New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau E, 12th Floor
625 Broadway, Albany, New York 12233-7017
Phone: (518) 402-9814 • **Fax:** (518) 402-9819
Website: www.dec.ny.gov

Joe Martens
Commissioner

April 18, 2013

Thomas Van Vranken
Environmental Manager
Norlite LLC
628 So. Saratoga Street
Cohoes, New York 12047

RE: Norlite, LLC, EPA ID No. NYD080469935
Request for Permit Modification
Optical Flow Sensor (OFS) Proposal

Dear Mr. Van Vranken:

The New York State Department of Environmental Conservation (Department) has received and reviewed your April 5, 2013 request for permit modification to replace the current measurement device used for determining the stack gas flow rate. The Department has made a determination to conditionally approve this request. The conditions of this approval are as follows:

1. This approval is only for the installation and testing of the Optical Flow Sensor as specified in the request. Permanent use is subject to further Departmental approval.

2. Based on the RATA, testing, and other factors related to the OFS in LWAK #1, the Department may also request a flow measurement comparison for LWAK #2 prior to final approval for permanent use.

3. Please confirm that the RATA will be performed at both the 'hot' stack and current stack gas flow measurement locations.

4. Please use a manometer for pressure measurement during the one-month testing period as well as the RATA testing at the 'hot' stack. If this technology is approved for permanent use, then either the stack gas flow will need to be continuously corrected for pressure, or a conservatively realistic correction factor will be applied.

Please install this technology as soon as possible. The Department is hopeful that this will be in place and being tested during the upcoming CfPT in May.

This is a minor modification in accordance with 373-1.7(c)(15). Norlite is required to notify all persons on the facility mailing list of these modifications. This requirement is consistent with 6 NYCRR Part 373-1.7(e). Please provide this office with a copy of your notification for our records.

Should you have any questions on this or need clarification, please contact Mr. James Lansing at (518) 402-9814.

Sincerely,

Thomas J. Killeen, P.E.
Chief, RCRA Permitting Section,

enclosure

ec: M. Cruden, DEC
J. Lansing, DEC
N. Baker, DEC, Region 4
R. Leone, DEC, Region 4
D. Spencer, DEC, Region 4
J. Quinn, DEC, Region 4
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Thomas Van Vranken
Norlite, LLC.
628 South Saratoga Street
Cohoes, NY 12047

Return Requested: Delivered Via Email

Subject:
Re: Proposal for Installation of Optical Stack Gas Flow Monitor

Date:
April 4, 2013

Contact:
Amit Chattopadhyay, PE

Phone:
201-398-4311

Email:
Amit.Chattopadhyay@arcadis-us.com

Dear Mr. Van Vranken:

Norlite, LLC (formerly Norlite Corporation) has been monitoring stack gas flow rates in the stacks of the two lightweight aggregate kilns since 2004 when the MACT Subpart EEE requirements came into effect for monitoring stack gas flow. To monitor the stack gas flows, Norlite has utilized Fluid Components International (FCI) Model GF90 gas flow meters. These instruments are installed at the lower sampling platform on each kiln wet scrubber exhaust stack. The flow rate monitoring systems (FRMS) are calibrated and audited in accordance with Part 60, Appendix B, PS 6 and Appendix F procedures. The FCI FRMS operate by having two probes which sit in the middle of the stack and air stream. One probe is at ambient temperature and acts as a reference while the other probe is heated to a specified temperature. As an air stream passes by the two probes, the heated probe is cooled. The change in temperature of the heated probe is mathematically converted to a standard cubic feet per minute (SCFM) flow rate which is captured by the Norlite Data Acquisition System (DAS).

