SGS EHS Air Quality Monitoring

Chris Schepcoff

christopher.schepcoff@sgs.com

+1 832 585 9376

WHEN YOU NEED TO BE SURE

SGS

COMMON AIR QUALITY CONTAMINANTS

- Volatile Organic Compounds (100+ Analytes)
  - Benzene
  - 1,3-Butadiene
  - Ethylene Oxide
- Pesticides/PAHs/PCBs/Dioxins
- Particulates
  - $PM_{2.5}$
  - PM_{10}
- Silica
- Heavy Metals
- Hydrogen Sulfide
- Ozone and Ozone Precursors

COMMON SAMPLING TIMES

- Grab Sample
  - 1 Minute Collection
- Short Term Exposure Limit (STEL)
  - 15 Minute Collection
- Time Weighted Average (TWA)
  - 8 Hour Collection
- Risk Assessment
  - 24 Hour Collection
- Perimeter Monitoring
  - 14 Days
- Real Time Measurement
  - Sample Collection and Immediate Analysis
- Continuous Monitoring
  - Sample Collection and Immediate Analysis Over a Time Period

DATA QUALITY OBJECTIVES

- Qualitative: Total Concentration per Media, such as Total ug or mg
- Quantitative: Concentration per Volume, such as ug/m^3
- Regulatory Compliance
- Screening

AIR QUALITY MONITORING

- Performed to measure the amount of pollution in the air at a given place over a given time
- Traditionally this is performed by passive or active sampling

Passive sampling	Active sampling
Simple and cheap	Generally more complex and expensive
No electrical power requirement	Reliant on electricity, battery or solar energy
Ideal for remote areas or where security or vandalism is a concern	Not ideal for remote areas or where security is a concern
Pollutant is adsorbed from the air through a diffusive body onto a sample specific collection media	Pollutant is pumped across a sample specific media or detected using electronic methods. Canisters that draw in air can also be used
Samples are sent to the laboratory for analysis. Concentration calculated based on mass of pollutant and sample volume	Samples can be sent to the laboratory for analysis or collected and analyzed automatically with data stored at regular intervals
Most commonly used for sampling periods ranging from 15 minutes to 2 weeks	Most commonly used for sampling periods ranging from one minute to 24 hours. Continuous sampling can range from days to a year or more

PASSIVE SAMPLING

- Accomplished when air enters a device by diffusing onto the adsorbent media.

PASSIVE SAMPLERS

- Badges
- Radiello® Air Samplers
- Thermal Desorption (TD) Tubes
- Directional Samplers

PASSIVE SAMPLERS

- Badges
  - Simple to Use
  - Reliable
  - Portable
  - Personal Monitoring
  - Area Monitoring

PASSIVE SAMPLERS

- Radiello® Air Samplers
  - Same Benefits as Badges
  - Added Advantages
    - Lower Reporting Limits
    - Higher Capacity
    - Faster Uptake

PASSIVE SAMPLERS

- Thermal Desorption (TD) Tubes
  - Passive Sampling with Diffusion Caps
  - Extended Sampling Periods – 14 Days
  - Collection of Volatiles and Semi-volatiles
  - Reusable

PASSIVE SAMPLERS

- Directional Samplers

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Shark-shaped sampler to hunt down 'fugitive' air pollution

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Industrial sites and highways could become cleaner in the future thanks to shark-shaped samplers that hunt 'fugitive' air pollutants.

Scientists at Lancaster University and the Environment Agency are working together to develop a new sampler to measure levels of so-called fugitive pollutants – such as particulates, and gases such as ammonia and nitrogen dioxide.

'Directional Passive Air Quality Samplers', which look similar to basking sharks and have been patented as part of ongoing research, are able to monitor the levels of pollutants that are caused by industrial activity, or traffic. The sources of these pollutants, such as airborne particles thrown up by transportation or extraction of raw materials, and intensive agriculture, cannot be identified by standard fixed integrated monitors.

