Geosyntec consultants

An Overview of Viable Fenceline Monitoring Techniques Pertaining to the Refinery Rule

Curtis T. Laush, Ph.D.

Austin Measurements Group Lab Director

claush@geosyntec.com

Phone: 512-354-3287

Fenceline Monitoring Options

- Referring to the EPA–HQ–OAR–2010–0682 rule guidelines, the viable fenceline air monitoring options are:
  - Multiple single-point time integrated samplers: *Passive Diffusive (PD) Sorbent Tubes*
  - Multiple single-point (near) real-time active sampling: *Auto-GC*
  - Integrated path (near) real-time monitoring of benzene directly: *UV-DOAS*
  - Integrated path (near) real-time monitoring of surrogate compounds: *OP-FTIR*

Monitoring for Benzene Using PD Tubes

- 14-day benzene samples are collected and analyzed in accordance with EPA Methods 325A and 325B.
- Sample placement per Section 8.2 of Method 325A.
- Meteorological data is to either be: 1) collected on site; or 2) NWS data can be used, if collected within 25 miles.
- For each 14-day sampling period, a "Δc" is determined by the difference between highest and lowest sample results.
- An annual average Δc is determined using the average of the 26 most recent 14-day Δc values.
- The new annual average Δc must be determined within 45 days of the end of each 14-day sampling period.
- The annual average Δc is compared to an action level of 9 $\mu g/m^3$ (≈ 3 ppb).
- If the annual average Δc is greater than 9 $\mu g/m^3$, then a ***root cause analysis*** must be conducted and corrective action taken.
- For many facilities, the action level is not anticipated to be exceeded, but in some cases (whether proven or anticipated), root cause analysis may warrant the use of…

Continuous, Real-Time Monitoring (CRM) Technologies

- UV-DOAS
  - This technology is the EPA Refinery Rule recommended CRM monitoring approach for benzene because of its low detection limits, measurement time resolution and relatively lower costs
  - The spectrum and amount of UV light absorbed identifies (via spectral absorption "fingerprint") and directly quantifies (via a physical property known as the Beer-Lambert Law) various molecules in its lightpath.
  - Continuous, real-time sub-ppbv level analysis of BTEX, NO_x, SO_2, simultaneously.
- OP-FTIR
  - Same description as UV-DOAS, except substitute IR light for UV light.
  - Continuous, real-time ppbv level analysis of multiple pollutants (VOCs, HRVOCs, inorganics, acids), simultaneously (often 20-40 compounds in an analysis method)
- Auto-GC
  - Its detector measures the quantity (by peak area) of various components, pushed by a carrier gas, that exit a chemical separation column; the sample peak retention time (peak appearance time) identifies the compound.
  - Continuous, *near* real-time sub-ppbv to ppbv level analysis of BTEX and *select* VOC's

