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Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program, Mailstop EE-5B
1000 Independence Avenue, SW. Washington, D.C. 20585-0121

Re: Energy Conservation Standards for Gas Compressors: Request for Information. Reference Docket # EERE-2014-BT-STD-0051, and/or RIN 1904-AD40.

Dear Docket Clerk:

The Gas Compressor Association (GCA) is a trade organization for the natural gas compression industry. Our member companies manufacture and package natural gas compressor packages and related components. Many members also own and operate fleets of natural gas compressors that they rent to customers or that are used to provide their customers with contract compression services. The engines on these natural gas compressors are predominately spark ignited engines which primarily burn wellhead or field natural gas.

On November 28, 2014, the U.S. Department of Energy (DOE) published a notice indicating that the agency is considering developing energy conservation standards for commercial and industrial compressors. 79 Fed. Reg. 70,797 (Nov. 28, 2014). In particular, DOE requested comments regarding the characteristics and energy use of natural gas compressors.

On December 17, 2014, DOE held the public meeting that was the subject of this Federal Register notice to gather more information about energy conservation standards for compressors. The comments provided below respond to various items identified in the presentation given at that meeting:

Item 3-1: Given the breadth of application of natural gas compressors, DOE requests comment on where potential cost-effective energy savings lie. Often, these exist where market forces do not incentivize the purchase of efficient equipment.

<u>Comment</u>: GCA does not support the adoption of energy efficiency standards for natural gas compressors operating in the oil and gas sector. Imposing one-size-fits-all energy efficiency standards to this equipment category would be uneconomical and impractical. As noted above, many companies provide contract compression services for well operators. But those compressors are not necessarily used only at the wellhead. Rather, a given compressor may be one day located at a wellhead and the next day located in transmission service. Therefore, it would be difficult for companies to comply with these efficiency standards if DOE developed different standards for different services or segments of the gas industry. Such standards would either restrict a company's ability to use compressors in various services if the efficiency standards varied, or, alternatively, it would potentially force such companies to

purchase more expensive compressors that met the highest potential standards, regardless of whether those standards are always necessary for the intended use of the compressor.

Furthermore, as DOE is likely aware, companies consider numerous factors before purchasing compression equipment. Cost is obviously one factor. Other considerations include, but are not limited to: efficiency, performance, the company's experience with using the equipment, vendor guarantees, maintenance considerations, operating conditions, safety concerns, fuel or electric power availability, the physical size of the equipment and space restrictions onsite, compression needs, the number of units to be used at a given location, and the type of service for which a given compressor may be needed. The importance of these factors is likely different for different companies and different operating scenarios. For example, one company may conclude that it is preferable to install a compressor with slightly lower factory-stated energy efficiency because that model has better actual performance and reliability in the field. Focusing solely on energy efficiency would ignore whether modifications to that compressor to reach that higher efficiency would cause other drawbacks such as: making maintenance more difficult (resulting in longer downtimes), increasing the size of the equipment (such that it may not fit at an existing facility and additionally may increase emissions as a byproduct), or creating a monopoly for one compressor manufacturer if not all compressor models available in the marketplace are capable of achieving that standard. If fewer manufacturers are able to meet those standards ahead of the compliance deadline, costs would most likely increase substantially as demand to purchase the new equipment would increase. If manufacturers are unable to meet demand, delays associated with installing this new equipment could have the unintended side effect of reducing energy production throughout the United States and could have various trickle-down effects such as increasing the cost of manufacturing in the U.S.

Moreover, many natural gas compressors are already subject to environmental requirements that indirectly address energy efficiency. For example, EPA's New Source Performance Standards (NSPS) require all new, modified, and reconstructed reciprocating compressors in the gathering, transmission and storage segments to change packing seals every 36 months of operation to prevent leaks. Although targeted at reducing emissions of volatile organic compounds (VOC's), the NSPS has the secondary benefit of additionally reducing methane emissions because any maintenance or operational steps to reduce VOC's will necessarily reduce methane emissions. In its December 17th presentation, DOE identified methane leakage as an indicator of energy efficiency. The NSPS will help reduce such leaks, thereby indirectly improving energy efficiency. Therefore, additional measures that are focused on the efficiency of the compressor itself are unnecessary.

Item 3-2: DOE requests comment on the scope of coverage – specifically, whether a gas compressor energy conservation standard should be inclusive or exclusive of the prime mover.

Comment: If DOE proceeds to develop an energy conservation standard for gas compressors, GCA believes that prime movers should not be included in the standard. Gas compressors are designed and manufactured to take incoming gases at a certain pressure and volume and increase the pressure of the gas as it exits the compressor. The primary function of a compressor is to create higher gas pressure in the system in order to condense gases for storage or to move gases through the system (such as a pipeline). In contrast, the prime mover, whether it is an electric motor, diesel-fueled engine, gaseous-fueled engine, or combustion turbine, simply supplies the mechanical power to drive the compressor and plays no part in the compressor's primary function of increasing gas pressure. The physical processes of most prime movers (combustion of fuel to produce mechanical power) are inherently different than the process and function of the compressor itself. Consequently, GCA believes that the inherently different functions of prime movers and compressors do not lend themselves to a single energy conservation standard. DOE should not consider a prime mover and compressor configuration as a piece of industrial equipment as defined in 42 USC Chapter 77, Subchapter III.

