the Baker Hughes flare.IQ[3] solution, that allow operators to achieve a combustion efficiency of 98 percent. This technology has been installed by operators worldwide. We believe the EPA proposed 95 percent destruction threshold is not justified given the availability of such systems.

Because it is not possible to control combustion efficiency for *unassisted flares*, we do not believe that setting a minimum threshold is feasible at this time. Rather, we recommend requiring continuous monitoring, reporting and verification. Rather than basing reported emissions on assumptions (e.g., stack is designed to meet xx% CE) reports should be based on real time monitoring. Also, with real time monitoring in place, operators may find levers to improve the combustion efficiency – effective control depends on accurate measurement.

We wish to underscore for EPA that one of the key requirements for flare operation is to maintain NHVcz of approximately 270 BTU/SCF minimum, typically measured by using a gas analyzer or calorimeter. Our experience is that those instruments are difficult to maintain. Field data acquired using flare.IQ indicate that the NHV calculation coming from the sound speed computation

[3] https://www.bakerhughes.com/panametrics/flare-management/flareiq

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method is a suitable alternative for flare gas NHV measurement. NHV from sound speed is within 3 percent when compared to measurements using a GC or a mass spectrometer.

We are happy to serve as a technical resource for the agency regarding flare efficiency solutions to support the agency's finalization of the methane rule.

Storage Vessels (§60.5395b and §60.5396c): Baker Hughes supports EPA's proposed standard for storage vessel affected facilities and recommends that EPA specifically include in the final rules an allowance for technology solutions that eliminate or replace thief hatches.

Baker Hughes supports EPA's proposed standard that all storage vessel affected facilities reduce methane and VOC emissions by 95 percent. Further, we support the proposed 6 tpy VOC and 20 tpy methane thresholds for a single storage vessel or a tank battery affected facility at completely new wellsites, centralized production facilities, and compressor stations. We also support EPA's retention of the current alternate control standard to maintain the uncontrolled actual VOC emissions from a single storage vessel or a tank battery affected facility at less than 4 tpy VOC and 14 tpy methane.

We agree with previous commenters that open thief hatches and deteriorated seals around tank openings are significant emissions sources at tank batteries. EPA is right to solicit comment on including a requirement to equip thief hatches with alarms, automated systems to monitor for pressure changes, or use of automatically closing thief hatches. We support such a requirement but note that operators have traditionally been hesitant to deploy electronic monitoring equipment near thief hatches due to the risk associated with electrified sensing technologies in potentially flammable atmospheres that can be present at the thief hatch.

A lower cost, less risky and more long-term abatement solution should be physical replacement of the thief hatch with a device that allows for capture of the emissions associate with pressure venting at the thief hatch port. There are technologies in late-stage development that will achieve significant reductions in storage vessel emissions associated with thief hatches. A thief hatch elimination device will eliminate the vent to atmosphere from thief hatches. This device would retrofit on to existing storage tanks and would replace thief hatches on new storage tanks. It would eliminate nearly 100 percent of the emissions resulting from thief hatches as it provides a pipe-away configuration to a vapor recovery system while still providing access to the tank contents for gaging and sampling purposes. It has the added benefit of protecting the worker from being exposed to flammable atmosphere at the thief hatch port as well as toxic vapors from the storage tank head space.

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We recommend that EPA include in both §60.5395b and §60.5396c allowance for solutions that eliminate or replace the thief hatch and provide a means of capturing emissions from thief hatch ports due to over pressure venting by piping those emissions to a flare or sales line.

Liquids Unloading (§60.5376b and §60.5390c): EPA should include a requirement that operators document solutions employed to reduce the frequency of liquids unloading events to the list of best management practice requirements for operators seeking exemption from the proposed zero-emission standard.

There are significant opportunities to reduce emissions associated with liquids unloading despite the diversity of circumstances and technologies involved. One means of facilitating reductions in methane emissions generated by liquids unloading is to deploy advanced methods that reduce the frequency of unloading events.

For example, Baker Hughes offers several technologies that improve production efficiency including ProductionLink™ Edge, an integrated production optimization platform providing real-time transmission and monitoring of artificial lift operational dataIn 2021, natural gas producer Vine Energy deployed ProductionLink™ Edge across 100 natural gas wells in Louisiana's Haynesville Shale. This follows a three-month joint pilot project in Haynesville Shale using the artificial lift solution across 10 wells, during which Vine's gas production increased by 5 percent and well unloading events decreased by 94 percent, which in turn reduced methane emissions.

§60.5376b(d) and §60.5390c(d) define the minimum requirements for a best management practice plan to minimize venting of methane and VOC emissions from liquids unloading events for operators seeking an exemption from the zero-emission standard defined in §60.5376b(b) and §60.5390c(b). Given the commercial availability of ProductionLink™ Edge and other such solutions, we recommend EPA include the following to the list of the requirements at §60.5376b(d) and §60.5390c(d).

> (5) Document technology and operating practices employed to reduce the need and frequency of liquids unloading events at a well affected facility.

Production optimization represents a best management practice for capable of delivering cost-effective efficiency improvements and significant methane and VOC emission reduction.

Conclusion

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Baker Hughes is committed to take energy forward, making it safer, cleaner, and more efficient for people and the planet. Natural gas is helping to achieve the world's carbon-reduction goals and will remain an important part of a sustainable energy future. We are committed making that future a reality. Thank you for considering our views and recommendations.

Yours sincerely,

Allyson Anderson Book

Chief Sustainability Officer
Baker Hughes