Pennsylvania Grade Crude Oil Coalition
P.O. Box 149
Mt. Jewett, PA 16740
Phone: (814) 230-3033
Email: admin@pagcoc.org
www.pagcoc.org

Cameron Energy Company
507 Cherry Grove Road
Clarendon, PA 16313
Phone: (814) 968-3337
Email: camelot1@atlanticbb.net

August 12, 2021
(sent via email)

Ms. Lanelle Wiggins
RFA/SBREFA Team Leader
US EPA – Office of Policy (1803A) – 1200 Penn Ave NW – Washington DC – 20460
202.566.2372

Re: Oil and Natural Gas Sector NSPS

Dear Ms. Wiggins,

Thank you for inviting these comments from the Pennsylvania Grade Crude Oil Coalition (PGCC) and Cameron Energy Company. These comments (the "August 12, 2021 comments") are intended to supplement the written comments I provided on July 13, 2021. These August 12, 2021 Comments are prepared in the response to the Supplemental Materials provided by the EPA team, and these August 12, 2021 comments are intended to supplement the questions and comments I raised during the teleconferences you and your EPA team conducted on July 29, 2021 and August 3, 2021.

As I previously noted in my July 13, 2021 written comments, PGCC is a trade organization that represents conventional oil and gas interests in Pennsylvania. Conventional wells are shallow (non-shale) vertical wells that produce both oil and natural gas. Pennsylvania boasts the first conventional well, drilled by "Colonel" Edwin Drake, in Titusville in 1859. Today there are over 100,000 conventional oil and gas wells in operation in Pennsylvania. These wells are located in western Pennsylvania, with the southwestern wells producing primarily natural gas and the northwestern wells producing primarily oil. Almost all Pennsylvania conventional wells are low producing "stripper" wells and are owned by small businesses or sole proprietors. I serve as Secretary of PGCC.

Cameron Energy Company is a family-owned company that employs approximately 40 men and women and has operations in three counties in northwestern Pennsylvania. Cameron supplies natural gas to about 15,000 local households and produces oil which is refined at American Refining Group in Bradford, Pennsylvania, the world's oldest continuously operating refinery. I serve as president of Cameron.

In the comments I submitted July 13, 2021 I noted that the short (two-week) timeframe permitted by EPA for the submission of materials and comments impeded my ability to respond in a thorough manner. I have been able to rectify that problem in part. Following the submission of comments on July 13, 2021 I met with the members of the PGCC Legal and Legislative Committees on July 15, 2021. As a result of that meeting, I am able to provide more detailed information about Pennsylvania's conventional wells. Further, during that committee meeting several PGCC committee members reminded that their companies operate conventional oil and gas wells in both Pennsylvania and New York State. Indeed, the same Upper Devonian sandstones that are the target formations for PGCC member operations are the target formations just across the border in New York State. The New York State wells are equipped, and function, in the same manner as those in Pennsylvania. At the direction of the PGCC committees, I made outreach to the Independent Oil and Gas Association of NY (IOGANY) and learned that IOGANY was already undertaking studies of methane emissions from New York State conventional wells. Given that the EPA timeline for response does not permit PGCC to undertake emission sampling, and given that IOGANY already has that sampling in hand, I will provide to you the IOGANY sampling results. Given the similarity of the conventional wells as between Pennsylvania and New York State, the IOGANY data will be a useful resource.

1. Qualities of Conventional Wells:

Many of the topics addressed in our Panel discussions relate to well qualities or infrastructure that are not representative of conventional wells located in Pennsylvania and New York State. Instead, several of the topics and questions are unique to shale (unconventional) well development. That shale development represents the focus of most new drilling, and therefore most new oil and gas sources, in the United States. Typical of this new development are the unconventional Marcellus and Utica shale wells in Pennsylvania.

The Pennsylvania and New York State conventional oil and gas industry differs significantly from the unconventional industry, from the size of the site needed to drill a well to the resources needed to complete and bring it on line. According to DEP's *Act 13 Frequently Asked Questions*:

> A conventional gas well, also known as a traditional well, is a well that produces oil or gas from a conventional formation. Conventional formations are variable in age, occurring both above and below the Elk Sandstone. While a limited number of such gas wells are capable of producing sufficient quantities of gas without stimulation by hydraulic fracturing, most conventional wells require this stimulation technique due to the reservoir characteristics in Pennsylvania. Stimulation of conventional wells, however, generally does not require the volume of fluids typically required for unconventional wells.
> http://files.dep.state.pa.us/OilGas/OilGasLandingPageFiles/Act13/Act_13_FAQ.pdf

DEP's description focuses on one operational distinction between conventional and unconventional wells – the volume of fluids required for hydraulic fracturing. While this is an important factor distinguishing the two types of operations, there are other differences between conventional and unconventional activities and operations that impact our panel discussion:

- A typical well pad cleared for a conventional oil or natural gas well is more than <u>35 times smaller</u> than that of a typical unconventional well. There are two primary reasons for this difference. First, the high-volume hydrofracturing process associated with the unconventional well requires fleets of high-pressure pumps, multiple tanks to contain stimulation, flowback and other fluids, multiple containers and vehicles to mobilize proppants, numerous sanitation facilities for the many workers, and the like. In contrast, Pennsylvania and New York state conventional wells sometimes do not involve hydrofracture at all. When hydrofracture is utilized, it is always a small-flow process, utilizing less than 10% of the pumping capacity of a Marcellus or Utica shale well, and requiring few tanks for stimulation supply, and few (and sometimes zero) tanks for flowback, inasmuch as flowback is frequently not associated with Pennsylvania and New York State conventional wells. Second, following completion of an unconventional well the well site must be of adequate size to accommodate the many items of required production infrastructure. In contrast, the Pennsylvania and New York State conventional wells require far fewer infrastructure items.

- Wellhead pressures of new conventional wells are only several hundred pounds and quickly reduce to very low pressures. The vast majority of conventional wells in Pennsylvania and New York State operate at less than 50 psi and most at less than 20 psi. Wellhead pressures of new unconventional wells are measured in thousands of pounds and unconventional wells employ safety measures and equipment entirely unnecessary in the conventional well industry.

The substantially greater pressures, and the items of infrastructure, associated with unconventional wells establish the potential for significant fugitive leak emissions. The pressures involved in conventional wells are orders of magnitude lower than unconventional wells and those lower pressures result in the need for far fewer (or no) items of associated infrastructure. Accordingly, it is the experience of the conventional oil and gas industry in Pennsylvania and New York State that fugitive emissions are non-existent in the majority of well sites and very limited in scope where such emissions exist.

Another key distinction is the substantially lower production yielded from conventional wells and the smaller return on investment compared to unconventional shale wells. Conventional wells have lower profitability than unconventional wells and are strongly influenced by oil and natural gas commodity prices and other market forces. For details as to costs and profitability I refer you to my comments submitted July 13, 2021. The cost distinction between the conventional and unconventional industries, however, has direct bearing upon the ability of the conventional industry to bear additional regulatory burdens. Further, the details as to cost and profitability inform as to what expenditures generate a worthy environmental return.

The well pad size difference discussed above is depicted in the following two photographs:

Unconventional Drilling Operation

Conventional Drilling Operation

The difference in formation pressure, production pressure and potential for flowback is reflected in the requisite pumping horsepower depicted in the following two photographs:

Unconventional Well Completion Fleet (hydrofracture)

Conventional Well Completion Truck (hydrofracture)

A topic that has frequently arisen in our panel discussions is the volume of produced product. As I noted in my comments submitted July 13, 2021, the typical conventional well in southwest Pennsylvania produces predominantly gas. First year production is expected to be approximately 12 million cubic feet; that translates to average production of 34,000 cubic feet per day. In comparison, production from a typical new shale well in Pennsylvania is expected to be approximately 5 million cubic feet per day (with some wells producing as much as 20 million cubic feet per day). The shale (unconventional) well gas volume is nearly 150 times greater than the gas volume of the conventional gas well.

The conventional wells located in northwest Pennsylvania produce primarily oil. Therefore, the gas volume from a new conventional oil well in northwestern Pennsylvania is even less than its conventional southwestern counterpart—approximately 14,000 cubic feet per day, well less than ½ of the gas production from a southwestern Pennsylvania conventional well, and 350 times less than an unconventional well.

Depletion takes a rapid toll on Pennsylvania conventional wells. As you examine the charts I provided in my comments submitted July 13, 2021, you will see that gas production declines 20 to 30% per year until the decline curve begins to flatten at years 4 to 5. You will recall that operators of Pennsylvania conventional wells submitted oil and gas production data to the state of Pennsylvania which shows cumulative conventional production for 2020 as follows:

a) Natural gas: 89,178,071 MCF
b) Oil: 2,824,251 barrels

Utilizing a BOE equivalent of 6000 cubic feet = 1 barrel, the 2020 average annual production for a reported conventional oil and gas well in Pennsylvania is 223 BOE. Thus, Pennsylvania average conventional well production is 0.61 BOE/day.

Conventional wells in New York State are very similar. Based upon 2019 production data on file with the NYSDEC the average conventional well production is 0.54 BOE/day.

The final significant difference between unconventional and conventional wells is the nature of the production equipment utilized to operate conventional wells. The model facilities used to create NSPS OOOOa assume the typical low production and marginal wellsite would have a similar complexity and fugitive equipment count (e.g., valves, flanges, connections, etc.) as much larger producing facilities. This is entirely incorrect, and this very significant difference requires additional focus.

There are over 100,000 conventional wells registered with the PADEP in Pennsylvania, with tens of thousands of those being predominantly oil wells located in the north, and, similarly, tens of thousands of predominantly gas wells located in the south. The predominantly oil wells are all simple facilities, generally fitting one of three configurations:

1) Pumping Unit. The majority of the predominantly oil wells consist of an above-ground well head and pump jack with below-ground tubing and rods. The pump jack operates the rods in an up and down motion to pump the oil to the well head. Two pipelines depart the well head, one carrying oil and one carrying natural gas. There are no other facilities or connections at the well site. The oil pipeline conveys oil from multiple wells to single or multiple oil collection tanks termed a tank battery. The gas pipeline conveys natural gas from multiple wells to a pipeline delivery point. Usually somewhere in that system the gas is conveyed through a separator to remove liquids and in some cases the gas is conveyed through a compressor to increase pressure at the delivery point. However, it should be

noted that many dozens or hundreds of wells might be served by a single separator, resulting in a far lower level of complexity and fugitive equipment count than that assumed in the EPA model facilities. The picture, below, depicts a typical pumping unit configuration.

2) Flow/Rabbit Facility: In this configuration the well head and tubing are present but the pump jack and rods are absent. If the production sandstone is of adequate gas pressure (a circumstance that exists in some new wells but generally lasts for only a few months), the pressure differential is utilized for a few minutes or hours per day to propel fluid via the tubing to the well head and collection tank; natural gas is separated from the fluid via a separator. During the remainder of the day natural gas is collected in the well head's second pipeline in fashion similar to configuration number one. Because most conventional wells have inadequate pressure to sustain such method of production the conventional industry employs the alternative method of a rabbit, which rabbit functions like a piston to move fluid in the tubing. A rabbit well is operated by intermittently shutting a production valve at the upper end of its production pipe to allow gas pressure in the well to build up. During such time the fluid accumulates above the rabbit which is at rest in the tubing near the bottom of the well. These fluids migrate upwards through the clearance between the rabbit and the inner walls of the tubing. At some point determined by a timer, or manually, the production valve is opened to the collection tank whereby pressure in the upper region of the tubing above the rabbit is reduced. The pressure differential above and below the rabbit causes the rabbit to rise in the tubing and thereby lift the fluids which are above the

rabbit. A well configured in this manner is similar to the picture above except that the pumpjack is not present.