Norlite has been reporting both MACT Exceedance cutoff reports as well as 25 and 50 cutoff reports as per the RCRA Part 373 permit for several years. These reports detail cutoffs or malfunctions which have occurred in the kiln system and resulted in a parameter which has either come to or met the operational permit limit. Stack Gas Flow Rate has been a parameter which has been detailed frequently on these reports. The majority of the Stack Gas Flow Rate cutoffs have been associated with a fault in the monitoring equipment which is identified as a MACT Span cutoff. Norlite with the assistance of Malcolm Pirnie-Arcadis have conducted extensive studies determining the cause of the MACT Span cutoffs for Stack Gas Flow Rate. The studies have shown that while the FCI FRMS are simple effective units for measuring air flow rate, they are susceptible to high moisture and water droplets in the stream they are measuring. Norlite and its consultant believe that Stack Gas Flow Rate Span excursions that last a short duration (two minutes or less, for example) are predominantly due to water droplets hitting the heated probe on the FCI unit. The water droplets cool the heated probe which in turn increases the difference in temperature of the two probes, which is correlated to an indication of flow rate change (increase) of the stack gas. As part of the studies, Norlite monitored pressure changes throughout the entire air pollution control system. If the flow rate was truly changing, as suggested by the FCI FRMS, then a significant change in pressures would be seen across the different modules of the air pollution control system. The studies did not find any such pressure changes to support a flow rate change. To further support the case that the stack gas flow rate wasn't changing, Norlite and its consultant looked at the I.D. fan performance of each kiln. The I.D. fan creates the draft throughout the entire air pollution control system and is located after the baghouse system and before the Venturi scrubber system. The I.D. fan has a variable speed drive which allows Norlite to change the I.D. fan speed to adjust for operational demands. A change in the I.D. fan speed will result in a change of the overall stack gas flow rate, as well as consequent pressure changes in the air pollution control systems . During the time when the stack gas flow meter has faulted causing a cutoff, the I.D. fan speed does not change as indicated by an amperage reading and percent speed level on the kiln control screen.

Once Norlite established what was causing the FCI FRMS to fault, studies were started to find a solution to prevent the faults from occurring. Norlite tried operational changes such as reducing the Mist Pad rinse water and lowering the I.D. fan speed with various successes. Reduced Mist Pad rinse water flow allowed the Mist Pad to become plugged with soda ash solution solids which eventually contributed to a high Ducon Differential pressure. Reducing the I.D. fan speed resulted in a low Venturi Differential Pressure which contributes to other cutoffs. Norlite explored with FCI any possibilities of modifying the probe with no suitable solution being found. At this point, Norlite is exploring replacing the FCI stack gas flow probes with a different technology.

Norlite has explored the use of several flow monitoring technologies which are well established in production and environmental applications. The most well-known and popular gas flow measurement is by an S-type pitot tube. The Pitot tube is an industrial standard for gas flow measurement and widely accepted by most if not all regulatory bodies. After much deliberation, Norlite decided not to pursue using pitot tubes as a stack gas flow measurement system. Pitot tubes have many small orifices which need to be pulsed with air to prevent them from plugging. Norlite had concerns that even with air pulsing the orifices; they would in time become plugged with soda ash solution solids or other particulate in the air stream. Norlite felt using a pitot tube for stack gas flow measurement would result in increased maintenance time to clear the orifices as well as errant stack gas flow readings. Norlite and its consultant also investigated the use of several other flow measurement technology options, including the ultrasonic measurement system and pressure drop related measurement system such as venturi, however, based on industry application investigations it was determined they were ultimately unlikely to provide a suitable or sustainable measuring system for the kilns. The main problem with most stack gas flow measuring systems is they have either a large number of high maintenance parts which could fail, are similarly affected by moisture in the exhaust gas stream or require significant stack structure modification in order to operate. Ultimately, Malcolm Pirnie-Arcadis found an Optical Flow Sensor technology that is being used for gas flow measurement and determined it could be a possible solution for Norlite.

Norlite and Malcolm Pirnie-Arcadis have met with OSI, the optical flow sensor vendor several times, and determined the technology would be a suitable alternative to the FCI flow gas meter currently being used. Norlite, Malcolm Pirnie-Arcadis, and OSI presented this technology with a demonstration unit to the NYSDEC on November 28, 2012.