Some additional rationale for not including prime movers within the scope of any proposed compressor energy conservation standards are as follows:

1) DOE derives its authority to establish energy conservation standards for industrial equipment from 42 USC Chapter 77, Subchapter III. That law states that DOE may include a type of industrial equipment that is not designated as "covered equipment" by rulemaking if it is necessary to do so for the purposes of the law. DOE's rationale for considering compressors as a candidate class of industrial equipment for energy conservation standards is that compressors are specifically included in the definition of "industrial equipment" in 42 USC Chapter 77, Paragraph 6311. Since "compressors" are not further defined in the law, DOE has asked whether the proper definition of compressor should be expanded to include the prime mover for the purposes of the energy conservation standards.

The language of 42 USC Chapter 77 clearly directs DOE to develop energy conservation standards for the listed "covered equipment." We do not believe that the law intended DOE to also include the external power sources that are needed to provide the energy for "covered equipment." Other equipment listed along with compressors includes fans, blowers, electric lights, evaporators, refrigerators, and other motors. All that equipment is powered by external sources, whether it is electricity from grid power, generators, heat pumps, fuel cells, etc. There is no language in the law that even suggests that the energy conservation standard for a refrigerator, fan, or commercial lights should include the external source of the power as well as the equipment itself. Compressors should be treated no differently than other "covered equipment," and the external source of power, i.e., the prime mover, should not be included in the definition or scope of a compressor.

Incorporating the prime mover within the definition of compressor would require burdensome and overly complex analysis (that may vary over time) to compare combustion-based prime movers with electric motors. For example, while electric motors may exhibit an efficiency advantage at the site level, this advantage is often mitigated by high energy losses associated with electric power transmission based on proximity. The method of electric power generation (coal, natural gas, nuclear, etc.) will also have a significant overall impact on the compressor efficiency comparisons. In regions lacking electric power transmission line infrastructure, the significant costs, challenging logistics, and regulatory barriers may limit feasibility of electric motor utilization regardless of efficiency concerns.

2) Including the prime mover within the definition of compressor for purposes of establishing energy conservation standards would create an unmanageable and complex system of standards.

Compressor packages are developed to address a specific envelope of needs and conditions, and are paired with a prime mover that best meets those needs. For example, a specific compressor may be paired with an electric motor where a source of electricity is available, a diesel engine if it is off-grid, or a gas engine or turbine where there is an ample supply of natural gas fuel. Although there may be a manageable number of specific compressor models, there are an uncountable number of possible compressor and prime mover combinations that are created to address a customer's specific field and fuel situations. Including the prime mover within the definition of compressor would create an unmanageable and unspecified number of "compressors" for which DOE would have to develop energy conservation standards.

3) Manufacturers of prime movers used to power compressors already have efficiency standards, are driven by market forces to improve efficiency, or are constrained in making efficiency improvements by existing federal emissions regulations. Consequently there is no need for DOE to develop additional energy efficiency standards for prime movers as part of a compressor regulation. For example, DOE is already required to develop efficiency standards for electric motors since they are listed as 'covered equipment" in 42 USC 77; and see 10 CFR Part 431, Subpart B. Combustion-based prime movers such as engines and turbines convert fuel to mechanical energy. Since owners and operators seek to minimize the costs of fuel, engine and turbine manufacturers are under constant market pressure to make their equipment as efficient as possible in order to satisfy customer demands. In the case of reciprocating internal combustion engines, energy efficiency has actually suffered due to the myriad of federal and state air quality regulations. Engine design efficiency and operations durability have been sacrificed to achieve continued compliance with these regulations.

4) Another complicating factor for compressors that are powered by gaseous-fueled engines or turbines is that the quality of the natural gas used as fuel varies across the country and the potential location of the compressor, e.g., pipeline, storage facility, wellhead. The quality of fuel gas has a significant effect on the efficiency of the prime mover. It would be impossible to account for – or measure – the impacts of natural gas quality on compressor efficiency if the prime mover was included with the compressor as part of any DOE energy conservation standard.

For the reasons indicated above, DOE should not include prime movers within the definition of gas compressors for the purposes of developing conservation standards under 42 USC 77.

Item 4-1: DOE requests comment about the test procedures that may be suitable for assessment of energy consumption in natural gas compressors. In addition to specifying which and how physical parameters must be measured, such a procedure should specify the conditions under which the measurements are taken and interpreted.

Comment: DOE should understand that there are no industry accepted methods to precisely measure efficiency in the field. While high quality instrumentation does exist at a cost, their application has not been readily adapted to suit the harsh conditions experienced in the field.

Compressor performance testing can determine compressor power consumption, compressor capacity, cylinder valve losses, cylinder volumetric efficiency, valve and ring leaks, as well as other variables. Dynamic internal compressor cylinder pressures, valve cap temperatures, and crankshaft position must be measured to calculate said performance of the compressor. Parameters are measured by a performance analyst over a several hour period at the physical location of the compressor while it is operating. Because most compressors are not part of a routine performance testing program, the analyst must shutdown the compressor to install temporary individual sensors for each measured parameter in order to assess energy efficiency. Upon restart of the compressor, each parameter is measured and fed into a performance analyzer for calculation of said performance. Accuracy for power and flow calculations is generally within 3-5%.

