AIHR SHARK

SGS EHS Passive Directional Sampler

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 absorbed 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
Passive sampling can provide a general indication of average pollution concentrations over a period ranging from 1 week to 1 month	Most commonly used for sampling periods from one minute to 24 hours

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

2 December 2014 17:20

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.

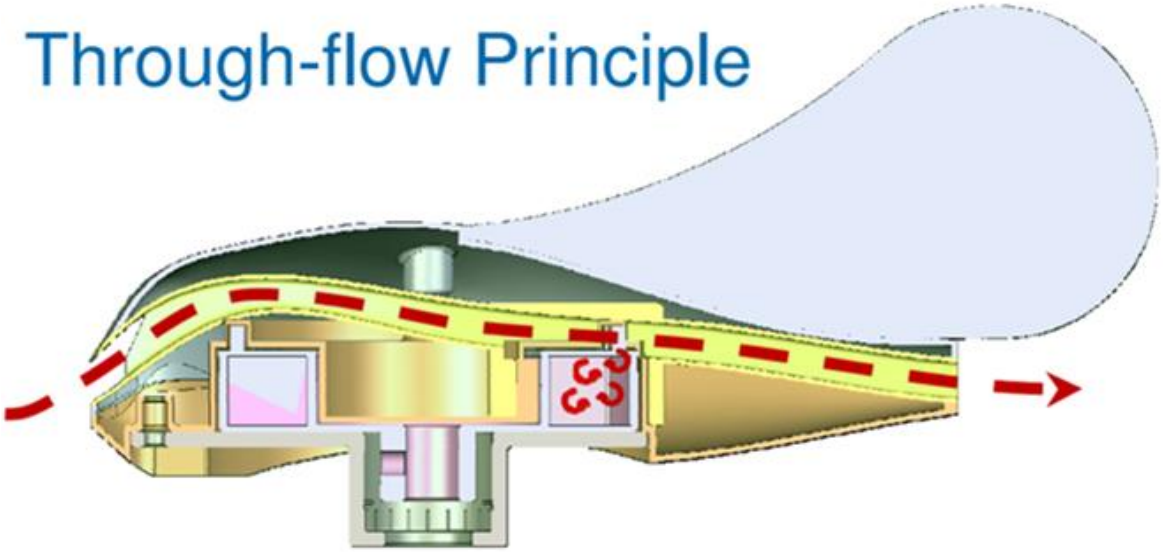
'Directional Passive Air Quality Samplers', which look similar to basking sharks and have been patented as part of ongoing research, are able to monitor the levels of pollutants that are caused by industrial activity, or traffic. The sources of these pollutants, such as airborne particles thrown up by 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-