3) Bailing Well: Wells that make insufficient fluid to justify the capital investment of a pumpjack, tubing and rods, are bailed to collect the fluid and to thereby stimulate improved natural gas production. A bailing well contains no below-ground equipment. At the surface is merely the well head and a single pipeline which conveys the natural gas. At some point (usually at intervals of months or years) a "bailing rig" is set up at the well location. The bailing rig lowers a cable into the well bore; secured at the end of the cable is a bailer which is a device that collects fluid. The bailer is lowered to the bottom of the hole, fluid enters the bailer, and the bailer is removed from the well bore; the fluid is then collected in a portable tank.

Configurations 1 and 2 are utilized in association with new conventional wells and are therefore directly relevant to the NSPS discussion underway. Configuration 3 is not associated with new conventional wells. However, the configuration may be relevant to the current discussion depending upon the EPA's treatment of a "modification".

Pennsylvania's (and New York State's) predominantly natural gas wells are also simple facilities, generally conforming to the "Flow/Rabbit Facility" described above. Swabbing is a variation of the "Flow/Rabbit Facility". During swabbing a service rig utilizes a steel cable to lower a rabbit-like device to the bottom of the tubing. As the service rig reels the device back to surface the fluid above the device is lifted out of the well bore. Below is a picture of a swabbing operation in southwest Pennsylvania.

The typical conventional oil well site in northwestern Pennsylvania and New York State would <u>not</u> normally include the following emission source types:

1) Glycol dehydrators
2) Amine gas sweetening units
3) Line heater, heater treater, reboilers
4) Gas compressors (a gas compressor, when in use, would typically be associated with a group of wells, not a single well)
5) Pneumatic controllers
6) Pneumatic pumps
7) Pipeline blowdowns

The typical conventional gas well also involves many fewer fugitive equipment items (valves, connections, etc.) than the models assumed by the EPA. The conventional gas well includes the well head (with no pumpjack). The gas pipeline is sometimes connected directly to the gas collection system. In other cases the pipeline is directed through a separator. In both cases there would normally be a meter installation. Some new conventional gas wells may have a line heater with a separator or a production unit (combination heater separator) early in well's life. As the well's pressure declines the line heater becomes unnecessary. Finally, wells in certain geographic areas may have a desiccant drier on the well site in lieu of a separator inasmuch as the drier will act as both a free water separator and a dehydrator, dehydrating by using calcium chloride pellets (no emissions).

Below is a photograph of a newly completed conventional gas well located in southwestern Pennsylvania. Visible are the well head, meter installation, and separator. The produced water tank is non-steel.

In contrast, below is a picture of infrastructure in place at a Pennsylvania Marcellus well pad:

The difference in physical qualities as between conventional wells on one hand, and unconventional wells on the other, is highly significant. The legislature of Pennsylvania has recognized that Pennsylvania's unconventional and conventional oil and gas industries are distinct and should be regulated separately. Act 52 of 2016 provides: "Any rulemaking concerning conventional oil and gas wells that the Environmental Quality Board undertakes after the effective date of this act shall be undertaken separately and independently of unconventional wells or other subjects and shall include a regulatory analysis form submitted to the Independent Regulatory Review Commission that is restricted to the subject of conventional oil and gas wells."

Similarly, the approach of the EPA should be a separate regulatory framework for conventional and unconventional wells. The conventional wells in Pennsylvania and New York State are configured in a manner significantly different than the models assumed by the EPA, namely models which assume elements consistent with an unconventional well configuration. The items of infrastructure and therefore the number of fugitive components (valves, flanges, connections, etc.) are qualitatively different as between conventional and unconventional wells. Similarly, the natural gas pressures are dozens of times, and flow volumes more than one hundred times, different as between unconventional wells and conventional wells. The combined factors of the number of components, the pressure contained by those components, and the amount of gas flowing through same, bear directly upon leak rates. That these factors result in very low leak rates at conventional wells is directly supported by the leak detection and repair (LDAR) monitoring examples discussed below.

2. LEAK DETECTION AND REPAIR (LDAR) MONITORING.

During the period of June 29 to July 14, 2021, IOGANY contracted Great Plains Analytical Services, Inc. (GAS) to conduct leak monitoring for New York State conventional gas well sites. GAS is a company that conducts LDAR monitoring nationwide for oil and gas operations. For the LDAR monitoring, GAS used its Standard Operating Procedures that conform with 40 CFR 60, Subpart OOOOa leak monitoring requirements.

To ensure a random selection of wells for onsite LDAR monitoring, an IOGANY representative built an Excel database of wells from three producers that consisted of 3,181 wells. The database included well name, County, Township, latitude, longitude, API# and BOE based on NYSDEC production records. A random number was assigned to each of the wells using the Excel random number generator function. An attorney (not affiliated with the producers) verified the list of wells and the random numbers generated. The list was sorted based on the number generated. The attorney chose to select the lowest 150 numbers to create the list of wells to be monitored.

A well operator accompanied the GAS optical gas imaging (OGI) camera surveyor team during the LDAR monitoring. There were no compressors at any of the facilities monitored. The following is a summary of the results:

- Number of gas well sites monitored: 150
- Total number of leaking components found: 22
- Total connectors leaking: 14
- Total valves leaking: 8
- Estimated component count for sites: 19,983
- Percent leak rate across all sites monitored for estimated component count: 0.11%

Although the OGI Camera used by GAS did not quantify the leaks, the OGI Camera Surveyor reported the leak volumes as minor based on the detected plume and cloud movement of leaking vapors visualized through the OGI Camera.

Leaks detected for 10 connectors and 5 valves were repaired the same day (or within 2 days) of LDAR monitoring and re-monitored with the OGI camera to verify repairs. Leaks that could not be repaired at the time were scheduled for repair within 30 days of discovery. Operators used the soap bubble test method to verify leak repair.

Appendix 1 contains more detailed results for the OGI camera survey conducted by GAS. GAS performed an actual count of valves operating at the facility. The estimated total number of other components (i.e., screwed connections) was determined for the typical well site and this count plus the valve count was used to estimate the total components count.

The operators who accompanied GAS and who performed the leak repairs also collected anecdotal information about the nature of the leaks. In particular, before repair, typical leaks detected by the OGI camera survey were tested via the soap bubble method. The soap bubble method demonstrated the existence of the leak; however, the soap bubbles also revealed that the leaks were very small, causing bubbles few in number and/or of small size. The small leaks were consistent with the low-pressure quality of the wells.

In addition to the monitoring performed by IOGANY a PGCC Committee member reported that extensive leak monitoring was undertaken by the Pennsylvania Department of Environmental Protection (PADEP) relative to 80 Pennsylvania conventional wells operated by the PGCC member.

Appendix 2 contains a summary of the results of the PADEP leak monitoring. It is observed that the PADEP inspector found no combustible gas detected at the well head and well area. These reports included 4 shut-in gas wells and 76 operating gas wells.

The inspector checked for combustible gases using an Altair 5 X Multi Gas Meter (photoionization detector). Although this monitoring was not following EPA Method 21 procedures, the reports do indicate that the Pennsylvania conventional wells have few leaking components.

3. REPORTING AND RECORDKEEPING

Pennsylvania bifurcates its oil and gas reporting requirements; a simple level of reporting (generally annual) pertains to conventional oil and gas operations; a significantly more complicated (and frequent) level of reporting is required for unconventional operations. At first glance, the EPA E-reporting template is similar to, or more complex than, the level of reporting required in Pennsylvania for unconventional oil and gas operations.

However, PGCC has not had time to dive into the details of the EPA E-reporting template. PGCC is an entirely volunteer organization. That volunteer status reflects the financial capabilities of the conventional industry that PGCC serves. The Pennsylvania conventional industry consists of sole proprietors and small companies that have small or no office staff. Cameron Energy is one of the larger conventional companies, and my wife is an unpaid "employee" who helps complete reports. Many other companies are literally mom and pops, and as I noted during our teleconference, some older conventional operators do not own a computer.

Pennsylvania's bifurcated reporting requirements also reflect the different qualities of the two industries. As noted above, the volume of oil and gas produced per well in Pennsylvania's unconventional industry is over one hundred times greater than the conventional industry. Accordingly, Pennsylvania's unconventional operators are required to report production on a monthly basis. Conventional operators report on an annual basis. Similarly, unconventional wells operate at pressures several dozen times greater than conventional wells and unconventional wells have many more components than conventional wells. Accordingly, the Pennsylvania Mechanical Well Integrity Report for unconventional operators is more detailed than the Report required for conventional operators.

As discussed below, PGCC's recommended solution at the federal level is to identify a subcategory which excludes low volume low pressure conventional wells from the NSPS rules under consideration. If that pathway is not followed then PGCC will need to find a volunteer who has time to examine the E-reporting template.

4. LIQUIDS UNLOADING

Pennsylvania and New York State liquids unloading in conventional wells generally requires a high velocity flow. The methods of tubing swabbing, rabbits (plunger lifts), casing swabbing and other methods depend upon venting, with no back pressure, to develop maximum velocity. Reduced velocity would equate to reduced effectiveness and likely increased cycles necessary to reduce liquid head pressures.

There is certainly no technology currently in use in New York State or Pennsylvania which would capture the emissions associated with the various methods of liquids unloading. The amount of gas emitted during these operations, is of course, dependent upon the age of well, availability of staff and thus frequency of the operation, and the like. The transit of a rabbit might occur several times per day or as infrequently as once per week. With each transit the amount of gas emitted is smaller than compared to a tubing or casing swab. A PGCC Committee member operating numerous conventional gas wells in southwestern Pennsylvania reports that swabbing is typically not required until somewhere between year 5 and year 10 of well operation. Thereafter, swabbing is performed on less frequent intervals because fluid production declines with the age of the southwestern Pennsylvania conventional well.

What can be universally said about the gas quantity from liquids unloading is that it is fundamentally limited by the low volume/low pressure nature of the well that is being unloaded, and in the case of swabbing, by the inherent infrequency of operations. In other words, even if one could collect or flare the emission, the amount emitted at a conventional well is fundamentally low, bringing into play the calculation of whether the cost of that recovery or flare is warranted.

Recovery might be technologically feasible with the modification of a vapor recovery system. However, the energy required to operate the vapor recovery system renders this theory impractical. First, taking into account the energy required to manufacture and operate the recovery systems, and taking into account the very low volume of gas involved with the conventional wells, it is highly unlikely that the energy recovered would exceed the energy expended. Therefore, the exercise of recovery itself would generate more emissions than it would recover. Second, the form of energy to operate the recovery system is electricity. Electricity is entirely unavailable at tens of thousands of well locations in Pennsylvania and New York and it is infeasible to make that electricity available (unless by generator—which of course involves yet another form of emission). Additional details about vapor recovery and electricity are provided, below, in the section pertaining to tanks.

Similarly, the technology to burn the emitted gas in the very short time it occurs, is not available. PGCC committee members did not have ideas for how such infrastructure might be invented or operated in a safe manner at a reasonable cost.