Energy efficiency testing would require specially trained employees using sensitive and high cost instruments, and often compressor downtime. Routine performance testing occurs on small populations of high power compressors for preventative maintenance purposes, but is otherwise unsustainable for the larger populations of "field gas compressors".

Item 5-1: DOE is seeking both present and historical shipments data (specifically from 2003-2013) for gas compressors, with further breakdowns, where available, including, but not limited to, equipment type (both compression principle and driver type), equipment size, and application. DOE is also interested in comments regarding how gas compressors are manufactured and shipped as original equipment from the manufacturer, for example, as a package (i.e., with both compressor and prime mover), or as a separate component, or both.

<u>Comment:</u> While the GCA is limited by its bylaws to the amount of specific information that can be released, the following horsepower percentages are representative of current package type and application. Approximately 8% of compressors shipped domestically are integrals where the prime mover and compressor share a common crankshaft. Most of these are provided from the OEM as a complete package including the skid and cooler. The remaining 92% are separable, and the prime mover and compressor combination are selected by the packager for optimal performance. Once packaged, approximately 96% go to gathering applications and the remaining 4% to transmission and storage.

Item 5-3: DOE seeks comment on how an energy conservation standard for gas compressors might impact future equipment shipments.

<u>Comment:</u> It is premature to comment as to how an energy conservation standard for gas compressors might impact future equipment shipments because the range of possibilities is so broad. If a regulation or standard favors one form of technology or one brand of product, then competition could be significantly hindered. The GCA will evaluate specific proposed regulations and comment as appropriate.

Item 5-4: DOE is seeking comment about the types of equipment used in gas compressors. Specifically, DOE is interested in information regarding the compression principles (e.g., positive-displacement or

dynamic compressors) and primary driver types (e.g., natural gas or steam turbines or electric motors) used in gas compressors, as well as what design, construction, and performance characteristics would be attributed to each type. DOE is also interested in information regarding the compression principles and driver types used in gas compressors based on application type.

Comment: The information requested under item 5-4 represents a broad knowledge that cannot be conveyed in formal comments especially given the time frame that the DOE has provided. The GCA suggests the following resources for DOE to utilize for education regarding the compressor industry:

- Best practices for Specifying & Procuring a Successful Large, High-Speed Reciprocating Compressor Package Paper
    - http://www.gmrc.org/resources?article_id=682&title=Best+Practices+for+Specifying+%26+Procuring+a+Successful+Large%2C+High-Speed+Reciprocating+Compressor+Package&year=2012&category=papers&author=Norm+Shade%2C+ACI+Services+Inc.%3B+Josh+Shaver%2C+Atmos+Energy%3B+Dan+Hannon+%26+Dave+McCoy%2C+Ariel+Corporation%3B+Ken+Hall+%26+David+Krenek%2C+Caterpillar%3B+Frank+Northrup%2C+SEC+Energy+Products%3B+Kelly+Eberle%2C+Beta+Machinery+Analysis
- The Value of Compressor Efficiency Paper
    - http://www.gmrc.org/resources?title=The+Value+of+Compressor+Efficiency
- Industry related training sessions
    - http://www.gmrc.org/gmrc-training

In addition, the DOE may want to consider the retaining the services of a consultant that is intimately familiar with the nuances of the gas compression industry that would be able to interact in a manner that is more efficient than formal comments from industry.

Item 5-5: DOE is also seeking comment about how gas compressors are sized (e.g., by brake horsepower, input/output pressure, or delivered gas volume) and the general sizes of gas compressors based on both equipment and application type.

Comment: This is a very broad question similar to item 5-4 and the same resources should be consulted. However to help DOE understand some of the other comments in this document, the GCA offers the following:

The main parameters in determining Compressor horsepower requirements are:

1) The volume of gas that needs to be compressed. Higher volume requires more horsepower.
2) The inlet and outlet pressure needed. Higher pressure ratios require more horsepower.
3) The type of gas being compressed (there is a significant variance in natural gas constituents from raw wellhead streams to "pipeline quality" natural gas).

The parameters above are often a range, rather than a single point and tradeoffs occur throughout the design process. The specific design of the compressor package will take many other factors into consideration as discussed in comments for item 3-1. Because these factors often change significantly and frequently during actual operation, most compressors are designed with a range of acceptable performance.

Item 5-6: DOE requests input on ways to characterize gas compressor sizing and selection practices for different equipment and end use applications.

Comment: See comments under 5-4

Item 5-7: DOE requests comment on the degree of gas compressor oversizing that is prevalent under current industry practices. Specifically, the degree to which this oversizing may be a factor for different end-use applications.