Norlite is proposing to the Department to allow the installation of one Optical Flow Sensor on Kiln 1 located in the ductwork approximately 16 feet from the exit of the baghouse system but before the I.D. fan housing. Norlite is proposing to install this monitor and collect data side by side with the current FCI flow monitoring system for at least one month. Norlite intends, with Department approval, to have the unit installed and operational before the start of the MACT Confirmatory Performance Test scheduled for the week of May 13, 2013. During the MACT testing, certified Pitot tube flow measurements will be made which can be compared against the Optical Flow Sensor data. Once the Department is comfortable with the data and the unit, Norlite would propose to have an official RATA conducted on the unit so it could replace the FCI flow measurement system as the official permitted unit. Once the Optical Flow Sensor is approved by the Department for Kiln 1, Norlite would also propose to have a unit installed on Kiln 2 followed by an official RATA for replacement of that FCI flow monitor. Norlite is hopeful that by the end of July, both kilns would have stack gas flow rate measured using the Optical Flow Sensor.

As with any new technology, there are some operational and permitting challenges which must be overcome before it can be used in an official certified setting. The Optical Flow Sensor Norlite is proposing to use requires the gas being measured at a temperature of at least 250 to 300 °F. The current location of the FCI flow monitors does not offer a gas temperature in the range needed for the Optical Flow Sensors to operate. Norlite has worked with Malcolm Pirnie-Arcadis and OSI, the Optical Flow Sensor manufacturer, to determine a suitable location for the new instrument to be installed. The location that was determined to be the most suitable is the ductwork after the baghouse but before the I.D. fan. The gas leaving the baghouse system is below 350 °F but above the minimum needed temperature of 250 °F. The gas leaving the baghouse system typically does not have a high opacity but does have some acid gases. The Optical Flow Sensor by OSI will work in up to 90% opacity and is completely unaffected by acid gases. Norlite understands that not only the installation but the location of this new instrument will require a RCRA and Title V permit modification. Norlite is pursuing this technology because it believes it will truly improve operations and reduce the number of cutoffs which are occurring.

The location of the instrument is only one part of the operation of this type of instrument. The instrument when fully functional will provide a measured duct velocity signal to Norlite's DAS system. In order to meet the requirements of the flow rate being given in standard cubic feet per minute, additional information will need to be collected and a calculation processed. Norlite will be installing a thermocouple to collect temperature data of the flue gas to be included into the standard cubic feet calculation. Changes in temperature can significantly change the standard cubic feet flow rate of a flue gas. At this time, Norlite is proposing to not install a pressure monitor in the vicinity of the Optical Flow Sensor. Pressure changes can alter the standard cubic feet calculation but the proposed installation location does not have a significantly different pressure from ambient pressure. The pressure at the installation location is only slightly negative, estimated at within 9 to 15 inches of water column below the atmospheric pressure of zero inches of water column, leading to a deviation of only 2.2 to 3.7 percent in the standard cubic feet calculation. Additionally, Norlite does not wish to install a pressure monitor at this location due to the environment it will be exposed to. Norlite has had difficulty maintaining the highly sensitive metal diaphragm pressure monitors, required for this duty, within this type of environment in the past. Despite the low level of dust leaving the bag house system, the diaphragms in the pressure monitors become fouled resulting in false pressure readings or even failure of the unit. Norlite does not believe operational pressure changes to be significant enough in the standard cubic feet calculation to warrant the installation of a pressure monitor which risks a reduction in confidence in the desired flow measurement reading. The purpose of this proposal is to get away from a stack gas monitoring system with faults continuously due to current Kiln exhaust stack gas dynamics.

The final piece to this proposal is to allow Norlite to calculate the standard cubic feet per minute calculation within the PLC of each kiln. The velocity and temperature data will be captured by the PLC on a continuous basis with the calculation also being conducted and provided on a continuous basis by a custom program supplied by an independent specialist PLC coding firm. Norlite will still provide a continuous instantaneous[1] stack gas flow rate as well as an hourly Rolling Average Stack Gas Flow Rate. To satisfy the requirements of the MACT regulations for when an instrument fails or faults, the unit will send a fault signal to the PLC when the voltage for the A and/or B detectors falls below 0.05 volts which is indicative of a failing light source. Additionally, a fault signal will be sent to the PLC from the unit when there is a loss of power to the flow meter.