Geosyntec consultants

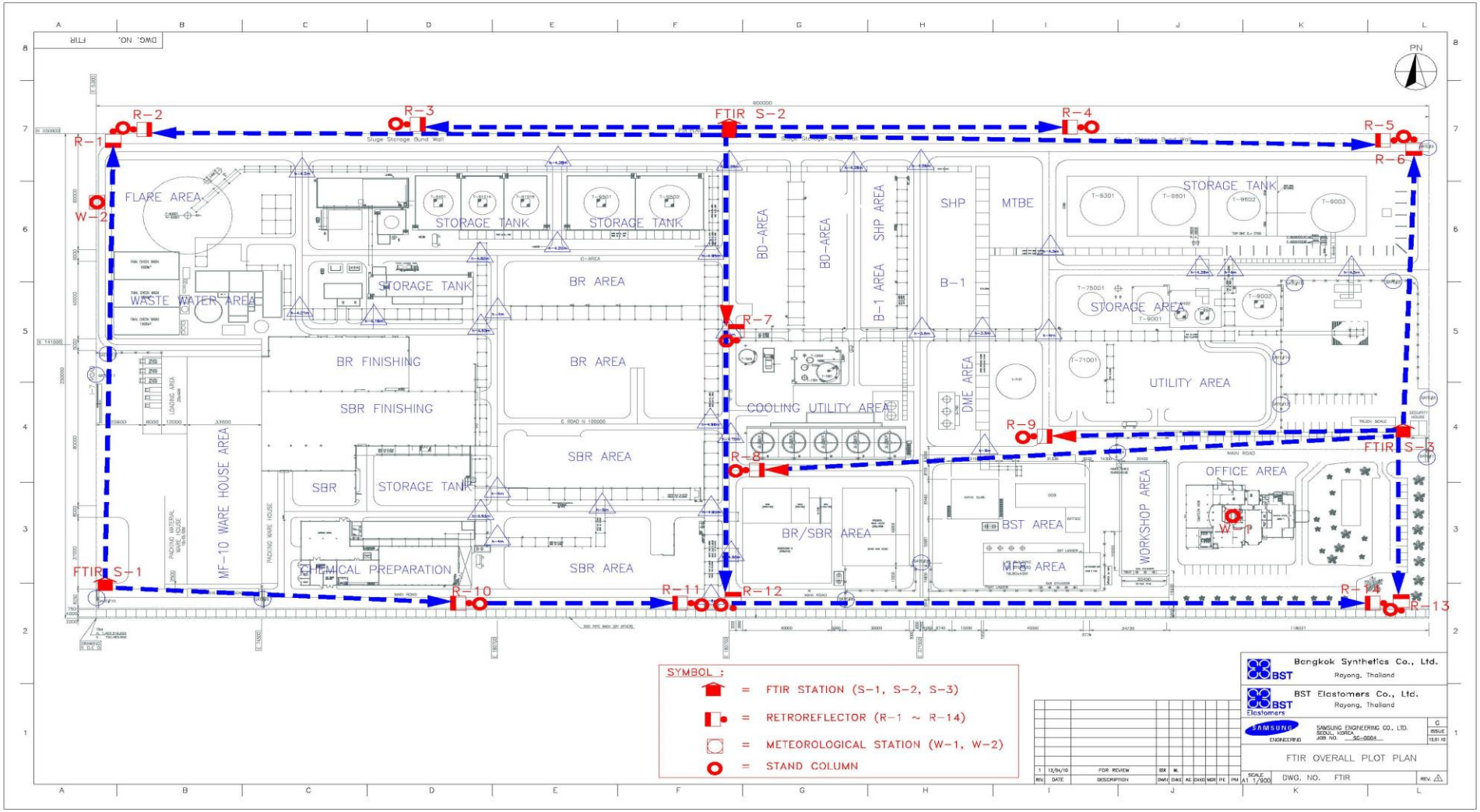
General Comparison Table of CRM Technologies at Fencelines

Parameter	UV-DOAS	OP-FTIR	Auto-GC
Sampling integration time	1-3 min.	1-5 min.	15-30 min.
Pollutants simultaneously monitored	BTEX, SO_2, NO_x	~many VOC's	BTEX, select VOC's
Benzene detection limits*	<< 1 ppbv (typically, ~200 pptv)	< 25 ppbv (recently, < 10 ppbv)	< 5 ppbv (with PID detector)
Calibration frequency	None required (Audits/validations should be done regularly)	None required (Audits/validations should be done regularly)	Daily/Weekly/Monthly (depends on accuracy requirements)
# Systems per 1 km fenceline path	1 open-path	~2 open-path	≥3 single-point
Approx. cost per system**	~$75K ($7.5K per mo.)	~$120K ($12K per mo.)	~$70K
Data up-time	>90%	>90%	~100%
Data maintenance/validations	Infrequent	Frequent	Somewhat frequent

*EPA is requiring DLs < 300 pptv
**Assuming permanent installation. Does not include met tower, infrastructure, etc. costs upon installation
Monthly rental cost typically ~10% of monitoring system list price

Geosyntec consultants

A Full and Interior Petrochemical Plant Pollution Perimeter Monitoring Network



Geosyntec consultants

Conclusions

- Most refineries can/should implement PD tubes when average benzene is low/zero
  - Cheapest option
  - Lack of temporal resolution doesn't matter
  - Remote (non-urban) facilities without excessive fugitives are certainly likely cases here
- CRM system (such as open-path UV-DOAS) deployment along fencelines on a temporary month-by-month basis is a possibility for root cause analysis
  - When difficult to differentiate fugitive benzene sources out of target refinery from background (adjacent plants)
  - When finding fugitive emissions directly from refinery tanks, or other sources
- CRM systems (such as OP-FTIR) very useful in profiling fugitive emission activity via surrogate compounds
  - Can also be deployed on a temporary basis