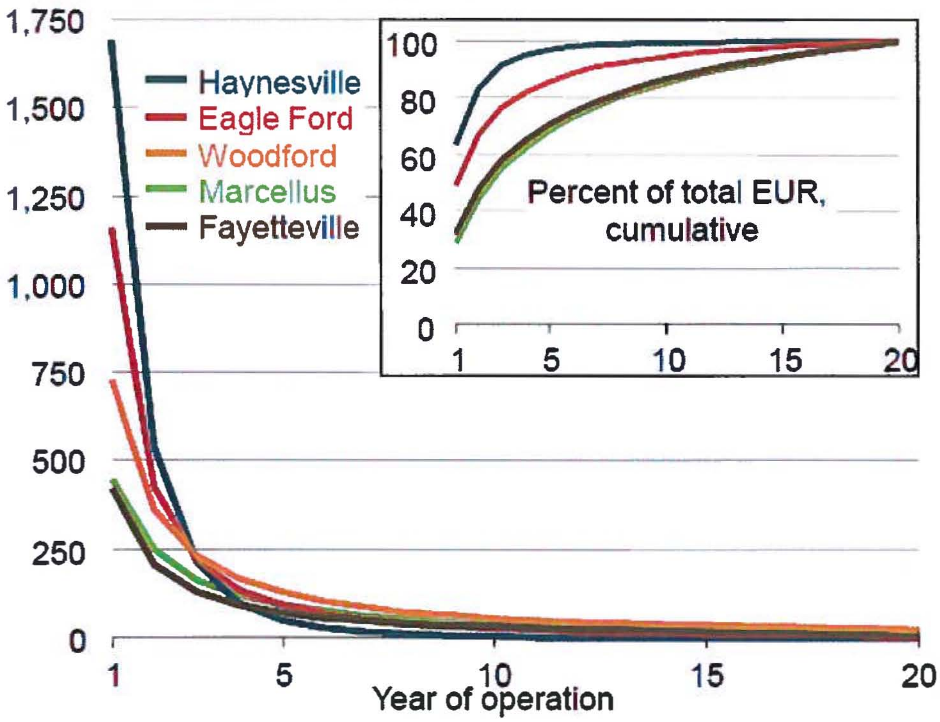
Comment: The amount of oversizing of a gas compressor varies widely throughout the industry, as the engineering practice of oversizing is similar to many other industries, and is influenced by many factors such as changing operating conditions, inability to cycle on and off, a finite amount of available sizes, and barriers to optimization. As a result of these factors, it is not practical to set an efficiency standard to be measured in the field. Each of these will be discussed in detail:

Changing Operating Conditions

Even though operators are financially incentivized to utilize optimally sized compressors, there are several situations where the operating conditions change over time that may result in the compressor being operated in a less than optimum manner.

First, volume requirements change as a result of gas well decline and drilling activity which changes the size requirement of the compressor. A compressor may be in an application that compresses gas from a single well or from an aggregate stream of gas from thousands of wells. Each gas well experiences a decline in production over its life. For shale gas wells, the initial decline is very high as can be seen in the following figure taken from the EIA Annual Energy Outlook 2012:

Figure 54. Average production profiles for shale gas wells in major U.S. shale plays by years of operation (million cubic feet per year)



Drilling activity can offset the decline by adding new wells to the stream of gas. Depending on the level of drilling activity, the volume may increase or decrease. As more and more streams are aggregated, there can be a dampening effect which can make the volumes remain more constant. The upstream and gathering segments typically have the highest volume changes. The larger sites in the midstream and processing sector sometimes have multiple units at the same site. In this case, compressor units can be added or subtracted (subject to economic limits) to help mitigate the volume changes over time. In the transmission segment, the volume changes tend to happen slower due to a higher level of aggregation and or pipeline capacity limitations.

Second, compressor demands can fluctuate due to operational conditions of the pipelines. All segments of the industry can experience rather dramatic swings in the operating pressures of the pipeline systems the compressors are part of. These changes in operating pressures have a significant impact on the loading of the compressor and therefore the amount of "oversizing" experienced at any given time. Even the transmission segment mentioned in the previous paragraph can see significant changes in pressures as pipelines experience periods of packing and drafting (using the pipeline as short term storage to meet cyclical daily demands for gas flow).

Third, ambient conditions can affect compressor loading on a day to day basis. Internal combustion prime movers will produce more power under conditions of higher air density (lower temperatures and higher barometric pressure) than under conditions of lower air density (higher temperatures and lower barometric pressure). De-rating of 0.5% horsepower is common for high ambient temperature operation on some types of internal combustion engines. The ambient conditions can also have an effect on the volume of gas reaching the compressors. Very low ambient temperature can result in freezing off of wells and station piping which can have immediate and significant effects on compressor loading.

Fourth, the design point of a compressor is often a range, not a single point. The time to procure and install a compressor can be 6 months or more. Operating conditions are forecasted well in advance of the actual operation, and as stated above, the conditions are likely to vary over time. Cylinder sizing is matched with the prime mover to enable satisfactory performance in various situations that are likely to be encountered.

Inability to cycle on and off

Most natural gas compressors are not cycled on and off to maintain desired flow. The majority of compressors must be started in an unloaded state and put on line manually after a warm up period. The majority of compressors are located at remote unmanned facilities (especially in the upstream and gathering sectors). As a result, compressors tend to be operated for long periods at a time, even if it means being operated in a less than optimum manner. There are some cases where compressors are started automatically and/or remotely, or where configuration changes such as unloading cylinders can be made while the compressor is operating, but this represents a small minority of compressors that the GCA represents.

