

# Challenges of Evaluating Regulatory Compliance with the GHG Mandatory Reporting Rule

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Preparation for compliance with the Environmental Protection Agency's (EPA's) recent "Mandatory Reporting of Greenhouse Gases: Petroleum and Natural Gas Systems" for the gas processing and production industry has required an unprecedented commitment of resources and effort. Not only has the rule implementation timeframe been aggressive, but these new rules apply to a large number of facilities and sources that have not previously been required to track, quantify and report greenhouse gas emissions.

This paper will investigate the approach that was taken to identify the requirements and achieve regulatory compliance by a large oil and gas production company with Subparts C and W of the rule. The challenges included:

- Inconsistencies of, and Changes to, Subparts C and W
- Screening of Facilities
- Measurements and Tracking
- Data Collection
- Data Retention



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## *Introduction*

The EPA published the final rule, 40 CFR Part 98 - Mandatory Greenhouse Gas (GHG) Reporting, in the Federal Register on October 30, 2009. The stated purpose of EPA's new rule is to collect accurate and timely GHG data to inform future policy decisions. The gases covered by the rule included carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) which are the GHG gases applicable to the gas production, gathering and processing industry.

This rule publication included Subpart C for General Stationary Fuel Combustion Sources. The GHG emissions reporting requirements, and related monitoring, recordkeeping, and verification requirements, apply to any facility that emits in excess of a threshold amount of 25,000 metric tons of GHG (expressed as carbon dioxide equivalents or CO<sub>2</sub>e) or more per year, or that meet any other applicability requirements of the rule. The GHG reporting rule requires monitoring and reporting of the identified GHGs in accordance with its prescribed methods.

On March 22, 2010 the EPA proposed another part of the rule specific to the gas production, processing and gathering industry: Subpart W - Mandatory Reporting of Greenhouse Gases from Petroleum and Natural Gas Systems. The final rule was published in the Federal Register on November 30, 2010. This subpart was originally proposed in 2009 but was withheld.

Mustang Engineering began to work with a large oil and gas production company on a special initiative to ensure compliance with the proposed GHG rulemaking prior to its publication in 2009. As part of this effort, Mustang Engineering personnel were engaged to participate as part of the oil and gas production company's core team. Initially focusing on Subpart C for processing and compressor stations, the team's goals were to:

- Using prior internal screening and a limit of 20,000 metric tons CO<sub>2</sub>e, determine applicability of the GHG Reporting Rule to each identified facility
- Perform gap assessments at each potentially applicable facility to identify current combustion sources and available monitoring and recommend solutions to comply with the rule
- Develop emission calculations to be deployed within the best-equipped system for future sustainable GHG emission reporting
- Produce the required GHG Monitoring Plans (GMP)
- Support the initial monthly data collection and check of the calculations of GHG gases

After the initial screening for Subpart C by oil and gas production company staff, a schedule of visits over a total of six weeks to 16 sites was developed. These sites included gas processing/NGL recovery facilities and compressor stations with enough natural gas engine-driven compression to potentially exceed the screening limit. At this point, the screening data and operating permits were provided to the gap assessment team. In preparing for the site visits, electronic copies of the P&IDs were collected.

An initial meeting with the operations staff at one field office was held to identify the best approach for the site visits. It was made clear by the operations staff that they did not have a great deal of extra time to spend in developing the information required to determine the gaps in data and identify any issue with measurements. It became obvious that the use of P&IDs to prepare prior to site visits would be critical to meeting the demanding schedule.

With diagrams developed to summarize the fuel gas consumers in each facility, each visit started with a review. In most cases, there had been minor changes to fuel gas consumers as well as other non-combustion consumers. The gap assessment team then proceeded with a walk-down of the fuel gas systems with pictures taken to document the instruments found. In the case of the space heaters, identification of the heater ratings from face plates was collected.

When Subpart W was released, a similar process was followed. However, the scope of work was much larger. Based on rule interpretations, the count of sites screened with the potential to emit 20,000 metric tons of CO<sub>2</sub>e and that warranted site visits was 34 when emissions from both Subparts C and W were evaluated.

