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Analytical Products and Solutions

Cooling Tower

TCEQ – 30 TAC - Chapter 115.760
Highly-Reactive Volatile Organic Compounds (HRVOC)
Cooling Tower Heat Exchange Systems

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To reduce federal mandated ozone levels in non-attainment Houston and surrounding counties, the Texas Commission for Environmental Quality (TCEQ) implemented regulations to curb olefinic hydrocarbon emission. With one of the most dense concentration of Petrochemical plants in the Houston area, there is the potential of elevated concentration of olefins in ambient air. Elevated concentration of olefins, categorized as Highly-Reactive Volatile Organic Compounds (HRVOC), in the presence of sun light promotes higher ozone formation. Hence the requirement to curb olefin emission in order to reduce ozone formation.

One of the targeted emission sources are cooling towers. Water utilized for non-contact process cooling could get contaminated with process medium due to heat exchanger leaks. Hence the volatiles are released to the environment in open cooling towers. The regulation requires the measurement of the concentration of defined olefin components as well as the cooling water flow in order to detect leaks and quantify the consequential emission amount.

The Siemens on-line process gas chromatograph provides speciated olefin concentrations as part of an integrated turn-key measurement solution. Based on many installations implemented and utilized, its track record over the last 15 years, functionality and ability to maintain ensures you can comply with the regulation and report accurate data with confidence.

Regulation Objective:

Reduce olefin emission

- Quantification
- Reduction of emission site cap

Quantify cooling tower emission

- Plants manufacturing or processing olefins
- Within HGB including Harris (Houston), Galveston, Brazoria, Chambers, Fort Bend, Liberty, Montgomery and Waller Counties

Regulatory Measurement Requirements:

- Continuous flow
- <8000 GPM cooling tower capacity
 - Off-line: total VOC bi-weekly, HRVOC speciation monthly: daily HRVOC speciation when >50ppbw, or
 - On-line: targeted HRVOC quantification
- >8000 GPM cooling tower capacity
 - Off-line: total VOC daily, HRVOC speciation monthly, daily lab HRVOC speciation when >50ppbw, or
 - On-line: targeted HRVOC quantification

Targeted components

- Harris County: Ethylene, Propylene, 1&i-Butene, trans-2-Butene, cis-2-Butene, 1,3 Butadiene
- Surrounding Counties: Ethylene, Propylene

Cont. Regulatory Measurement Requirements:

Sample Transport and Preparation

- Liquid water at water temperature
- Extraction with "Appendix P" stripper or equivalent

Analytical Performance

- Continuous update ≤ 15 minutes
- Measurement system uptime $>95\%$
- Validation according Performance Spec 9
 - Validation focus is analyzer
 - Initial 7 day drift performance test
 - Daily validation at mid-point
 - Quarterly validation at low-, mid- and high point
 - Validation based on average of 3 consecutive analysis ($\leq 5\%$)
 - Drift $<10\%$ /week
 - Linearity $\geq 99.5\%$

Emission Quantification:

- According Calculation 7.1 in TCEQ Appendix-P

The HRVOC cooling tower rule has specific analytical requirements. Although the measurement requires the interference free separation of the indicated olefins, at low ppm, the challenge to correct measurement and utilizing a maintainable measurement system is the extraction system. The mentioned Appendix-P stripper was designed for temporary usage but not for continuous utilization over long periods of time. The stripper extracts most volatiles. However, the high flow of hydrocarbon free stripping air needed dilutes the volatiles resulting in poor detectability impacting the "base" emission when no volatiles are detected. The large volume filled with Beryl saddles represents a large surface to accumulate inorganic contaminants and particulates representing challenging maintenance. Siemens provides an alternative extraction system. Smaller, no filling and low extraction gas flow improving measurement sensitivity by a magnitude. It further permits periodic quick draining to remove particulates as well as rinsing to clean deposits. The sparging system has undergone

documented Method 301 equivalence testing, has been used hundreds of time and became the standard for such on-line measurement. Furthermore, because traditional water flow control is not meeting the required drift performance, every Siemens sparger comes with an automatic electronic sparging gas and water flow control ensuring drift requirements.

Continuous Speciated Monitoring On-line Process Gas Chromatograph

| | |
|----------------------|----------------------------------------------------------------------|
| Utilities: | Carrier Gas Helium or Hydrogen, Fuel Gas Hydrogen, Combustion Air |
| Control: | Instrument Air |
| Design: | MAXUM II |
| Analytcs: | 2 Backflush trains to common FID |
| Cycle Time: | 7.5 min |
| Related Measurement: | Total VOC |
| Sample Temperature: | 55° C from sparger |
| Communication: | AO, Ethernet Modbus, OPC |
| Measuring Ranges: | 0-200 ppbw (in water) |
| Minimum Sensitivity: | ~ 0.5 ppbw (in water) |
| Linearity: | $>10^3$ |
| Repeatability: | +/- 2% |
| Uptime: | $> 98-99\%$ |
| Validation: | Auto Validation for 3 external standards (vapor standard) |

Sample Conditioning System

Flow Control:

- Sparging Gas continuous with EPC and Massflow Controller
- Water Flow continuous with MagFlow device and automatically controlled flow valve

Extraction System:

- Siemens AAI-1 Sparging System
- Dual sparger with individual drain valves
- Continuous water heater
- Sparging gas dryer
- Heated enclosure mounted below or back-to-back with analyzer

| | |
|---------------------------|----------------------------|
| System Integration | 3-sided, Cabinet, Shelter |
| System Monitoring | Analyzer System Management |

With more than a hundred of analyzer measurement systems on cooling towers, the MAXUM process gas chromatograph and Siemens sparging system provide proven, reliable, maintainable, and repeatable turn-key cooling tower monitoring system for satisfying the most rigorously regulatory requirements. Furthermore, assisting with in depth training enables you to support your installed measurement systems with confidence. And by having the largest dedicated analytical support group, we can provide expert support from remote or on site to assist you to meet regulatory compliance.

For more information, please contact:

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