Finite amount of available sizes

There is a finite amount of available gas compressors sizes that are available. Engine prime movers and compressors are manufactured in standard size options to fill a variety of needs. These sizes are generally based on horsepower increments. Compressor cylinders are chosen to compliment the horsepower and rpm characteristics of the prime mover and compressor. Operators typically choose a compressor that is as close to their projected needs as possible, but rarely is it exact. As mentioned above, more often than not a range of operating parameters is selected. Below is an example of horsepower options for one family of natural gas prime movers from Caterpillar:

Ratings

G3500B LE RATINGS

	1400 rpm bkW	1400 rpm bhp
G3520B LE	1286	1725
G3516B LE	1029	1380
G3512B LE	772	1035
G3508B LE	515	690

As can be seen above, if an operator needed a 1200 horsepower compressor based on their projected volume, pressure ratios, and gas composition, they could choose either a 1,035 horsepower G3512B LE or a 1,380 Horsepower G3516B LE. If the operator choses the 1,035 horsepower engine, they would be short nearly 20% production. If they chose the 1,380 horsepower engine, they would have nearly 20% excess horsepower available.

Barriers to Optimization

In many situations, an operator may choose to operate a compressor at a less than optimal efficiency because it is the most economical or practical solution given the various barriers to optimization. The first barrier is cost. It can cost a significant amount of money to uninstall a compressor and reinstall a replacement. Besides the capital dollars to procure and install the new equipment, there are also permitting and startup costs and lost production. The current regulatory environment can have very long permitting times. Given the various costs, it is not uncommon for a project to downsize a compressor to remain uneconomical until the inefficiency reaches 40-50%. Some operators utilize rental compression, especially in projects where operating conditions are anticipated to change. This can mitigate the capital cost to purchase a new asset and the need to dispose of the old asset, but it does not mitigate the other factors such as installation cost, permitting and lost production.

Not practical to set an efficiency standard

It is not practical to set an efficiency standard to be measured in the field. As discussed above, there are many factors that affect the operation of natural gas compressors and many compressors must be operated outside of optimal conditions. Any standard of efficiency chosen would have to take into account all of the variables and the specific operating conditions for that particular compressor and therefore by necessity, the standard would have to change constantly.

Item 5-10: DOE requests comment on how compressors are marketed, sold, shipped, and assembled, and on the various distribution channels through which gas compressors pass through from the manufacturer to the final end-user.

Comment: Most reciprocating natural gas compressor packages sold in the US that are going to a US destination are marketed and sold directly to the end user companies. Typically those are Producers, Midstream, and Pipeline Transmission companies but also include contract compression providers. Approximately 10 to 15% of equipment sold is sold through an Engineering firm who has been hired by the end user to provide necessary engineering, procurement and definition of the required compressor equipment scope of supply. There are very little if any agents or other third parties involved in US transactions. Most larger compressor packages shipped in the US are shipped 60 to 80% assembled with final assembly and installation at the customer's jobsite location. Depending on the physical size of the equipment and the transportation logistics, (IE. weight restrictions, size restrictions, State limitations, weather, etc.) more/less disassembly at the point of manufacture and then reassembly at the jobsite may be required.

Natural gas compressors are designed and manufactured in a variety of power, pressure and flow ratings by a number of specialty manufacturers including Ariel, Dresser Rand, GE and others. Typical power ratings for natural gas compressors are 50 horsepower to 8000 horsepower. The compressor manufacturer generally sells and ships the bare compressor to a "compressor packager". The compressor packager is responsible for the integration of the bare compressor into a completely engineered compressor package fit for delivery and installation at the end-user's field operation location.

Upon a request for quotation from a customer, the compressor packager's engineering team selects the appropriate size bare compressor, an appropriate prime mover such as electric motor or natural gas engine, an engineered cooling system, a control and instrumentation system, piping and pressure vessels, and structural steel skid necessary to support the compressor package during transportation, installation and operations.

Item 5-11: DOE seeks comment on the different agents involved in the sale and installation of a typical gas compressor for each distribution channel.

Comment: Generally, the compressor packager markets the complete compressor package to end users, lease compression fleet operators, and other third parties such as engineering firms for integration into field operation facilities.

Item 6-3: DOE seeks input on gas leakage by equipment type, and on data that may help characterize the amount of leakage by specific source.

Comment: There are several EPA regulatory vehicles that already address gas leakage by equipment type, including large and small compressors. Most are contained in EPA's NSPS, NESHAP, and GHG regulations.

Regulations addressing natural gas compressors are contained in the LDAR program (Leak Detection and Repair Program), regulations such as 40 CFR 60, Subpart OOOO, and the recently updated GHG program (Green House Gas Program) 40 CFR 98, Subpart W.

These regulations address and establish control limits for emissions (leakage) and maintenance requirements from petroleum equipment that includes almost every aspect of petroleum drilling, extraction, processing, and transportation. This includes detailed methods on measuring/testing and quantifying leaking compressors and associated equipment. Documentation, tracking, and records retention requirements are also included in each of the regulations.

All these regulations address compressor operation and throughout the oil and gas industry segments. They are in place and updated regularly.

Any additional regulations concerning compressor operations and/or emissions and leakage would likely be a redundant burden on compressor operators and while providing little, if any, additional benefit to the efficiency of the compressor. Additional regulation by the DOE could create conflicts in operational requirements for the compressor operators.