Due to the aggressive timing for compliance with the rule and expansive scope due to the large number of facilities, many challenges were faced during project implementation for both Subparts. These challenges can be broadly categorized into the following areas:

- Inconsistencies of and Changes to Subparts C and W
- Screening of Facilities
- Measurements and Tracking
- Data Collection
- Data Retention

The remainder of this paper will discuss these challenges in greater detail, focusing on rule requirements of the processing facilities. The solutions adopted to address compliance will also be discussed.

### ***Inconsistencies of and Changes to Subpart C and W***

In order to ensure compliance by the dates in the draft Subpart W Rule due to the large number of facilities, work had to begin before the final version of the rule was published. Assumptions were made on ambiguous portions of the rule while the team waited for clarification in the final rule.

On November 30, 2010, the final Subpart W rule was published in the Federal Register. In the final rule several key changes were made that affected the applicability of the sites visited earlier in the year to ensure compliance should they be included. They are summarized as follows:

- Gathering lines and booster (compressor) stations were excluded,
- Processing Emission Sources were added:
  - Reciprocating and Centrifugal Compressor Blowdown Valve Leakage,
  - Blowdown Vent Stacks,
- Storage Tanks were removed from the Processing Emissions Sources.

The number of sites now requiring monitoring for both Subparts C and W was now reduced to seven sites from the 34 sites visited. Some compressor station facilities were still required to monitor

Subpart C stationary combustion sources based on the applicability threshold even though they would not be required to monitor Subpart W sources at this time due to the exclusion.

Besides the key changes mentioned above, there have been additional challenges where the rule is silent on how to handle measurements/calculations. Two cases of this are rod packing vents to flare and compressor blowdown valves to flare. These cases are discussed below.

A configuration in several of the sites had the rod packing vents connected to the flare. While this has the benefit of destruction of 98% of the methane, the rule is silent on how to handle these calculations from the rod packing vents. At the time of this writing, the interpretation is that all rod packing vent flow, whether to flare or to the atmosphere, must be measured. The impact of modifying the connections to flare is significant since no isolation valve exists in the common vent line. The current thinking is that plant turnarounds will be required should the current interpretation be upheld. Since the flare flow is measured at these plants, it is likely that the rod packing vent flow measurement will not be used for the final flare emissions based on the current rule language.

Since only wet seal vent emissions were mentioned in the proposed rule and in for this company all centrifugal compressors are configured with dry seals, no emissions were anticipated. The new requirement to measure the leak rate of the blowdown valves when closed and the unit pressurized, or the leak rate for the isolation valves when the blowdown valve is open allows for acoustic measurement. A significant number of the blowdown valves on both centrifugal and reciprocating compressors are routed to flare. The compressor blowdowns connected to flare will not require piping changes since the acoustic method does not require any piping changes. Neither the centrifugal nor the reciprocating compressor sections mention handling of the blowdown valve vent to flare emissions in their respective calculation sections.

Although the team found the majority of challenges around rule changes were around Subpart W, there were also some inconsistencies between the general provisions of the rule and Subpart W. For example, the definition of facility was different.

### ***Facility Challenges***

Due to the large number of facilities which had previously not been required to report greenhouse gas emissions to this level of detail, the screenings and gap assessments required unprecedented effort. To add further to the complexity, the sites are of different ages and legacies with unique degrees of documentation, instrumentation and automation. In order to be most effective while visiting the sites and performing gap analyses, significant preparation work was done before going to the field.

For Subpart C, prior to each site visit a diagram of the fuel gas system was developed along with a list of the combustion sources based on P&IDs from the sites. As expected, the quality and accuracy of drawings was variable depending on the quality of the P&IDs and changes in the field.

In generating this information, it became apparent that the common pipe (CP) method would be used at many sites since the sites typically had one master fuel meter that was also part of the accounting system. Two further general types of complications were identified at this point:

1. Consumers of fuel gas that were not combustion sources were common for many of the facilities. However most of these non-combustion sources were not measured individually. The non-combustion sources found included:
  - Flare pilot gas
  - Flare purge gas
  - Starter gas for natural gas engine starts
  - Sales to off-site consumers
2. Without any de minimis for the combustion sources, all combustion sources would need to be identified and their sizes determined. These included space heaters for buildings with process equipment to avoid freezing temperatures where produced water was present as well as the office heating systems.

In preparing for these site visits and discussing the current emissions monitoring being performed on many of these sites, the use of operating hours for the engine emissions was discussed in the context of fulfilling the GHG MRR. Clearly this data already existed and would be easy to apply. However, the GHG MRR clearly required accurate fuel gas measurements, if available.