Again, economies of scale are at play in the difference between conventional and unconventional operations. While the per unit cost of recovery would not be warranted in a conventional well setting given the fundamentally small daily production of Pennsylvania and New York State conventional wells, the per unit cost of recovery at an unconventional well would be lower given that production is one hundred fifty times greater than a conventional gas well and 350 times lower than a conventional oil well, and given that unconventional wells are fewer in number and are more likely to be served by electricity (or be in closer proximity to an existing electrical source). Again, the model that treats conventional wells the same as unconventional wells is fundamentally flawed and will not result in a workable regulatory framework.

5. TANK BATTERIES

Five factors affecting control of emissions at conventional tank batteries have not been discussed in the SER panel discussions: 1) tank composition; 2) cost of oxygen monitoring; 3) unavailability of gas sales pipeline; 4) Intermittent gas generation; and 5) difficulty of powering the control infrastructure.

1) Tank Composition: At Pennsylvania and New York conventional well sites or tank batteries there exist tens of thousands of non-steel tanks. These tanks are typically made of a poly plastic or fiberglass material that operate at atmospheric pressure (i.e., no hatches or pressure/vacuum valves). These tanks are used both to receive fluids as directly produced from the well and to hold produced water that is separated after draining. Emissions from the latter would be minimal; however, emissions from the former are contemplated as part of our NSPS discussion. In either event, the non-steel tanks are not designed to hold any pressure. To control emissions the non-steel tank would need to be replaced with a suitably

equipped steel tank that is equipped with thief hatches and pressure/vacuum (e.g., Enardo). The material cost alone exceeds $6000 per tank and installation would roughly double that cost.

Additionally, tens of thousands of existing steel tanks are not sealed units and would require modifications. The modifications would be difficult because the tanks are not uniform. Indeed, at older tank batteries or wells, some tanks are converted from other uses and are of disparate manufacture, such as riveted tanks, and could not be modified at all. These existing tanks would fall within the orbit of the NSPS rules under discussion if a new well were connected to the existing tank battery or if an adjacent tank was replaced.

Depicted below is a typical conventional New York State gas well serviced by poly tank:

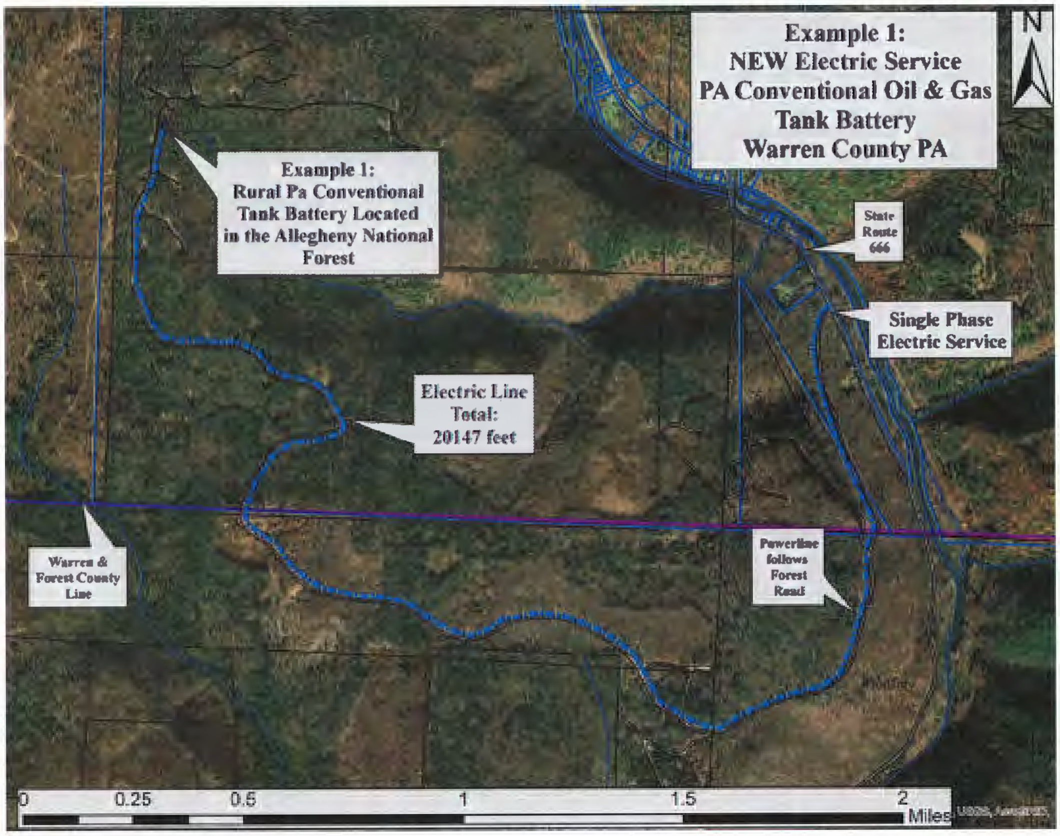
2) Cost of Oxygen Monitoring: any vapor recovery unit would require simultaneous installation of methods/technologies to prevent oxygen (air) from entering the storage vent gas collected by the vapor recover unity. Failure to detect oxygen in the natural gas would result in an explosive mixture and could not be permitted in any part of the collection system. The oxygen monitoring adds to cost and complexity of the facility.

3) Pipeline Availability: Not all tank batteries are adjacent to natural gas pipeline facilities and in those circumstances a flare or enclosed combustor would be required. This would be especially problematic in the intermittent pumping situations discussed immediately below.

4) Intermittent Well Operations: In Pennsylvania and New York State conventional operations the flow to tanks is intermittent. For example, the wells producing predominantly oil are pumped at intervals ranging from once per week to once per day. The pumping times range from a few minutes to a few hours. During the majority of the day, at the majority of the tank batteries, there are no material emissions from the tanks because there is no flow to the tanks. Consequently, there is no fuel for a flare or enclosed combustor; if the tank emissions were the source of fuel to power a generator to operate a vapor recovery unit, the generator would not function full time and would require manual attendance at each cycling. Similarly, flow to tanks at conventional gas wells occurs intermittently, sometime in concert with the cycling of a rabbit or in other instances only when sufficient fluid is accumulated in a separator. In the latter instance the fluid flow might be for a mere matter of seconds, and it would be impossible to capture associated emissions.

5) Electricity: Conventional operations in Pennsylvania and New York often occur in remote areas not served by electricity. The photograph above, depicting the New York State conventional gas well, is typical of a location not served by electricity. Similarly, tens of thousands of oil wells are operated by internal combustion engines (ice) due to the unavailability of electricity. Below is a photograph of such an ice well.

Forest County Pennsylvania is typical of the problem. Forest County is home to 5713 active conventional oil and gas wells. Forest County is sparsely populated, with approximately 3000 full time residents. The Allegheny National Forest covers over 90% of the County meaning roads are few and electrical service is non-existent in those areas. Even where electrical service is available in the County, it is primarily single-phase, meaning it is not suitable to provide power over long distances. The map, below, depicts one of Cameron Energy's several tank battery locations in Forest County, not serviced by electricity.



Roughly four miles of electric line would need to be installed to service the tank battery. However, the available service is only single phase; the resulting amperage at the destination would be only approximately 3 amps, which would not be sufficient to operate a vapor recovery unit. Therefore, one or more transformers would also be required, thus adding to the cost. The cost for electrical service, alone, would be $128,000. (See Appendix 3 for multiple examples.) Total gas sales from the tank battery in 2020 were $3,435. Gas sales from vapor recovery would obviously be substantially less than that amount. The costs of installation and operation of the electric service and vapor recovery unit would never be recoverable. This tank battery location is an area where Cameron is drilling new oil wells and is thus relevant to our NSPS discussion.

6. APPLICATION OF REGULATORY FRAMEWORK

There has not been adequate time in our panel discussions to flesh out when a new or modified item such as a tank or compressor would fall within the regulatory framework. For example, with respect to tanks, a new conventional oil well would, in most instances, be connected to an existing collection system, meaning that the produced oil would be collected at an existing tank battery. If there is a risk that the additional production would cause emissions at the tank battery to exceed 6 tpy, the prudent conventional operator would either not drill the well or suffer the cost (and environmental disturbance) of establishing a new/separate tank battery. Assuming the well is drilled and the new tank is constructed, the emissions, nevertheless, would be the same as if the more efficient connection was made to the existing tank.

This points to the latent problem with the OOOOa regulations in general, and the NSPS discussion in particular, namely, that the emission regulations have been crafted from the outset with large unconventional shale wells in mind. A new shale well is going to be connected to a tank facility where the emissions will either be greater or lesser than 6 tpy and there are no discretionary layout alternatives that will change that proposition. In the context of the conventional wells the operator is put to the Hobson's choice of doing what is sensible (connecting efficiently to the existing tank battery) or avoiding the OOOOa problem by creating a new tank battery—with the ultimate emissions being the same in either event. This is yet another argument for the wisdom of creating a sub-category which excludes conventional wells from the regulation.

The same considerations apply to the replacement of a compressor. Often times compressors are changed because production is <u>declining</u> and the attendant risk of emissions is therefore declining in step with the production. Nevertheless, if the replaced compressor is regarded as a modification which triggers the application of the regulation, the expensive burden of the regulatory framework descends upon the operator. The operator would be better off to continue to operate the inefficient compressor, burning more fuel, and bringing the wells to an earlier termination than if the compressor was resized.

7. PLACING THE CONVENTIONAL WELL LDAR "PROBLEM" IN CONTEXT

Understanding the scope of the conventional well "problem" is essential. Oil and natural gas production systems account for about 1.2% of the US Green House Gases Inventory (GHGI). Low production wells account for about 10 to 11% of U.S. production. Therefore, the emissions from the low production wells are in the 0.10 to 0.20% range of the GHGI.

Nationally, low production wells average about 2.5 to 2.7 barrels per day if they are oil wells and 22 to 24 mcf if they are natural gas wells. The average Pennsylvania and New York State conventional wells produce about 1/5 of the national average. The potential for problematic emissions in Pennsylvania and New York State is not present and therefore the predicate for imposing a new regulatory framework does not exist.

Nevertheless, this panel process is underway in contemplation that Pennsylvania and New York State conventional operators will have to comply with NSPS LDAR requirements that EPA acknowledges are very costly. As one compares the financial information I provided in my July 13, 2021 comments, with the per well site costs projected by the EPA for LDAR compliance, it is obvious that the NSPS LDAR requirements put Pennsylvania and New York State conventional operators in serious economic jeopardy. Indeed, in some cases, the cost of site compliance is greater than site revenue. EPA recognized this reality when it did not impose the LDAR program on low production wells in its October 2016 Control Techniques Guidelines (CTG) for existing oil and natural gas production facilities operating on Ozone Nonattainment areas.

It is of deep concern that the EPA is moving forward without reliable data appropriate to identify the emissions profile of low production wells. The U.S. Department of Energy (DOE) has initiated a study of emissions from low production wells and that study is now just a few months from completion. Preliminary results indicate no quantifiable or measurable emissions from low production wells or tank facilities. Indeed, preliminary results are revealing that the top 10% emission sources contribute roughly 3/4 of the total measured emissions.

Low production conventional wells do not have the well pressure or flow rate to be top 10% emission sources, nor could they come anywhere close to that, even if the conventional wells were beset by rampant negligence. But negligent care is not the norm. Life in the conventional oil and gas patch is hardscrabble, and leaks represent a loss of precious revenue. Meaningful leaks are not hard to detect. A conventional operator can smell or hear a meaningful leak. The soap bubble testing done in New York State confirms that a $100,000 detection device is $99,999 of overkill. Conventional operators in Pennsylvania and New York State already have ample incentive to address emissions and the test results cited herein demonstrate the effectiveness of the care the conventional operators have given. You will recall that the IOGANY testing was random; the Pennsylvania testing was performed without advance notice to the operator. The preliminary results of the DOE study are consistent with the Pennsylvania and New York State test results. In short, the EPA has not shown that in Pennsylvania and New York State there is a problem to be solved with conventional oil and gas wells.