A brief outline of each of the regulations noted above where compressors are referenced is included in the following:

I. Leak Detection and Repair programs (LDAR) program requirements addressing Natural Gas leakage by equipment type (**Including Compressors**) is addressed in multiple natural gas production and transportation regulations promulgated by the EPA (see Appendix A below) such as VV, KKK, etc.

Appendix A Federal Regulations That Require a Formal LDAR Program With Method 21

40 CFR		Regulation Title
Part	Subpart	
60	VV	SOCMI VOC Equipment Leaks NSPS
60	DDD	Volatile Organic Compound (VOC) Emissions from the Polymer Manufacturing Industry
60	GGG	Petroleum Refinery VOC Equipment Leaks NSPS
60	KKK	Onshore Natural Gas Processing Plant VOC Equipment Leaks NSPS
61	J	National Emission Standard for Equipment Leaks (Fugitive Emission Sources) of Benzene
61	V	Equipment Leaks NESHAP
63	H	Organic HAP Equipment Leak NESHAP (HON)
63	I	Organic HAP Equipment Leak NESHAP for Certain Processes
63	J	Polyvinyl Chloride and Copolymers Production NESHAP
63	R	Gasoline Distribution Facilities (Bulk Gasoline Terminals and Pipeline Breakout Stations)
63	CC	Hazardous Air Pollutants from Petroleum Refineries
63	DD	Hazardous Air Pollutants from Off-Site Waste and Recovery Operations
63	SS	Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process
63	TT	Equipment Leaks – Control Level 1
63	UU	Equipment Leaks – Control Level 2
63	YY	Hazardous Air Pollutants for Source Categories: Generic Maximum Achievable Control Technology Standards
63	GGG	Pharmaceuticals Production
63	III	Hazardous Air Pollutants from Flexible Polyurethane Foam Production
63	MMM	Hazardous Air Pollutants for Pesticide Active Ingredient Production
63	FFFF	Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing
63	GGGGG	Hazardous Air Pollutants: Site Remediation
63	HHHHH	Hazardous Air Pollutants: Miscellaneous Coating Manufacturing
65	F	Consolidated Federal Air Rule – Equipment Leaks
264	BB	Equipment Leaks for Hazardous Waste TSDFs
265	BB	Equipment Leaks for Interim Status Hazardous Waste TSDFs

Note: Many of these regulations have identical requirements, but some have different applicability and control requirements.

II. Similar to LDAR programs above, EPA 40 CFR 60, Subpart OOOO addresses Natural Gas Production, Transmission, and Distribution. It establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO_2) emissions from affected facilities.

§60.5365 Am I subject to this subpart?

The following facilities are subject to the provisions Subpart OOOO:

(a) Each gas well affected facility, which is a single natural gas well.

(b) Each centrifugal compressor affected facility, which is a single centrifugal compressor using wet seals that is located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment.

(c) Each **reciprocating compressor affected facility**, which is a single reciprocating compressor located between the wellhead and the point of custody transfer to the natural gas transmission and storage segment.

Note: Additional non-compressor sources are noted in the regulation.

§60.5385 What standards apply to reciprocating compressor affected facilities?

You must comply with the standards in paragraphs (a) through (d) of this section for each reciprocating compressor affected facility.

(a) You must replace the reciprocating compressor rod packing according to either paragraph (a)(1) or (2) of this section.

(1) Before the compressor has operated for 26,000 hours. The number of hours of operation must be continuously monitored beginning upon initial startup of your reciprocating compressor affected facility, or October 15, 2012, or the date of the most recent reciprocating compressor rod packing replacement, whichever is later.

(2) Prior to 36 months from the date of the most recent rod packing replacement, or 36 months from the date of startup for a new reciprocating compressor for which the rod packing has not yet been replaced.

(b) You must demonstrate initial compliance with standards that apply to reciprocating compressor affected facilities as required by §60.5410.

(c) You must demonstrate continuous compliance with standards that apply to reciprocating compressor affected facilities as required by §60.5415.

(d) You must perform the required notification, recordkeeping, and reporting as required by §60.5420.

III. 40 CFR 98, MANDATORY GREENHOUSE GAS REPORTING

NOTE that this references below does not address the whole GHG part (40 cfr. 98, subpart W), only the parts that reference compressors.

- **Purpose and Scope** -- This part establishes mandatory greenhouse gas (GHG) reporting requirements for owners and operators of certain facilities that directly emit GHG.
- **Who Must Report** -- The GHG reporting requirements and related monitoring, recordkeeping, and reporting requirements of this part apply to the owners and operators of any facility that is located in the United States or under or attached to the Outer Continental Shelf

40 CFR 98.230, **Subpart W**—Petroleum and Natural Gas Systems

This source category consists of the following industry segments:

(2) *Onshore petroleum and natural gas production.* Onshore petroleum and natural gas production means all equipment on a single well-pad or associated with a single well-pad (including but not limited to **compressors**, generators, dehydrators, storage vessels, and portable non-self-propelled equipment which includes well drilling and completion equipment, workover equipment, gravity separation equipment, auxiliary non-transportation-related equipment, and leased, rented or contracted equipment) used in the production, extraction, recovery, lifting, stabilization, separation or treating of petroleum and/or natural gas (including condensate). This equipment also includes associated storage or measurement vessels and all enhanced oil recovery (EOR) operations using CO_2 or natural gas injection, and all petroleum and natural gas production equipment located on islands, artificial islands, or structures connected by a causeway to land, an island, or an artificial island.