To certify the unit to meet the specified MACT regulations, Norlite is proposing to conduct RATA testing as was previously undertaken for the FCI units. A S-pitot tube will provide certified flow rate measurement from the wet scrubber exhaust stack at the first platform while the Optical Flow Sensors will be in the ductwork after the bag house systems. The correction factors for moisture in the stack at the Pitot tube, and at the Optical Flow Sensor location will be accounted for, and each will have a dry standard cubic feet per minute flow rate to compare against. It is relevant to point out that the moisture being added in the scrubber and going in to the stack is part of

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[1] OSI's OFS-2000 flow sensor takes 4,000 samples in about 0.27 seconds to calculate instantaneous velocity. The sensor averages the internal samples to update the serial and current loop outputs. Note that the fastest update is about every 3 seconds.

the air pollution control systems and not indicative of the combustion process. The main purpose for stack gas flow measurement is to ensure the combustion process is occurring at an optimal rate.

It is noted that the flue gas flow rate at the ID fan inlet (i.e., before the scrubber) is indicative of the quantity of the generated combustion product. Previous tests have indicated that the moisture content in the combustion product is typically approximately 8%, which is significantly less than the level of moisture typically tested at the stack, which is around 15%. For routine reporting, we propose to the DEC to ignore the minor amount of moisture in the combustion gases, and report the SCFM data from the Optical Flow Sensor. If however, the DEC insists to have the moisture correction, we propose to use a fixed amount of moisture content value at the Optical Flow Sensor as obtained during RATA testing at that location. We also do not believe that the stack moisture content will have any valid impact on the flow data from the Optical Flow Sensor. The omission of the moisture in the scrubber system for routine combustion gas flow reporting will not affect the ability or reduce the validity of the data supplied by the Optical Flow Sensor. The I.D. fan is the only source which controls flow rates from the combustion chamber through the Air Pollution Control system. Any changes in the I.D. fan speed will result in a flow rate change which the Optical Flow Sensor will detect. The addition of water in the wet scrubber system is an input in the scrubber system but not an input that will have an appreciable effect on stack gas flow rates. Norlite is confident the moisture corrected flow rates for the Pitot tube will still be well within the allowed 20 percent deviation, with a realistic estimation of less than half that amount based on past recorded data.

Norlite is hopeful the Department will grant permission for Norlite to proceed with the installation of the Optical Flow Sensor for stack gas measurement. To ensure the process keeps advancing, Norlite has corporate approval and has submitted documentation to the corporate level to request the necessary financing to complete this process. Once Norlite has finally received internal approvals and Department approval, OSI can typically deliver a unit for installation within approximately 3 weeks of our confirmed order. It is estimated there will be a 2 day installation process, which will also include on-site training for certain Norlite employees, and some modification to the PLC to monitor the instrument and provide the calculated gas flow based upon the measured duct velocity measurement and process temperature.

The author believes that it will be an exciting opportunity for Norlite at the prospect of utilizing the Optical Flow Sensor for combustion gas flow measurement and is confident this type of unit will help Norlite significantly reduce the amount of stack gas flow cutoffs which occur but also the overall amount of cutoffs in general which occur. If after reviewing this proposal the Department has any questions or comments, the Department can contact Norlite directly. If necessary, Norlite can coordinate a conference call with Malcolm Prinie-Arcadis and/or OSI if a more technical discussion is needed. Norlite appreciates the Department's time and consideration when reviewing this proposal.

Should you have any questions regarding this letter, please contact me at (201) 398-4311 (direct line), or email at amit.chattopadhyay@arcadis-us.com.

Sincerely,

MALCOLM PIRNIE, a Division of ARCADIS-US, Inc.

Amit Chattopadhyay, PE
Principal Consultant II
Board Certified Environmental Engineer

Copies:
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