8. ESTABLISHING A SUBCATEGORY THAT EXCLUDES CONVENTIONAL WELLS

Performance Standards (NSPS) fugitive emissions regulations created a specific problem for low producing conventional wells like those in Pennsylvania and New York State. When EPA developed its fugitive emissions requirements, it generated its Best System of Emissions Reductions (BSER) technology based on large, hydraulically fractured unconventional wells, and its initial proposal applied only to those unconventional wells. However, in finalizing the fugitive emissions regulations, EPA expanded their scope to include low production wells, but EPA never revised the BSER requirements to reflect this broader application.

The EPA heard much feedback that the high production well Leak Detection and Repair (LDAR) program is economically infeasible for low production wells and provides minimal environmental benefits. EPA agreed to reconsider the low production well impact of its fugitive emissions program. In its 2020 revisions to the NSPS, the fugitive emissions program provided an off-ramp when well sites fall below 15 barrels/day.

Now there appears to be a change in policy underway that is deaf to the concerns that were raised and addressed by the off-ramp. Once again, merely because conventional and unconventional wells produce the same or similar products, the differences between the two industries are being forgotten or ignored. In the panel discussions the EPA intimates that the off-ramp is being closed and that conventional wells are to be swept into the same regulatory framework as unconventional wells. Yet the two industries are different. To regulate two wells in the same fashion, where one produces 150 times more than the other and operates at many dozens of times greater pressure, is nonsensical.

A significant body of information supports the exclusion of conventional wells from the regulatory framework. The emission testing cited above demonstrates that, in the conventional context, the emissions problem is not qualitatively widespread, and that where an emission is occurring the quantity is small. The pictures included herein show the lack of fugitive emission components. The information presented herein and addressed at our panel discussions demonstrates that the expenditures required for emission control yield very little return in the conventional context. This is a simple reflection of the fact that the emissions are small and that any effort to collect them is expensive in context.

The solution is to exclude conventional wells from the regulatory framework. A simple and tested means of accomplishing that exclusion is to continue the stripper well exception, with the threshold for stripper wells being understood to be 15 BOE/day.

In the panel discussions the EPA has been unable to commit to that exclusion and has asked for other means of subcategorization. I offer the following:

1) Utilize alternative EPA Stripper Well threshold of 10 barrels per day. The threshold of 10 barrels per day is found at subpart F of 40 CFR Part 435. The EPA brought this CFR section to the attention of PGCC several years ago in association with a new rule promulgated by the EPA prohibiting discharge of onshore "unconventional oil and gas" (UOG) wastewaters to publicly owned treatment works (POTWs). By its own admission in its scoping documents, the EPA did not intend for its new rule to prohibit treatment of wastewater from "conventional" wells at POTW's. However, in the final iteration of the Rule the EPA defined a UOG as "crude oil and natural gas produced by a well drilled into a shale and/or tight formation (including, but not limited to, shale gas, shale oil, tight gas, and tight oil". That definition was different than the definition used in the scoping documents; in particular, the final definition removed the phrase "low porosity, low permeability" formation from the definition.

   The new definition expanded a UOG well to include what Pennsylvania defines as conventional wells. This is the source of my remark during our teleconference, that in the view of the EPA, Drake's well in Titusville is an unconventional well.

   PGCC brought legal action to prevent the implementation of the new rule and definition as to Pennsylvania conventional wells. Ultimately, that suit was resolved satisfactorily, when the EPA determined that, under subpart F, the new rule would not apply to "stripper wells" meaning wells producing less than 10 barrels per day. Because PGCC member wells produce less than 10 barrels per day, PGCC members were and are able to continue to deliver wastewater to POTWs.

   Interestingly, PGCC and EPA did not arrive at a satisfactory result via the clarification of the definition of a UOG. Therefore, I have grave reservations about the efficacy of the definition of "hydraulic fracturing" as set out in the EPA supplemental materials reviewed at our July 29 and August 3 meetings. That definition relies upon "tight formations", the same term that gave rise to the controversy in the POTW matter. Without more, the term "tight" is far too ambiguous to distinguish between what all of us would agree is an unconventional well and what, for example, Pennsylvania law defines as a conventional well.

   The threshold of 10 BOE/day is a compromise amount that may address whatever reservations the EPA has about continuing with the 15 BOE/day threshold. It is also an amount that effectively excludes Pennsylvania and New York State conventional wells, inasmuch as those wells produce 15 times less than that threshold amount.

2) Categorize by well bore direction. In Pennsylvania and New York State conventional wells are almost entirely vertical well bores. Where horizontal well bores have been attempted the hoped-for goal is the achievement of production far greater than a vertical conventional well. If that goal is achieved, the resulting additional production may lead to additional emissions befitting the regulatory framework and/or revenue that yields a reasonable per unit cost for the implementation of emission control measures. PGCC supports a regulatory approach which excludes vertical well bores from the regulatory framework. (Some conventional wells deviate from vertical at the surface in order to pass under streams, wetlands, and similar features. These "slant" well bores then become vertical wells as the well bore passes through the producing formations. The important distinction is the bore direction at the producing formation depths.)

3) Categorization by hydrofracture size. In Pennsylvania and New York State most new conventional wells are hydrofractured. However, those hydrofractures are designed for the high permeability, low production, low pressure formations that are the target of the conventional industry. The conventional hydrofractures are qualitatively different than the high volume, high pressure hydrofractures that are necessary to the completion of unconventional shale wells. Therefore, identifying the qualities that are unique to each industry's different hydrofractures would be an effective means of categorizing the two industries and excluding the hydrofractured conventional wells from inclusion in the NSPS regulations.

   Factors that distinguish the two types of hydrofractures include the following:
   a) Fluid volume
   b) Pumping pressures
   c) Shut-in pressures
   d) Permeability of fractured formations
   e) Flowback rates and times

   The PGCC committee members were reluctant to provide specific volume, pressure, Darcie and flowback suggestions without consulting all PGCC members. There has not been enough certainty of information or adequate time to conduct a PGCC member survey. However, it can be confidently said that the differences in volume, pressures, Darcie and flowback are very significant—in all cases at least 10 to 100 times different, and in some cases 1000's of times different as between the two industries—such that the categorization of hydrofracture size would be an effective, useful means of subcategorization.

Sincerely,

Arthur Stewart
Camelot1@atlanticbb.net

APPENDIX 1

Appendix 1. Independent Oil & Gas Association of New York (IOGANY) LDAR Monitoring

LDAR monitoring conducted by: Great Plains Analytical Services, Inc., 303 W. 3rd St. Elk City, OK 73644; www.gasinc.us

Item	Monitoring Date	Company	Facility/Well Name	Well API #	County	Facility Latitude	Facility Longitude	Facility Valve Count	Est. Facility Total Component Count	No. Leaking Components Found	Specify Component Types Leaking	Date Leaking Components Repaired
1	6/30/2021	Empire	CHYLINSKI #179	31-013-11000	CHAUTAUQUA	42.19189	-79.68599	15	120	1	Connector	7/1/2021
2	7/13/2021	Empire	FARNER-ZOAR VALLEY #1 #162	31-009-12459	CATTARAUGUS	42.45647	-78.8096	14	112	1	Connector	Scheduled 30 days from discover date
3	7/7/2021	Empire	FARRAR, WILLIAM #086	31-013-10878	CHAUTAUQUA	42.33573	-79.45288	24	192	1	Connector	7/1/2021
4	6/30/2021	Empire	HARRINGTON, A. #2	31-013-16976	CHAUTAUQUA	42.25955	-79.5287	16	128	1	Connector	7/1/2021
5	6/30/2021	Empire	NYSRA 5-23	31-013-16713	CHAUTAUQUA	42.23768	-79.58223	15	120	1	Connector	7/1/2021
6	7/7/2021	Empire	RININGER, T. #1	31-013-16454	CHAUTAUQUA	42.03955	-79.21566	10	80	1	Connector	7/7/2021
7	7/1/2021	Empire	SNELL, WILLIS #060	31-013-10460	CHAUTAUQUA	42.36246	-79.3754	16	128	1	Connector	7/1/2021
8	7/1/2021	Empire	STANTON, CLIFFSTAR #1 #152	31-013-10660	CHAUTAUQUA	42.4236	-79.39146	13	104	1	Connector	7/1/2021
9	7/1/2021	Empire	VILLAGE OF BROCTON #299	31-013-11711	CHAUTAUQUA	42.35931	-79.41608	27	216	1	Connector	7/1/2021
10	7/14/2021	Empire	WATERMAN UNIT #1 #318	31-013-12103	CHAUTAUQUA	42.46521	-79.14822	21	168	1	Connector	Scheduled 30 days from discover date
11	7/13/2021	Minard Run	KELLER 2H	31-053-26057-00-00	MADISON	42.742486	-75.620252	22	178	1	Connector	7/13/2021
12	7/14/2021	Stedman	ARNDT 1	31-029-16605	ERIE	42.84123	-78.5941	9	90	1	Connector	7/14/2021
13	7/8/2021	Stedman	BARTON 2	31-009-18280	CATTARAUGUS	42.1208	-79.03594	21	210	1	Connector	Scheduled 30 days from discover date
14	7/8/2021	Stedman	LOOMIS 1	31-009-17990	CATTARAUGUS	42.11887	-79.04911	26	260	1	Connector	Scheduled 30 days from discover date
15	7/1/2021	Empire	KINGSMITH FARM INC. #525	31-013-12611	CHAUTAUQUA	42.2634	-79.39327	25	200	1	Valve	7/1/2021
16	7/8/2021	Empire	LAMPSON/MCKAY #1	31-009-22318	CATTARAUGUS	42.27358	-79.02026	24	192	1	Valve	7/9/2021
17	7/7/2021	Empire	NORDLAND, J. #2	31-013-16620	CHAUTAUQUA	42.01254	-79.15536	9	72	1	Valve	7/9/2021
18	7/14/2021	Minard Run	JENSON 1247	31-099-21404-00-00	SENECA	42.883989	-76.898948	23	179	1	Valve	Scheduled 30 days from discover date
19	6/29/2021	Stedman	KELWASKI 1	31-013-24512	CHAUTAUQUA	42.159443	-79.65629	22	220	1	Valve	6/29/2021
20	7/14/2021	Stedman	KUTTER 3	31-037-23022	GENESEE	42.99582	-78.42084	12	120	1	Valve	Scheduled 30 days from discover date
21	7/12/2021	Stedman	NYSRA 1-1	31-013-15692	CHAUTAUQUA	42.27926	-79.15172	20	200	1	Valve	Scheduled 30 days from discover date
22	7/14/2021	Stedman	PARKS 2	31-037-23082	GENESEE	43.0161	-78.43665	7	70	1	Valve	7/14/2021
23	7/13/2021	Empire	ALLEN #1	31-009-23336	CATTARAUGUS	42.3862	-78.94571	8	64	0	N/A	N/A
24	6/30/2021	Empire	BABCOCK, DALE #130	31-013-10177	CHAUTAUQUA	42.23837	-79.65768	17	136	0	N/A	N/A