(3) *Onshore natural gas processing.* Natural gas processing means the separation of natural gas liquids (NGLs) or non-methane gases from produced natural gas, or the separation of NGLs into one or more component mixtures. Separation includes one or more of the following: forced extraction of natural gas liquids, sulfur and carbon dioxide removal, fractionation of NGLs, or the capture of CO_2 separated from natural gas streams. **This segment also includes all residue gas compression equipment owned or operated by the natural gas processing plant.** This industry segment includes processing plants that fractionate gas liquids, and processing plants that do not fractionate gas liquids but have an annual average throughput of 25 MMscf per day or greater.

(4) *Onshore natural gas transmission compression.* Onshore natural gas transmission compression means any stationary combination of compressors that **move natural gas from production fields, natural gas processing plants, or other transmission compressors through transmission pipelines to natural gas distribution pipelines,** LNG storage facilities, or into underground storage. In addition, a transmission compressor station includes equipment for liquids separation, and tanks for the storage of water and hydrocarbon liquids. Residue (sales) gas compression that is part of onshore natural gas processing plants are included in the onshore natural gas processing segment and are excluded from this segment.

40 CFR 98.232 GHGs to report.

You must report CO_2, CH_4, and N_2O emissions from each industry segment specified in paragraph (b) through (i) of this section

~~(b) For **offshore** petroleum and natural gas production~~

(c) For an onshore petroleum and natural gas **production facility**, report CO_2, CH_4, and N_2O emissions from only the following source types on a single well-pad or associated with a single well-pad:

(11) Reciprocating **compressor** rod packing venting.

(21) Equipment leaks from valves, connectors, open ended lines, pressure relief valves, pumps, flanges, and other equipment leak sources (such as instruments, loading arms, stuffing boxes, **compressor seals**, dump lever arms, and breather caps).

(22) You must use the methods in §98.233(z) and report under this subpart the emissions of CO_2, CH_4, and N_2O from stationary or portable fuel combustion equipment that cannot move on roadways under its own power and drive train, and that is located at an onshore petroleum and natural gas production facility as defined in §98.238. Stationary or portable equipment are the following equipment, which are integral to the extraction, processing, or movement of oil or natural gas: well drilling and completion equipment, workover equipment, natural gas dehydrators, **natural gas compressors**, electrical generators, steam boilers, and process heaters.

(d) For onshore **natural gas processing**, report CO_2, CH_4, and N_2O emissions from the following sources:

(1) Reciprocating compressor rod packing venting.

(e) For onshore natural gas **transmission compression**, report CO_2, CH_4, and N_2O emissions from the following sources:

(1) **Reciprocating compressor** rod packing venting.

(f) For **underground natural gas storage**, report CO_2, CH_4, and N_2O emissions from the following sources:

(1) Reciprocating compressor rod packing venting.

(g) **For LNG storage**, report CO_2, CH_4, and N_2O emissions from the following sources:

(1) Reciprocating compressor rod packing venting.

(h) **LNG import and export equipment**, report CO_2, CH_4, and N_2O emissions from the following sources:

(1) Reciprocating compressor rod packing venting.

§98.233 Calculating GHG emissions.

(p) Reciprocating compressor venting. Calculate CH_4 and CO_2 emissions from all reciprocating compressor vents as follows. . For each reciprocating compressor covered in §98.232(d)(1), (e)(1), (f)(1), (g)(1), and (h)(1) you must conduct an annual measurement for each compressor in the mode in which it is found during the annual measurement, except as specified in paragraph (p)(9) of this section. Measure emissions from (including emissions manifolded to common vents) reciprocating rod packing vents, unit isolation valve vents, and blowdown valve vents. Record emissions from the following vent types in the specified compressor modes during the annual measurement as follows:

(1) Operating or standby pressurized mode, blowdown vent leakage through the blowdown vent stack.

(2) Operating mode, reciprocating rod packing emissions.

(3) Not operating, depressurized mode, unit isolation valve leakage through the blowdown vent stack, without blind flanges.

§98.234 Monitoring and QA/QC requirements.

The GHG emissions data for petroleum and natural gas emissions sources must be quality assured as applicable as specified in this section. Offshore petroleum and **natural gas production facilities** shall adhere to the monitoring and QA/QC requirements as set forth **in 30 CFR 250.**

§98.236 Data reporting requirements.

(a) Report annual emissions in metric tons of CO_2e for each GHG separately for each of the industry segments listed in paragraphs (a)(1) through (8) of this section.

(1) Onshore petroleum and natural gas production.

(2) Offshore petroleum and natural gas production.

(3) Onshore natural gas processing.

(4) Onshore natural gas transmission compression.

(5) Underground natural gas storage.

(6) LNG storage.

(7) LNG import and export.

(8) Natural gas distribution.

Item 6-4: DOE seeks input on technologies available to reduce gas leakage, including the cost effectiveness and applicability of each.

Comment:

The EPA has promulgated rules for rod packing replacement under 40 CFR 60 Subpart OOOO. This rule addresses leakage in several areas:

- Requires that rod packings in reciprocating compressors be replaced every 26,000 hours. The rod packing seal has potential to be one of the largest leak points for reciprocating compressors
- Requires 95% reduction in emissions (i.e. leakage) in wet gas seals of centrifugal compressors.
- Requires the use of low bleed pneumatic controllers which are often an ancillary item on a gas compressor package.