Due to environmental regulations as part of industrial permits, operators need to install controls – such as dampening of road surfaces to keep down dust, and the fitting of wind shields to conveyors – to reduce fugitive pollutants. However, this is not currently done on a targeted basis, and is therefore inefficient, due to the lack of suitable monitors that can pinpoint the direction of pollution sources.

Dr Maria Angeles Solera García, a senior research associate at Lancaster University, said: "Industrial site operators, in order to comply with the permits issued by regulators, put in numerous costly control measures to tackle fugitive air pollutants in these complex environments. However, these are mostly untargeted as they do not have access to the evidence that more mobile and cost-effective monitors may provide. This is what our research is looking to achieve.

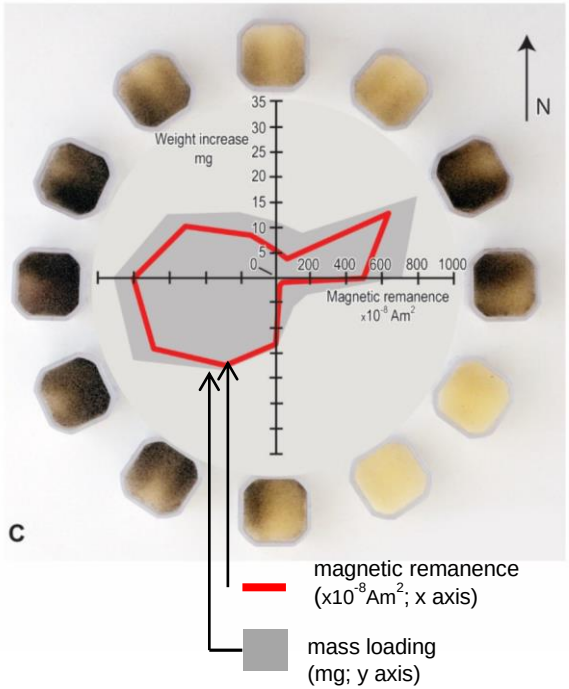
At Lancaster University, in partnership with the Environment Agency, we are developing monitors that are easily deployable in the field, that do not require a power source and are affordable.

Dr Maria Angeles Solera García

PASSIVE SAMPLERS

- Directional Samplers

PREVAILING DOWNWIND (DPAS C)



PASSIVE SAMPLERS

- Directional Samplers
  - For more accuracy in pinpointing the emissions source, the use of multiple passives directional samplers is recommended

ACTIVE SAMPLING

- Performed by drawing air through adsorbent media, filter, solution, or vessel using an air pump

ACTIVE SAMPLERS

- Filters
- Gas Sampling Vessels
- Adsorbent Tubes
- Polyurethane Foam (PUF) Samplers
- Impingers and Bubblers

ACTIVE SAMPLERS

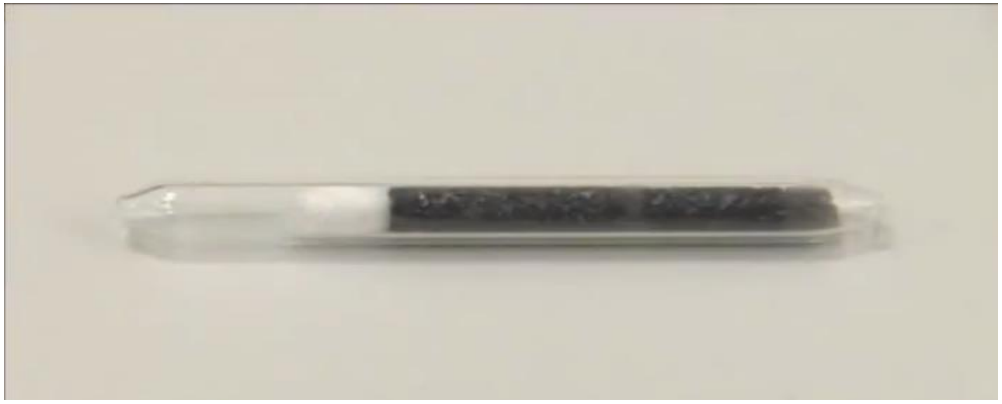
- Filters
  - Particulate Matter
  - Heavy Metals
  - Asbestos
  - Silica