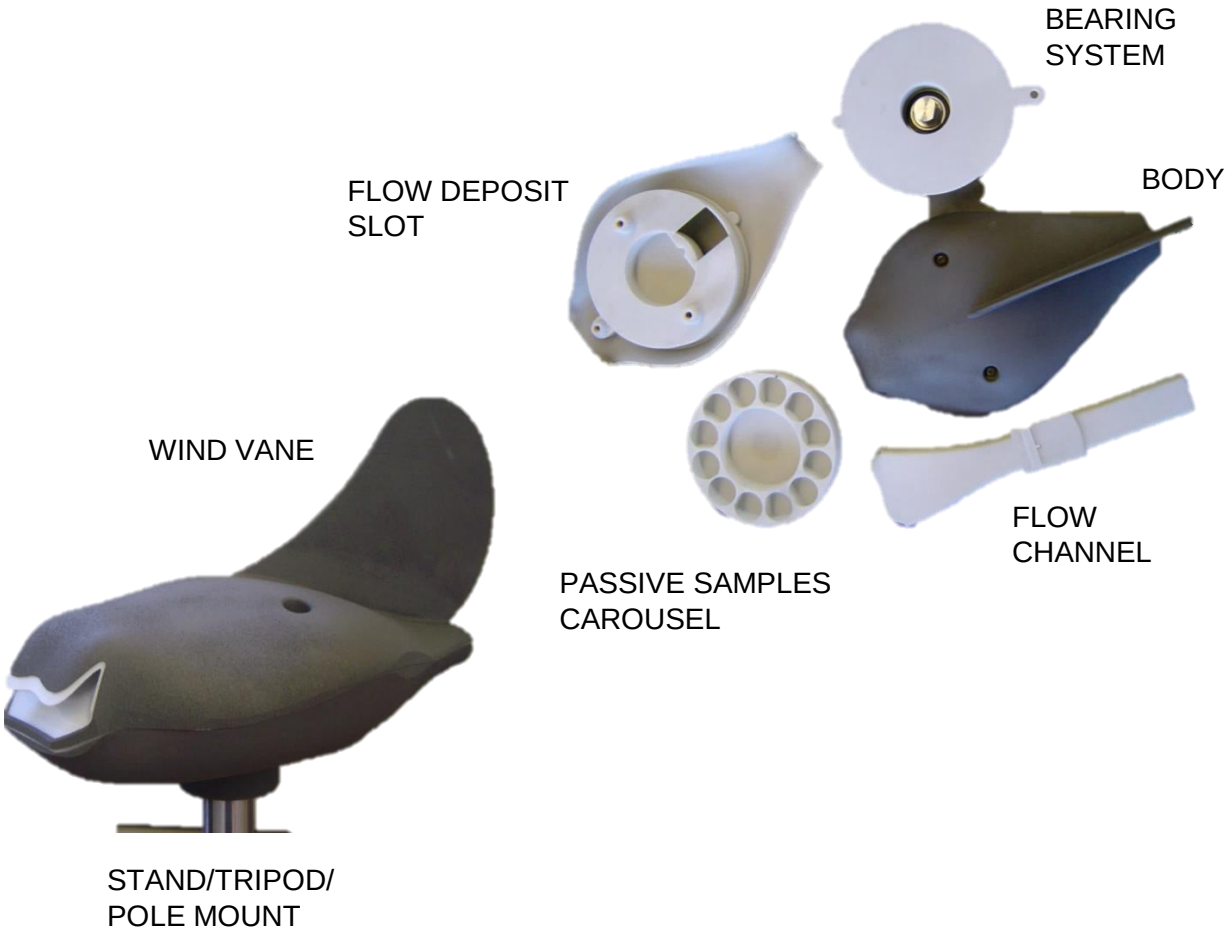
> *At Lancaster University, in partnership with the Environment Agency, we are developing monitors that are easily deployable in the field, that do not require a power source and are affordable.*
>
> Dr Maria Angeles Solera García

AIHR SHARK



- The flow through design and “wind vane” allows for the air flow to be directed onto one of twelve passive collection devices
- Each collection device is at a fixed rotation (30 degrees)
- By analyzing the 12 passive collection devices after the sampling campaign, higher concentrations in each of the devices provide an indication of source direction