The current price of natural gas is under $4/MMBtu. With lower gas prices, the monetary savings to operators for reducing gas leakage is minimal. Also, in many instances, the beneficiary of the gas savings is not the same entity that bears the cost to reduce the leakage. Examples include:

- Many contractual arrangements allocate fuel and/or lost and unaccounted for gas back to the owner of the gas, whereas equipment maintenance is usually on the operator of the equipment, not necessarily the same entity.
- In rental compression, maintenance costs are usually born by the compressor rental company, while the cost of lost gas is born by the producer or customer.

Additionally, in spite of the lack of cost effectiveness to reduce leakage, the vast majority of leaks are repaired for safety reasons. Leaking natural gas can create a very hazardous situation, especially if the compressor package is located inside of a building or enclosure. In additions, some natural gas in the upstream and gathering segments may contain substances that are harmful for humans to breathe.

See Item 6-3 for additional Subpart W and LDAR programs comments.

Item 6-5: DOE requests specific comment on compressor blowdown, including estimated leak volume, technologies able to reduce blowdown frequency and capture the gas blown down.

Comment: Compressor blowdown is an event that frequently occurs at the shutdown or subsequent restart of a compressor. Blowdown is required when any part of the compressor process system is repaired, for personnel safety reasons. Additionally blowdowns occur to facilitate easier starting of the compressor and decrease the likelihood of start failure. The latter could be reduced by utilization of a "startup bypass" line if it is installed on the compressor package or on the piping in the field. Regarding the amount of gas blown down, the GCA is developing a model which will give an accurate prediction based on package horsepower to comply with EPA rules already in place.

Compressor valve replacement is perhaps the most frequent repair requiring compressor blowdown. High reliability compressor valves which translate to reduced blowdown events are not generally the high efficiency variety. Valve reliability and valve efficiency are generally inversely related variables and operators must take both into account when choosing the most desirable valve to be used in a specific application.

Recapture of blowdown gas is rarely done in the upstream and midstream segments due to the unsustainable nature of the added equipment that would be required to do so. If blowdown to atmosphere must be prevented, an alternate method should be considered.

Item 6-8: DOE seeks recommendations or sources of data or analysis on the fraction of time, in hours, per year that has compressors spend at off-design (efficiencies other than the specified design point) operation under normal operating conditions.

Comment: Because of the factors discussed under Item 5-7 (changing conditions, design range versus a design point, etc…), it will be very difficult to obtain meaningful data from a representative sample in response to this request.

Item 6-12: DOE is interested in what opportunities, if any, for improving gas compressor energy efficiency are possible.

Comment: See Item 3-1

Item 6-13: DOE requests comment about any compressor features that represent usefulness to the user, such as pressure, flow, fuel type, physical size, portability, serviceability, emissions, and acoustic noise, and on applications in which particular forms of utility may be especially important. Additionally, how would an effort to increase energy efficiency of a compressor affect these features?

Comment: See Item 5-4

Item 6-14: DOE seeks comment about whether installation costs for gas compressors changes with higher efficiency of equipment. If so, DOE seeks comment about the reasons for, and the amount of such an increase.

Comment: Installation costs will be dependent upon the type of changes required to increase efficiency. If the changes are internal to the compressor cylinders themselves, the installation cost changes may be negligible. However, the engineering and retooling costs will likely cause a substantial increase to the initial purchase price of the product. If external to the cylinders, such as oversized valves, piping, and/or appurtenances, the installation costs will likely increase.

Item 6-15: DOE seeks comment about whether maintenance costs for gas compressors changes with higher efficiency equipment. If so, DOE seeks comment about the reasons for, and the amount of such a change.

Comment: Reference comment on Item 6-5 regarding compressor valve reliability vs compressor valve efficiency. As higher efficiency components are used, it is not uncommon to see an increase in failure rates and therefore maintenance costs.

Item 6-16: DOE seeks comment about whether repair costs for gas compressors changes with higher efficiency equipment. If so DOE seeks comment about the reason for, and the amount of such a change.

Comment: Higher efficiency components are oftentimes more complex and rebuild/repair costs of those components are increased. Higher efficiency valves are ones that allow flow through a less obstructed path, and as such, complex angles and reliefs are machined into the valve seat and guard. This requires more sophisticated machinery and increased labor hours for both initial manufacturing and subsequent repair.

Item 7-1: DOE is interested in how these efficiency improvements would impact equipment performance, features, utility or safety.

Comment: It is premature to comment as to how efficiency improvements would impact equipment performance, features, utility or safety because the range of possibilities is so broad. The GCA will evaluate specific proposed regulations and comment as appropriate.

Summary

The GCA is interested in working with the DOE to ensure that any regulations considered by the DOE are practical, not cost prohibitive, and technically sound. It is in the best interest of both the DOE and the industry to work together to achieve reasonable results that have a favorable cost/benefit ratio. The GCA will be able to provide more detailed comments as the DOE's process becomes more focused and refined. The comments provided herein are very limited due to short time frame and the breadth of the requested comments.

Sincerely,

Mark Davis
GCA HSE Committee Chairman