The screenings and gap assessments at the 34 facilities identified as potential reporters under both Subparts C and W for processing introduced a whole new set of challenges.

There were several challenges to estimating the emissions for each of the sites previously screened. The question of whether compressor stations were production or processing was debated. Prior to publication of the final rule, since some compressor stations were monitored in 2010 for Subpart C combustion emissions, a conservative assumption was presumed that the final rule would include these as processing.

Second, extensive emission rate data for some emission sources was not available; for example, rod packing vents on reciprocating compressors. Published papers indicated that a single rod packing seal could emit approximately 30 standard cubic feet per hour (scfh) when installed initially. However, the same papers indicated that field tests measured up to 900 scfh per individual rod packing. A conservative estimate was utilized to ensure that all sites with the potential to emit above the applicability threshold would be examined during the gap assessment.

The issue of emissions from wet seals for centrifugal compressors was reviewed but the sites were determined to have only dry seals on the centrifugal compressors.

Third, the quantity and quality of the gas to a flare varies from year to year. Sites with enough throughput could conceivably exceed the 25,000 metric tons of CO<sub>2</sub>e if a single extended flaring event occurred or several large but short lived flare events occurred. The only sites with flares that were not included in the sites to assess were those that had few combustion sources (drivers for compressors were electric motor driven) and had few other Subpart W emissions.

## ***Measurements and Tracking***

The majority of challenges in the area of measurements and tracking were found during the Subpart W gap assessments.

Of particular interest with respect to Subpart W was the challenge of how to perform the annual measurement of the rod packing venting. While most compressors had the vents off the rod packing seal or the distance piece housing headered together and routed to a safe location outside and above compressor buildings, the accessibility for performing the annual measurement safely was a large question. For many of the compressors located in enclosed buildings, the vent line was extended above the roof line and many times equipment and piping outside the building made access difficult.

This information is confirmed and discussed in a recent review of study results, "Review of Compressor Station Measurements" performed by URS and University of Texas on behalf of the EPA. The review noted:

- Not all vents are accessible, or safely accessible
- Some vents are joined, and when different equipment in different operating modes are joined to the same vent, we cannot produce the stratified EF's.

During the gap assessment site visits, pictures of typical rod packing vent piping and the outside access were made for future reviews of piping changes that may be required to perform the annual rod packing venting measurements.

The flare emission source was another area of concern in light of the fact that none of the sites have an on-line analyzer for the flow to flare. In the NGL recovery facilities, the residue or sales gas is used for fuel gas and the flare purge is generally located downstream of the master fuel gas meter. For this reason, the baseline flow to flare is residue gas. However, when a malfunction occurs, the composition could be inlet gas or NGL in addition to residue gas. The challenge of how to characterize the composition during flaring events is an ongoing discussion.

The proposed rule required blowdown vents to be tracked. The facilities were generally tracking only the large blowdowns such as the yard piping in a compressor station. However, all blowdown vents to the atmosphere were now interpreted to be included in the rule. Of particular note were compressor blowdown pig launchers/receivers and filter separator blowdowns for filter replacement, which were identified as sources. Other maintenance was also flagged to operations when repairs required blowdowns of gas piping. Also during this time, the question of venting from the engine starters using station gas was evaluated. The information on the starter rates based on the manufacturer model number was collected and the rate determined. Plans were made to request tracking of number of starts and an estimate of the average time for each start.

When the final rule was issued, only blowdown of piping and equipment with more than 50 cubic feet of physical volume would be required to be tracked. In many sites, most of the fuel gas filter separators and pig launchers/receivers were smaller than this de minimis. Typical pressure and temperature information for equipment that can be blown down on a regular basis, like compressor and equipment that are regularly maintained, was requested. The matter of large blowdowns for repairs remains a task for operations to track with both an estimate of the physical volume and the

pressure and temperature when the system was opened to the atmosphere. A number of sites noted that they would open the bypass to flare for many of large equipment before opening the equipment to the atmosphere, reducing the overall GHG emissions.