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Item	Monitoring Date	Company	Facility/Well Name	Well API #	County	Facility Latitude	Facility Longitude	Facility Valve Count	Est. Facility Total Component Count	No. Leaking Components Found	Specify Component Types Leaking	Date Leaking Components Repaired
25	7/13/2021	Empire	BAIRD #2	31-009-16423	CATTARAUGUS	42.3521	-78.93384	6	48	0	N/A	N/A
26	7/8/2021	Empire	BARRETT, C. #2	31-009-18287	CATTARAUGUS	42.21224	-79.05252	12	96	0	N/A	N/A
27	7/14/2021	Empire	BECKER, A. #1 #308	31-013-12093	CHAUTAUQUA	42.47855	-79.15231	16	128	0	N/A	N/A
28	7/12/2021	Empire	BEIGHTOL L. #5	31-013-18303	CHAUTAUQUA	42.19148	-79.16647	9	72	0	N/A	N/A
29	6/30/2021	Empire	BERBEN, L. #1	31-013-18547	CHAUTAUQUA	42.20735	-79.55389	7	56	0	N/A	N/A
30	7/13/2021	Empire	BERGEY, D #1	31-009-17276	CATTARAUGUS	42.35072	-78.96106	15	120	0	N/A	N/A
31	6/30/2021	Empire	BERTRAM, JOYCE #127	31-013-12597	CHAUTAUQUA	42.27557	-79.50384	13	104	0	N/A	N/A
32	7/13/2021	Empire	BEVIER #1233-I	31-029-14900	ERIE	42.54035	-78.86728	10	80	0	N/A	N/A
33	7/14/2021	Empire	BIRGE #1838-I	31-037-02924	GENESEE	42.97703	-78.45826	9	72	0	N/A	N/A
34	6/30/2021	Empire	BOEHM, M. #2	31-013-15251	CHAUTAUQUA	42.22674	-79.53512	11	88	0	N/A	N/A
35	7/1/2021	Empire	BOWEN, CALVIN #219	31-013-11063	CHAUTAUQUA	42.24827	-79.63546	13	104	0	N/A	N/A
36	7/13/2021	Empire	BOWERS #4	31-009-23284	CATTARAUGUS	42.39717	-78.92313	8	64	0	N/A	N/A
37	7/7/2021	Empire	BROWN, G. #3	31-009-17161	CATTARAUGUS	42.17168	-79.03338	5	40	0	N/A	N/A
38	7/14/2021	Empire	BURKE, D. #1	31-029-22066	ERIE	42.67553	-79.02043	17	136	0	N/A	N/A
39	6/30/2021	Empire	CALDWELL #2	31-013-13218	CHAUTAUQUA	42.29227	-79.67264	7	56	0	N/A	N/A
40	7/13/2021	Empire	CARLSEN, A #1	31-029-22471	ERIE	42.54874	-78.52074	16	128	0	N/A	N/A
41	7/14/2021	Empire	CHERRY #1 #279	31-013-11783	CHAUTAUQUA	42.48163	-79.3086	12	96	0	N/A	N/A
42	6/30/2021	Empire	CLOVERBANK #1	31-013-15180	CHAUTAUQUA	42.20097	-79.55921	14	112	0	N/A	N/A
43	6/30/2021	Empire	COLEMAN, H. #4	31-013-20763	CHAUTAUQUA	42.19161	-79.47651	17	136	0	N/A	N/A
44	7/7/2021	Empire	EDWARDS, I. #1 KA167	31-013-17861	CHAUTAUQUA	42.04557	-79.52448	12	96	0	N/A	N/A
45	7/1/2021	Empire	FARVER UNIT #1 #248	31-013-12131	CHAUTAUQUA	42.38345	-79.41387	13	104	0	N/A	N/A
46	7/14/2021	Empire	FOSS UNIT #2 #420	31-029-13096	ERIE	42.71953	-78.51726	11	88	0	N/A	N/A
47	7/13/2021	Empire	FRANK, J. #2	31-009-17175	CATTARAUGUS	42.33386	-78.67938	10	80	0	N/A	N/A
48	7/13/2021	Empire	GARDINER #1	31-009-18077	CATTARAUGUS	42.37644	-78.86385	8	64	0	N/A	N/A
49	6/29/2021	Empire	GEHR #740	31-013-18142	CHAUTAUQUA	42.14307	-79.66502	18	144	0	N/A	N/A
50	7/14/2021	Empire	HECHT, G. #3 #411	31-029-12419	ERIE	42.59219	-79.1175	16	128	0	N/A	N/A
51	7/12/2021	Empire	HERSHBERGER, JOHN UNIT #1 KP	31-009-19103	CATTARAUGUS	42.22806	-78.98416	7	56	0	N/A	N/A
52	7/13/2021	Empire	HOSKINS UNIT #1	31-029-22175	ERIE	42.55911	-78.70396	16	128	0	N/A	N/A
53	7/12/2021	Empire	HOSTETLER 1	31-009-25504	CATTARAUGUS	42.248349	-79.011115	9	72	0	N/A	N/A
54	7/12/2021	Empire	JENKS, GERTRUDE #1 KX008	31-009-17147	CATTARAUGUS	42.19588	-78.9785	19	152	0	N/A	N/A
55	7/13/2021	Empire	KOTA, F #1	31-009-16929	CATTARAUGUS	42.42836	-78.93404	7	56	0	N/A	N/A
56	7/7/2021	Empire	KUREK, EDWARD UNIT #2 KX021	31-009-17949	CATTARAUGUS	42.17718	-79.01214	4	32	0	N/A	N/A
57	6/29/2021	Empire	LICTUS, V. #1	31-013-16007	CHAUTAUQUA	42.00624	-79.63328	18	144	0	N/A	N/A
58	6/30/2021	Empire	LIMBERG, D. #1	31-013-15344	CHAUTAUQUA	42.17984	-79.48589	13	104	0	N/A	N/A

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Item	Monitoring Date	Company	Facility/Well Name	Well API #	County	Facility Latitude	Facility Longitude	Facility Valve Count	Est. Facility Total Component Count	No. Leaking Components Found	Specify Component Types Leaking	Date Leaking Components Repaired
59	7/14/2021	Empire	LOTT, R&S. UNIT #1	31-099-23112	SENECA	42.882707	-76.805275	19	152	0	N/A	N/A
60	7/14/2021	Empire	LUTHERAN SOCIETY #1	31-029-22273	ERIE	42.81043	-78.69292	24	192	0	N/A	N/A
61	6/29/2021	Empire	LYONS, R. #2 CB150	31-013-22615	CHAUTAUQUA	42.05512	-79.54483	21	168	0	N/A	N/A
62	6/30/2021	Empire	MARTINSON, P. #1	31-013-16356	CHAUTAUQUA	42.17008	-79.55669	19	152	0	N/A	N/A
63	6/30/2021	Empire	MEEDER, ANDY #183	31-013-10705	CHAUTAUQUA	42.18988	-79.66013	21	168	0	N/A	N/A
64	7/8/2021	Empire	MILLER, E.I. #1	31-009-22449	CATTARAUGUS	42.29277	-79.03489	21	168	0	N/A	N/A
65	7/8/2021	Empire	MILLER, I. #1	31-009-16784	CATTARAUGUS	42.2969	-79.03308	12	96	0	N/A	N/A
66	6/30/2021	Empire	MOORE, J. #1	31-013-14314	CHAUTAUQUA	42.2766	-79.73808	9	72	0	N/A	N/A
67	7/1/2021	Empire	NIXON, A. #2	31-013-14300	CHAUTAUQUA	42.29544	-79.60309	10	80	0	N/A	N/A
68	7/12/2021	Empire	NORD N. #1	31-013-18122	CHAUTAUQUA	42.18196	-79.10582	18	144	0	N/A	N/A
69	7/1/2021	Empire	NYHART, LYLE #056	31-013-10299	CHAUTAUQUA	42.36048	-79.33164	12	96	0	N/A	N/A
70	7/12/2021	Empire	NYSRA #10-1636	31-013-15357	CHAUTAUQUA	42.24184	-79.22955	14	112	0	N/A	N/A
71	6/30/2021	Empire	NYSRA #2-1289	31-013-14880	CHAUTAUQUA	42.10525	-79.49464	16	128	0	N/A	N/A
72	7/12/2021	Empire	OLMSTEAD, H. #1	31-013-15418	CHAUTAUQUA	42.20523	-79.22658	17	136	0	N/A	N/A
73	7/7/2021	Empire	ONOFRIO, JAMES #296	31-013-11671	CHAUTAUQUA	42.31029	-79.42343	20	160	0	N/A	N/A
74	7/13/2021	Empire	PLOETZ, E. #3	31-009-16961	CATTARAUGUS	42.36282	-78.66036	10	80	0	N/A	N/A
75	6/30/2021	Empire	PROPHETER, EARLENE #552	31-013-13760	CHAUTAUQUA	42.26745	-79.56428	16	128	0	N/A	N/A
76	6/29/2021	Empire	REITZ #715	31-013-18306	CHAUTAUQUA	42.09934	-79.69114	23	184	0	N/A	N/A
77	6/30/2021	Empire	RICE, M. #3	31-013-18259	CHAUTAUQUA	42.17597	-79.45117	14	112	0	N/A	N/A
78	7/13/2021	Empire	RODERICK, EMILY O. #1-A #3	31-029-12403	ERIE	42.53549	-78.51061	8	64	0	N/A	N/A
79	6/29/2021	Empire	ROUSH, H. #2	31-013-19068	CHAUTAUQUA	42.01724	-79.62353	21	168	0	N/A	N/A
80	7/13/2021	Empire	SALISBURY, M #4	31-009-22055	CATTARAUGUS	42.36021	-78.87274	12	96	0	N/A	N/A
81	7/14/2021	Empire	SAMS & SONS, A. #1 #337	31-013-12170	CHAUTAUQUA	42.4588	-79.37866	14	112	0	N/A	N/A
82	7/14/2021	Empire	SCHMIDT, BLITZER #1	31-029-22418	ERIE	43.00487	-78.47961	16	128	0	N/A	N/A
83	7/1/2021	Empire	SCHUSTER UNIT #1	31-013-22526	CHAUTAUQUA	42.29618	-79.57808	22	176	0	N/A	N/A
84	7/7/2021	Empire	SHERMAN, W.J. #1	31-013-13976	CHAUTAUQUA	42.0739	-79.34085	17	136	0	N/A	N/A
85	7/13/2021	Empire	SHETLER, E #5	31-009-22039	CATTARAUGUS	42.35424	-78.97517	12	96	0	N/A	N/A
86	7/12/2021	Empire	SHETLER, LEWIS UNIT #1 KA123	31-009-17093	CATTARAUGUS	42.24085	-78.98213	17	136	0	N/A	N/A
87	7/7/2021	Empire	SHOEMAKER, JACK #307	31-013-11316	CHAUTAUQUA	42.32486	-79.42106	15	120	0	N/A	N/A
88	7/12/2021	Empire	SHORT, G. #1	31-013-19292	CHAUTAUQUA	42.16125	-79.13976	14	112	0	N/A	N/A
89	7/7/2021	Empire	SINGER-SETSER #7334	31-013-21770	CHAUTAUQUA	42.00451	-79.36443	18	144	0	N/A	N/A
90	7/12/2021	Empire	SKILLMAN, N. #2	31-013-19210	CHAUTAUQUA	42.16934	-79.35508	17	136	0	N/A	N/A
91	7/14/2021	Empire	SMITH-GRIGGS #2	31-099-23041	SENECA	42.981519	-76.847799	19	152	0	N/A	N/A
92	7/8/2021	Empire	SOBIERAJ #1	31-009-22342	CATTARAUGUS	42.2788	-79.02944	16	128	0	N/A	N/A