SGS EHS AIHR SHARK COMPONENTS

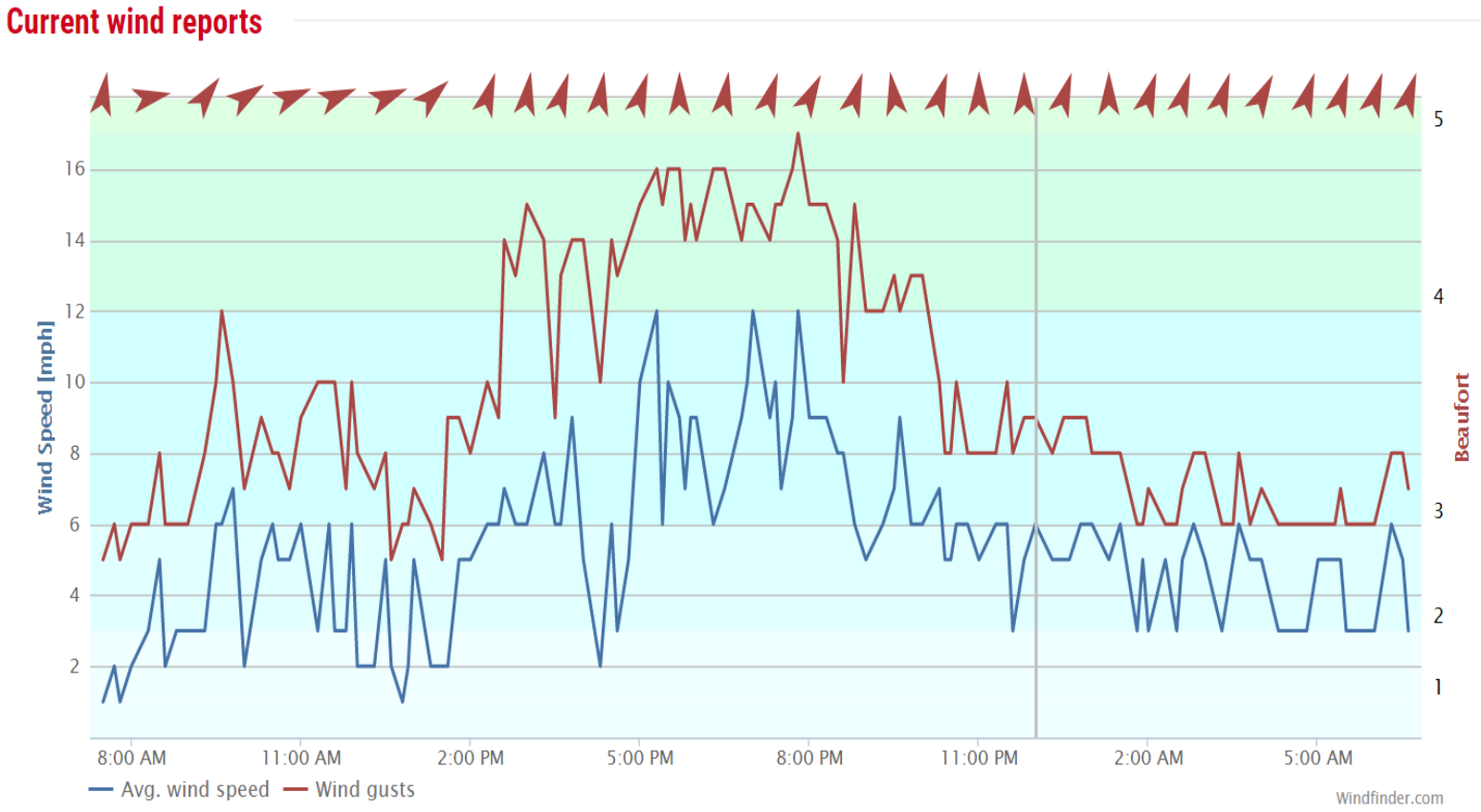


WIND SPEED AND WIND GUST IMPACT ON DIRECTIONAL AIHR SHARK ROTATION

- Wind-tunnel trials have demonstrated the minimum, or “start up”, speed for the vane to align with the wind depends on the “angle of attack”
- Winds blowing obliquely across the vane (60-90 degree angles) have lower start-up speeds of 0.67 to 2.24 MPH, impacting a greater cross-sectional area. Winds blowing in line with the vane (30 degree angle) have higher start-up speeds of 6.71 to 8.95 MPH, impacting a smaller cross-sectional area
- The wind-tunnel trials were for steady/straight winds in a laboratory. The outdoor wind environment is more gusty and variable in speed/direction. Outdoor conditions allow the vane move with the wind since the vane is nudged into line by short faster gusts
- In conditions with multiple obstructions such as refinery structures the AIHR Shark will provide a more “true” wind direction vs. regional wind data

WIND GUST VS. WIND SPEED

- Even at low wind speeds gusts are sufficient to orientate the AIHR Shark into the correct directional sample position based on changing wind directions