### ***Data Collection and Calculations***

During the gap assessments for Subpart C, it was found that every site visited had automation to measure and total the flow of the major fuel gas meters. In several cases, fuel gas was purchased from a local pipeline and the data was provided in monthly reports. The familiarity of the Mustang team with both distributed control system (DCS) and supervisory control and data acquisition (SCADA) historians made it possible to quickly identify the best methods for data collection on a monthly basis, commonly by Excel spreadsheets.

The one small challenge in this area was in data tag labeling between various accounting and historian systems and drawings. Operations is often more familiar with the naming conventions used with accounting meter tagging found in the SCADA system. However, these are not the tags shown on most P&IDs or used in data systems. Some translation was required to ensure that the correct data was used for the GHG calculations.

As a part of the GMP effort, a spreadsheet with the calculations for Subpart C was prepared. The calculations were configured to input monthly data for tracking during the year. As a result, imbalances were identified where a non-combustion source downstream of a CP master meter was larger than the master meter flow. Troubleshooting of these issues generally pointed towards measurement issues and these were resolved shortly after the month closed in most cases.

When the team moved on to Subpart W, the data collection requirements were described by several members of the team as being an order-of-magnitude larger than those in Subpart C. The Subpart W data collection requirements proved to be significantly more difficult.

In developing the diagrams for each source for Subpart W, a detailed set of data requirements spreadsheets were created to assist the operations staff in understanding what data would be required, from what source and its frequency and type (e.g. total, spot, average). While extremely challenging to present in a clear fashion, the team was successful in accurately listing the data requirements in a way that all involved could understand the basis. The team is developing the Excel spreadsheet to perform the Subpart W calculations as the GHG monitoring plan for each site is completed. Like Subpart C, monthly data will be collected for the annual calculations.

### ***Data Retention***

After the gap assessments for Subpart C, it was clear that differing data systems were being utilized across the facilities to gather the required information. However no central repository existed to maintain the data in one location. Also, no strong candidate systems were identified at any of the sites which could be used at across all sites.

Thus, to make the data collection more reliable and ensure that the data collected each month was retained, a Microsoft SharePoint site was created. Key site staff responsible for collecting data were provided secure access so they could place the monthly data in the operating site's directory. This avoided e-mailing and the possible misplacement of key data. While data retention was already in

place for the historians found at each site, the transfer of the monthly reports to a common, secure repository provided the protection needed to meet the three year retention requirement in the rule. This also ensured that data would be quickly accessible during an audit and minimized the field staff attempting to recreate monthly reports.

The environmental staff assigned to each site uploaded the data into the Excel spreadsheet periodically to ensure that the data looked consistent. In addition, the calculations included projections for the annual emissions to provide some feedback on whether a site was expected to exceed the 25,000 metric tons CO<sub>2</sub>e limit for 2010.

## ***Conclusions***

As is detailed in this paper, the effort to translate and “decode” the requirements for the GHG mandatory reporting rule has been challenging. The core project team’s experience with both environmental air emission monitoring as well as process operations experience in the upstream industry and gas processing served to strengthen the communications of the data requirements to the site operations staff. In addition, the team’s extensive experience with process data historians for plants and compressor stations as well as large databases, such as the ones that are used to track work orders and equipment for field production, has been invaluable during the gap analyses.

The 2010 Subpart C emission calculations for the potentially applicable sites for the client were successfully completed in this year. Some but not all of the sites exceeded 25,000 metric tons and will be required to report.

The immediate challenge ahead will be organizing the data collection and calculation methods for the processing plants for Subpart W as this work is currently in progress. While a lot more data will be required, the emission calculations will be completed to meet the compliance requirements in 2011 for 2012 reporting.

However, the single greatest test will be the effort to comply with the requirements for production facilities included in Subpart W. The final rule for production changed noticeably from the proposed rule and has not been discussed here. Some of the more onerous requirements for periodic sampling were removed but the overall load on the industry is still significant.

The magnitude of the effort to track all of the equipment and sites that are to be considered production is a large effort when the number of wells totals in the thousands. At the time of this writing the oil and gas production company is staffing up and developing a plan of attack to quantify the production sites and associated well pad equipment. Unlike the processing facilities, few P&IDs, much less process flow diagrams are available for the production sites. For some sites, determining if it is included in the industry segment defined as production according to the rule is challenging.

The lessons learned from the Subpart C and W projects for Processing will undoubtedly be extremely valuable as we work towards compliance on the Production side of Subpart W.