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93	7/12/2021	Empire	SPRAGUE, R. #1	31-013-21154	CHAUTAUQUA	42.17415	-79.163	13	104	0	N/A	N/A
94	7/12/2021	Empire	SPRAGUE, R. #2	31-013-21183	CHAUTAUQUA	42.14376	-79.17349	25	200	0	N/A	N/A
95	7/13/2021	Empire	STEARNS #265-I	31-029-68454	ERIE	42.53815	-78.83457	12	96	0	N/A	N/A
96	7/14/2021	Empire	STEELE #1 #(38472)	31-069-26153	ONTARIO	42.888204	-77.445536	15	120	0	N/A	N/A
97	7/13/2021	Empire	STEWART, R. #1	31-013-19704	CHAUTAUQUA	42.43777	-79.10925	9	72	0	N/A	N/A
98	7/12/2021	Empire	STONE, ROBERT #1 KX012	31-009-17267	CATTARAUGUS	42.18392	-78.97694	19	152	0	N/A	N/A
99	7/13/2021	Empire	VAN ETTEN, C 4	31-009-23486	CATTARAUGUS	42.37561	-78.97659	9	72	0	N/A	N/A
100	6/29/2021	Empire	VOLK, MURRAY #111	31-013-10250	CHAUTAUQUA	42.16012	-79.66939	14	112	0	N/A	N/A
101	7/1/2021	Empire	WEISE #2	31-013-22516	CHAUTAUQUA	42.30163	-79.48772	13	104	0	N/A	N/A
102	6/30/2021	Empire	WELLS, C. #1	31-013-20910	CHAUTAUQUA	42.17203	-79.44921	20	160	0	N/A	N/A
103	7/1/2021	Empire	WHEELER, ETHEL J. #1 #171	31-013-04948	CHAUTAUQUA	42.3873	-79.38811	17	136	0	N/A	N/A
104	6/29/2021	Empire	WHITE, D. #1A	31-013-17667	CHAUTAUQUA	42.05076	-79.65577	9	72	0	N/A	N/A
105	7/14/2021	Empire	WHITE, H&G. UNIT #1 #37	31-013-12308	CHAUTAUQUA	42.47056	-79.14332	14	112	0	N/A	N/A
106	6/30/2021	Empire	WILCOX, R. #1	31-013-15342	CHAUTAUQUA	42.22705	-79.51831	19	152	0	N/A	N/A
107	7/8/2021	Empire	YODER, L. #1	31-009-22269	CATTARAUGUS	42.28518	-79.04047	14	112	0	N/A	N/A
108	7/13/2021	Minard Run	BLASI 1-H	31-017-26018-00-00	CHENANGO	42.648838	-75.641504	17	167	0	N/A	N/A
109	7/13/2021	Minard Run	BLOOD 1	31-017-26049-00-00	CHENANGO	42.534655	-75.643197	38	190	0	N/A	N/A
110	7/13/2021	Minard Run	DROMGOOLE 6-498	31-053-23870-00-00	MADISON	42.760633	-75.621469	15	171	0	N/A	N/A
111	7/14/2021	Minard Run	FREIER 1 (626015)	31-099-23937-00-00	SENECA	42.81898	-76.91344	23	181	0	N/A	N/A
112	7/14/2021	Minard Run	HARTMAN 624594	31-099-22947-00-00	SENECA	42.8475	-76.862831	21	173	0	N/A	N/A
113	7/14/2021	Minard Run	JELLINGHAUSE 975-6	31-011-21238-00-00	CAYUGA	42.880884	-76.659369	10	162	0	N/A	N/A
114	7/14/2021	Minard Run	JORDAN 1233	31-011-21361-00-00	CAYUGA	42.822698	-76.660466	26	182	0	N/A	N/A
115	7/14/2021	Minard Run	KIDD 2513	31-099-19414-00-00	SENECA	42.842792	-76.864407	21	175	0	N/A	N/A
116	7/14/2021	Minard Run	LOCKWOOD 1078-2	31-011-20647-00-00	CAYUGA	42.909675	-76.627696	17	171	0	N/A	N/A
117	7/14/2021	Minard Run	LOTT 624600	31-099-22944-00-00	SENECA	42.879692	-76.812171	15	171	0	N/A	N/A
118	7/14/2021	Minard Run	O'HARA 1 (626943)	31-011-26167-00-00	CAYUGA	42.885995	-76.637353	25	183	0	N/A	N/A
119	7/13/2021	Minard Run	PARTEKO 3H	31-053-26159-00-00	MADISON	42.814676	-75.645428	17	175	0	N/A	N/A
120	7/14/2021	Minard Run	QUILL (CASLER)420-4	31-011-19637-00-00	CAYUGA	42.933672	-76.710002	14	166	0	N/A	N/A
121	7/14/2021	Minard Run	RASMUSSEN 624597	31-099-22959-00-00	SENECA	42.82297	-76.868404	21	179	0	N/A	N/A
122	7/14/2021	Minard Run	SCHENCK 2 (626404)	31-011-26004-00-00	CAYUGA	42.818251	-76.656732	22	178	0	N/A	N/A
123	7/14/2021	Minard Run	SHANK 952-4	31-011-20561-00-00	CAYUGA	42.89529	-76.65031	16	170	0	N/A	N/A
124	7/14/2021	Minard Run	SORENSEN 1 (4119)	31-099-19580-00-00	SENECA	42.817479	-76.900422	18	172	0	N/A	N/A
125	7/14/2021	Minard Run	STAEHR 1039-3	31-011-20614-00-00	CAYUGA	42.86217	-76.67724	23	179	0	N/A	N/A
126	7/14/2021	Minard Run	STAHL 1	31-099-11618-00-00	SENECA	42.838418	-76.788827	19	177	0	N/A	N/A

Appendix 1. Independent Oil & Gas Association of New York (IOGANY) LDAR Monitoring

LDAR monitoring conducted by: Great Plains Analytical Services, Inc., 303 W. 3rd St. Elk City, OK 73644; www.gasinc.us

Item	Monitoring Date	Company	Facility/Well Name	Well API #	County	Facility Latitude	Facility Longitude	Facility Valve Count	Est. Facility Total Component Count	No. Leaking Components Found	Specify Component Types Leaking	Date Leaking Components Repaired
127	7/14/2021	Stedman	ARK 3	31-013-25519	CHAUTAUQUA	42.532808	-79.200885	16	160	0	N/A	N/A
128	7/14/2021	Stedman	ARRIGO/NOTARO 1	31-029-20738	ERIE	42.60361	-79.02022	12	120	0	N/A	N/A
129	6/29/2021	Stedman	BALDWIN 1	31-013-25486	CHAUTAUQUA	42.072161	-79.499891	22	220	0	N/A	N/A
130	7/14/2021	Stedman	BAUDER 1	31-029-15425	ERIE	42.82464	-78.5682	13	130	0	N/A	N/A
131	6/29/2021	Stedman	COCHRAN WN1644	31-013-12805	CHAUTAUQUA	42.06982	-79.59679	18	180	0	N/A	N/A
132	7/14/2021	Stedman	CUMMINGS 3	31-037-23229	GENESEE	43.02212	-78.43102	14	140	0	N/A	N/A
133	7/14/2021	Stedman	DAWSON TANNER 1	31-121-13277	WYOMING	42.53701	-78.40613	11	110	0	N/A	N/A
134	6/29/2021	Stedman	EDDY 2	31-013-20404	CHAUTAUQUA	42.05722	-79.5209	29	290	0	N/A	N/A
135	7/8/2021	Stedman	FISHER UNIT 1	31-009-17018	CATTARAUGUS	42.11956	-78.95865	14	140	0	N/A	N/A
136	7/14/2021	Stedman	JEWITT 1	31-029-14435	ERIE	42.65487	-79.00545	8	80	0	N/A	N/A
137	7/12/2021	Stedman	JOHNSON, B 1	31-013-18825	CHAUTAUQUA	42.26444	-79.14571	17	170	0	N/A	N/A
138	7/14/2021	Stedman	KAPPUS 1	31-029-19717	ERIE	42.68932	-78.90587	6	60	0	N/A	N/A
139	7/1/2021	Stedman	LOWN 3A	31-013-18404	CHAUTAUQUA	42.17374	-79.38077	15	150	0	N/A	N/A
140	7/8/2021	Stedman	MEADE 1	31-009-16723	CATTARAUGUS	42.112	-79.03195	17	170	0	N/A	N/A
141	7/8/2021	Stedman	MOSHER-PARKER UNIT 1	31-009-19745	CATTARAUGUS	42.11074	-79.04346	18	180	0	N/A	N/A
142	6/29/2021	Stedman	NYSRA 4-2	31-013-12578	CHAUTAUQUA	42.044	-79.49336	13	130	0	N/A	N/A
143	7/1/2021	Stedman	NYSRA 6-3	31-013-16237	CHAUTAUQUA	42.28027	-79.40854	21	210	0	N/A	N/A
144	7/1/2021	Stedman	NYSRA 6-4	31-013-16309	CHAUTAUQUA	42.27374	-79.38311	22	220	0	N/A	N/A
145	7/14/2021	Stedman	PASCHKE 1	31-029-19968	ERIE	42.89489	-78.60515	10	100	0	N/A	N/A
146	7/14/2021	Stedman	PILLER 2	31-029-18678	ERIE	42.61787	-78.88231	14	140	0	N/A	N/A
147	6/29/2021	Stedman	ROCKY 3161	31-013-14792	CHAUTAUQUA	42.06563	-79.52502	21	210	0	N/A	N/A
148	7/8/2021	Stedman	SWEENEY, W. SR. 2	31-013-17970	CHAUTAUQUA	42.00782	-79.3564	15	150	0	N/A	N/A
149	7/14/2021	Stedman	TORRELLI 1	31-029-24575	ERIE	42.982251	-78.520648	13	130	0	N/A	N/A
150	7/14/2021	Stedman	ZILLIOX 1	31-121-19164	WYOMING	42.53771	-78.36208	12	120	0	N/A	N/A
								2339	19983	22		
									Percent Leakers - All Components:	0.11%		
									Percent Leakers - Valves:	0.34%		