ACTIVE SAMPLERS

- Gas Sampling Vessels
  - Whole Air Sampling
  - Volatile Organic Compounds
  - Collection 1 minute to 24 hours
  - Higher Shipping Costs
    - Canisters
    - Gas Sample Bags
    - Glass Bulb

ACTIVE SAMPLERS

- Adsorbent Tubes
  - Thermal Desorption Tubes
    - Active Sampling w/ Pump
    - Heated and Carrier Gas Delivers to GC Column
  - Solvent Desorption Tubes
    - One-Time Use
    - Two Bed Construction Identifies Breakthrough
    - Monitor Higher Concentrations
    - Less Moisture Interferences
    - Better Suited for Highly Reactive Analytes
    - Carbon Disulfide Desorption Aliquot Injected



ACTIVE SAMPLERS

- Polyurethane Foam (PUF) Samplers
  - Organic Pesticides
  - Polychlorinated Biphenyls (PCBs)
  - Polycyclic Aromatic Hydrocarbons (PAHs)
  - Polyhalogenated Dioxins and Furans
    - High Volume Sampling
      - Shorter Collection Period
      - Lower Detection Limits
      - Large Equipment
      - Area Sampling

ACTIVE SAMPLERS

- Impingers and Bubblers
  - Collect Airborne Chemicals into a Liquid Medium
  - Liquid Medium Specific to Contaminant
  - Chemical Reaction or Physically Dissolves the Chemical of Concern

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Active Sampling to Obtain Rapid, On-Site Results and Detect Episodic Contamination

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Benefits
  - Higher Frequency of Sampling
  - Allow for Early Warning
  - Reduce Issues Related to Sampling, Transportation, Disposal
  - Reduced Cost per Analysis
- Disadvantages
  - Validation of Devices
  - Changing Field Conditions
  - Higher Initial Investment

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Electrochemical Sensors
  - Carbon Monoxide
  - Hydrogen Sulfide
  - Ozone
  - Particulates
- Photoionization Detectors (PID)
  - Broad Range of Volatile Organic Compounds
- Gas Chromatography (GC)
  - Analyte Speciation

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Electrochemical Sensors
  - Handheld, Portable
  - Cross Interferences

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Historically used to Monitor Stack Gases for Combustion Controls
  - Continuous Emission Monitoring Systems (CEMS)
- Currently an Emerging Technology
  - Internet of Things (IoT)
  - Cloud Computing
  - Sensor Improvements
  - Micro Electronics

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

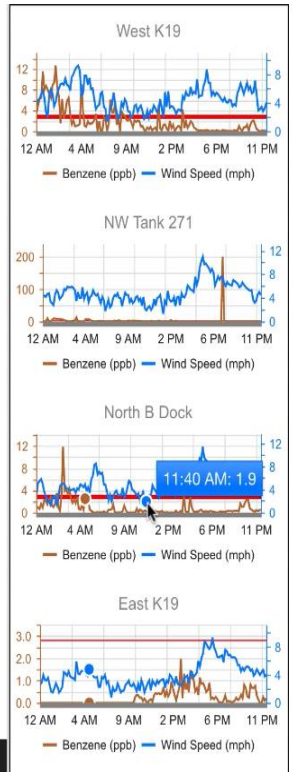
- Web Server Connections
  - 4G, Wi-Fi, Ethernet
- Automatic Alerts
  - Phone, PC, Tablets
- Sample Initiation
  - Preset Thresholds, Manual Activation