N/A = Not Applicable

APPENDIX 2

Appendix 2 - Combustible Gas Monitoring

Item	Date	API #	Classification	MCF/Month	Barrels Oil/Month	Number of Compressors	Combustible Gas Detected?
1	5/24/2021	37-105-21099	Gas Well Shutin	0	0	0	0
2	5/24/2021	37-105-21098	Gas Well Shutin	0	0	0	0
3	5/24/2021	37-105-21239	Gas Well Shutin	0	0	0	0
4	6/8/2021	37-105-21339	Gas Well	67	0	0	0
5	6/8/2021	37-105-21338	Gas Well	245	0	0	0
6	6/8/2021	37-105-21340	Gas Well	86	0	0	0
7	6/21/2021	37-105-21475	Gas Well	11	0	0	0
8	6/21/2021	37-105-21474	Gas Well	47	0	0	0
9	6/21/2021	37-105-21473	Gas Well	105	0	0	0
10	6/21/2021	37-105-21327	Gas Well	114	0	0	0
11	6/21/2021	37-105-21329	Gas Well	101	0	0	0
12	6/21/2021	37-105-21328	Gas Well	84	0	0	0
13	6/21/2021	37-105-21217	Gas Well	140	0	0	0
14	6/22/2021	37-105-21345	Gas Well	324	0	0	0
15	6/22/2021	37-105-21086	Gas Well	165	0	0	0
16	6/28/2021	37-105-21331	Gas Well	205	0	0	0
17	6/28/2021	37-105-21095	Gas Well	186	0	0	0
18	6/28/2021	37-105-21219	Gas Well	79	0	0	0
19	6/28/2021	37-105-21306	Gas Well	184	0	0	0
20	6/28/2021	37-105-21304	Gas Well	52	0	0	0
21	6/28/2021	37-105-21218	Gas Well	29	0	0	0
22	6/28/2021	37-105-21346	Gas Well	97	0	0	0
23	6/29/2021	37-105-21200	Gas Well	22	0	0	0
24	6/29/2021	37-105-21094	Gas Well	171	0	0	0
25	6/29/2021	37-105-21321	Gas Well	31	0	0	0
26	6/29/2021	37-105-21275	Gas Well	80	0	0	0
27	6/29/2021	37-105-21130	Gas Well	71	0	0	0
28	6/29/2021	37-105-21132	Gas Well	33	0	0	0
29	6/29/2021	37-105-21319	Gas Well	Shut in	0	0	0
30	6/29/2021	37-105-21320	Gas Well	Shut in	0	0	0
31	6/29/2021	37-105-21486	Gas Well	8	0	0	0
32	6/29/2021	37-105-21305	Gas Well	91	0	0	0
33	6/29/2021	37-105-21210	Gas Well	69	0	0	0
34	6/29/2021	37-105-21211	Gas Well	147	0	0	0
35	6/29/2021	37-105-21087	Gas Well	2	0	0	0
36	6/29/2021	37-105-21201	Gas Well	26	0	0	0
37	6/29/2021	37-105-21208	Gas Well	68	0	0	0
38	6/29/2021	37-105-2119	Gas Well	Shut in	0	0	0
39	6/30/2021	37-105-21221	Gas Well	248	0	0	0
40	6/30/2021	37-105-21093	Gas Well	167	0	0	0
41	6/30/2021	37-105-21203	Gas Well	24	0	0	0
42	6/30/2021	37-105-21202	Gas Well	14	0	0	0
43	6/30/2021	37-105-21311	Gas Well	12	0	0	0
44	6/30/2021	37-105-21204	Gas Well	20	0	0	0
45	6/30/2021	37-105-21205	Gas Well	48	0	0	0
46	6/30/2021	37-105-21310	Gas Well	89	0	0	0
47	6/30/2021	37-105-21309	Gas Well	91	0	0	0
48	6/30/2021	37-105-21207	Gas Well	66	0	0	0
49	6/30/2021	37-105-21206	Gas Well	130	0	0	0
50	7/6/2021	37-105-21316	Gas Well	130	0	0	0

Appendix 2 - Combustible Gas Monitoring

Item	Date	API #	Classification	MCF/Month	Barrels Oil/Month	Number of Compressors	Combustible Gas Detected?
51	7/6/2021	37-105-21326	Gas Well	69	0	0	0
52	7/6/2021	37-105-21235	Gas Well	22	0	0	0
53	7/6/2021	37-105-21236	Gas Well	4	0	0	0
54	7/7/2021	37-105-21472	Gas Well	175	0	0	0
55	7/7/2021	37-105-21314	Gas Well	116	0	0	0
56	7/7/2021	37-105-21476	Gas Well	116	0	0	0
57	7/7/2021	37-105-21303	Gas Well	12	0	0	0
58	7/7/2021	37-105-21347	Gas Well	69	0	0	0
59	7/7/2021	37-105-21317	Gas Well	87	0	0	0
60	7/7/2021	37-105-21315	Gas Well	54	0	0	0
61	7/7/2021	37-105-21505	Gas Well	91	0	0	0
62	7/7/2021	37-105-21222	Gas Well	114	0	0	0
63	7/7/2021	37-105-21220	Gas Well	88	0	0	0
64	7/7/2021	37-105-21325	Gas Well	57	0	0	0
65	7/7/2021	37-105-21313	Gas Well	204	0	0	0
66	7/7/2021	37-105-21223	Gas Well	119	0	0	0
67	7/7/2021	37-105-21308	Gas Well	48	0	0	0
68	7/7/2021	37-105-21322	Gas Well	192	0	0	0
69	7/7/2021	37-105-21214	Gas Well	341	0	0	0
70	7/8/2021	37-105-21324	Gas Well	140	0	0	0
71	7/8/2021	37-105-21332	Gas Well	98	0	0	0
72	7/8/2021	37-105-21312	Gas Well	31	0	0	0
73	7/8/2021	37-105-21212	Gas Well	107	0	0	0
74	7/8/2021	37-105-21216	Gas Well	Shut-in	0	0	0
75	7/8/2021	37-105-21215	Gas Well	107	0	0	0
76	7/8/2021	37-105-21318	Gas Well	215	0	0	0
77	7/8/2021	37-105-21213	Gas Well	119	0	0	0
78	7/8/2021	37-105-21085	Gas Well	9	0	0	0
79	7/8/2021	37-105-21489	Gas Well	117	0	0	0
80	7/8/2021	37-105-21307	Gas Well	170	0	0	0

This wellhead assembly and all fittings and connecting lines were checked for combustible gas detection with an Altair 5 X Multi Gas Meter

APPENDIX 3

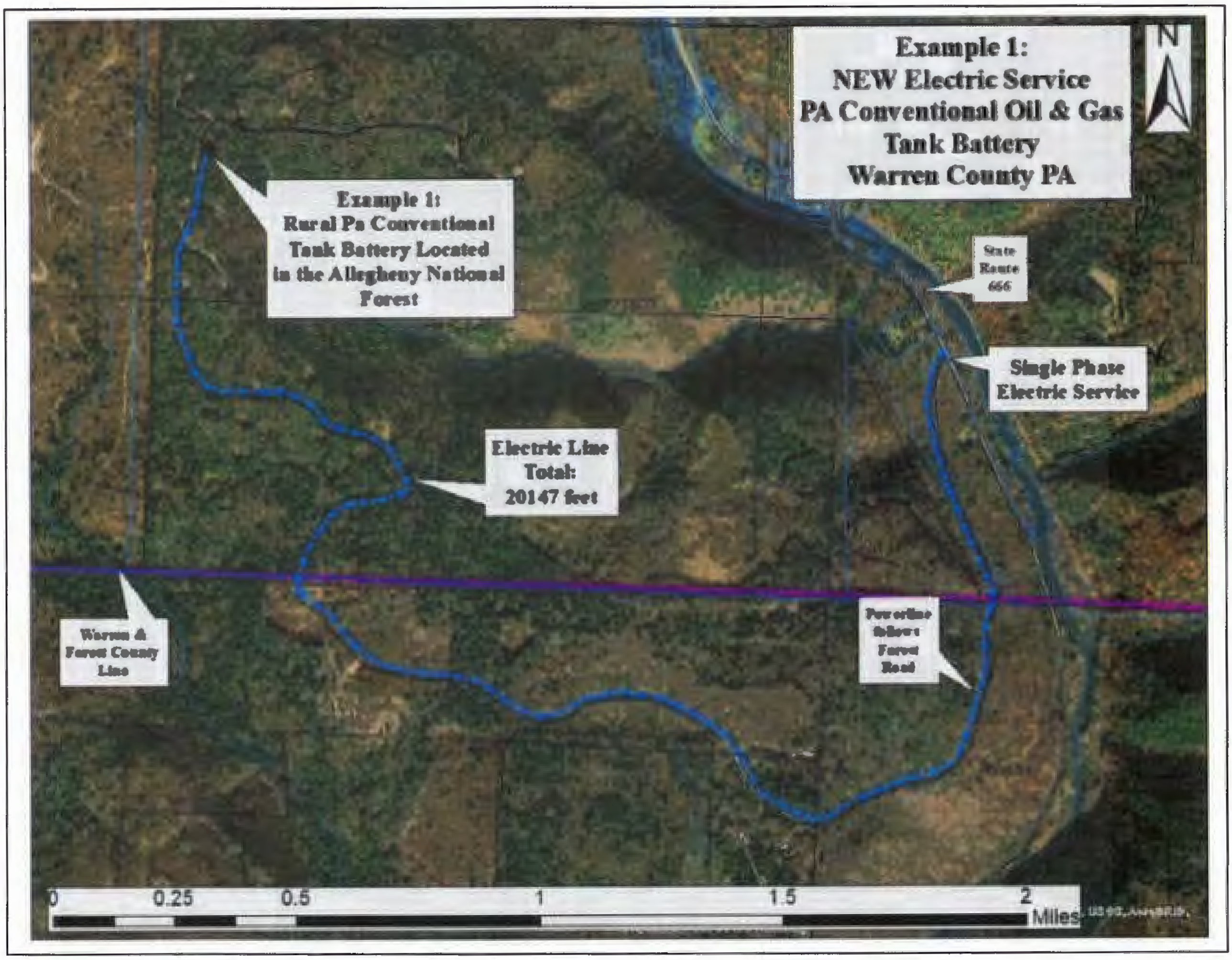
APPENDIX 3

Four Examples of Tank Batteries With No Electrical Service

Price quotation obtained from Hull Electric Warren, Pennsylvania August 9, 2021:

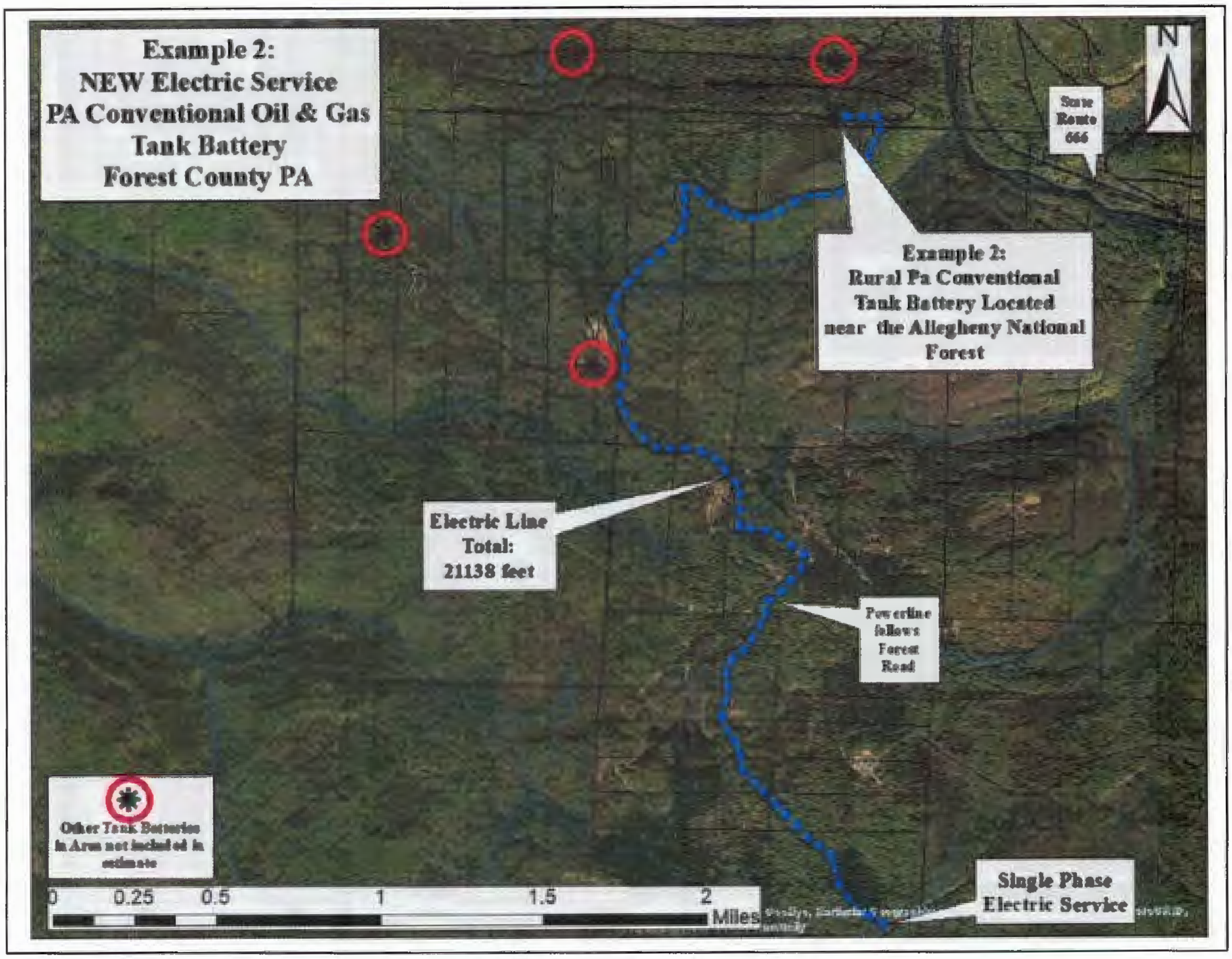
1.) Above Ground Power Line:
   a. 0000 Single Phase (1,000ft spools) - $2.85/ft
   b. 0000 Three Phase (1,000ft spools) - $3.60/ft
2.) Fuse Box Disconnect: (2 at each example):
   a. Single Phase - $375.00/each
   b. Three Phase - $525.00/each
3.) Power Poles (assume power pole every 200ft) - $350.00/each
4.) Power Pole Hook-up materials (assume 1 each of the following at every power pole):
   a. Wedge Clamps - $5.58/each
   b. Isolators - $8.63/each
   c. Wire Hangers - $8.75/each
5.) Miscellaneous Connection materials:
   a. Wire Connectors -$15.50/each (1 connector every 1,000 feet)
   b. Electric Meter - $60.00/each (1 at each example)
6.) 480 volt booster transformer - $6,750/each (1 at each new single phase service connection)
7.) Estimate New Service Connection by Local Electric Company - $2,500 at each point (*includes new pole, and service transformer*)
8.) Estimate of Labor to install new electric lines/service - $1,800 per day (*includes travel time, fuel, three man crew, electric connetion points and 1,600 ft line set*)

Example 1 – Cost $128,023.08



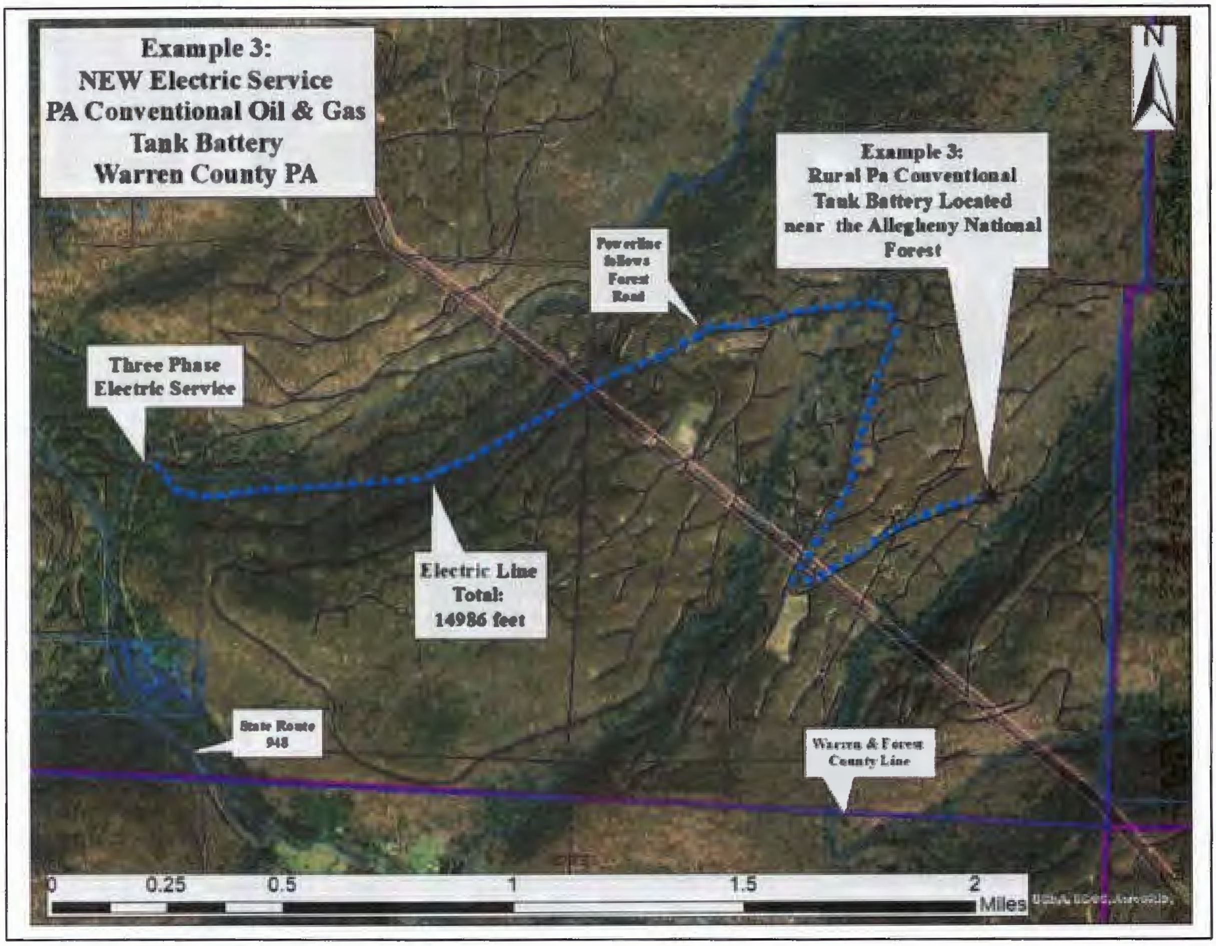
Example 1 Single Phase Electric--20,147 foot project: Estimated cost for installing new electric service is **$128,023.08** assuming 12.59 days of work. Project requires booster transformer to compensate for single phase service.

Example 2 – Cost $133,696.55



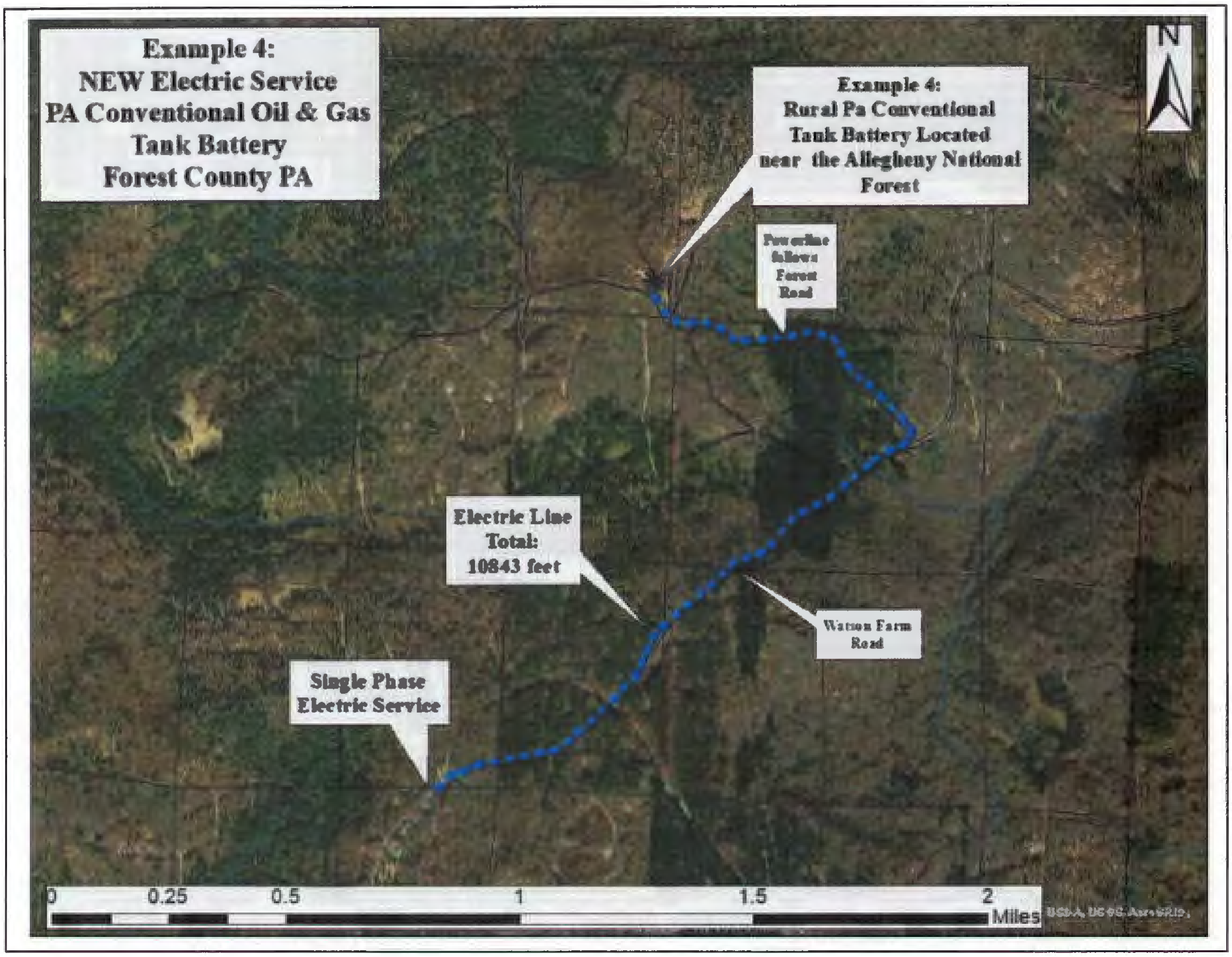
Example 2 Single Phase Electric--21,138 foot project: Forest County, Pennsylvania. Estimated cost for installing new electric service is **$133,696.55** assuming 13.21 days of work. This total does not include the installation and cost of the methane collection device. Using a "voltage drop calculator" it is estimated to only have **2 AMPs** of usable power at the end of the run; booster transformer therefore required.

Example 3 – Cost $103,265.85



Example 3 Three Phase Electric--14,986 foot project: Warren County, Pennsylvania. Estimated cost for installing new electric service is **$103,265.85** assuming 9.36 days of work. This total does not include the installation and cost of the methane collection device. Using a "voltage drop calculator" it is estimated to only have **6 AMPs** of usable power at the end of the run; booster transformer therefore required.

Example 4 – Cost $74,757.68



Example 4 Single Phase Electric--10,843 foot project: Forest County, Pennsylvania. The estimated cost for installing new electric service is **$74,757.68** assuming 6.77 days of work. This total does not include the installation and cost of the methane collection device. Using a "voltage drop calculator" it is estimated to only have **7 AMPs** of usable power at the end of the run; booster transformer required.