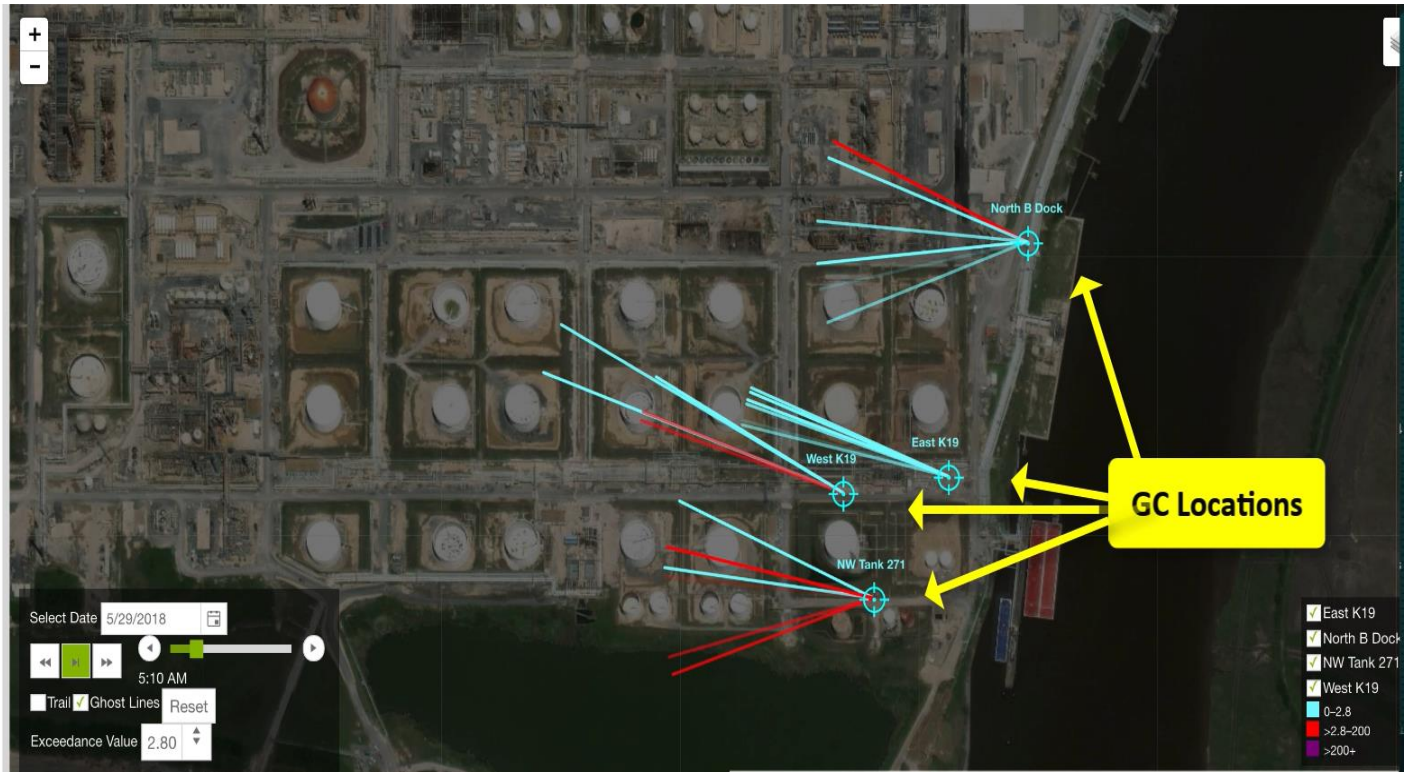
REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Field Gas Chromatography
  - Portable
  - Results Every Ten Minutes
  - Wind Speed and Wind Direction

REAL-TIME MEASUREMENT AND CONTINUOUS MONITORING

- Cloud Computing Software Packages
  - Real Time Data Interpretation
  - Data Management





CONTACT

- For further information please contact:

Chris Schepcoff
christopher.schepcoff@sgs.com
+1 832 585 9376

QUESTIONS?