AIHR SHARK FIELD DEPLOYMENT

- Mounts on top of a TD tube shelter
- Fifteen minute set-up

AIHR SHARK ADVANTAGES

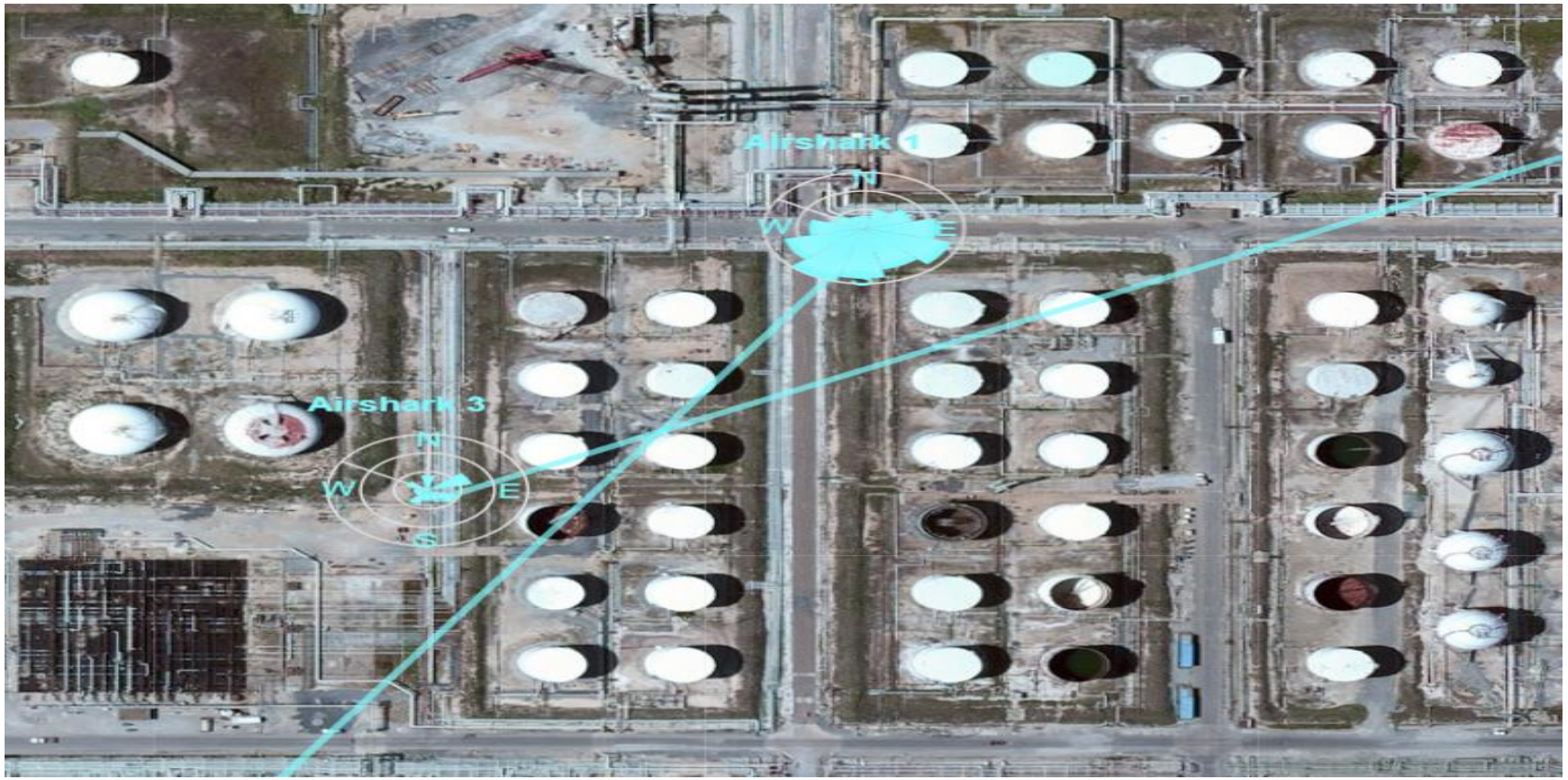
- Cost effective
- Ideal for any location within a refinery
- No requirement for electricity or sample pumps
- Limited technical experience required and maintenance free
- Low level directional indicator
- Preventative, post exceedance, or tiered investigative approach
- Forensic fingerprinting with additional analytes
- One week deployment for troubleshooting or two weeks in-line with TD tubes
- Custom electronic deliverables uploaded into any mapping software for triangulation and “pinpointing” of emission sources
- Avoid expensive theoretical modelling
- Discount provided in conjunction with annual EPA 325 analytical program

SOFTWARE SOLUTION

- A hands-free tool to assist with data interpretation in determining the direction from where a benzene source may have originated
- Solution utilizes a “compass” for each sample point that represents the 12 sample cartridges and their relative location
- Map provides geocoded locations. The location of benzene sources can be approximated by vectors

SHARK ATTACK

- Once an area of concern is identified the sharks move in to pinpoint a specific emission source



CLIENT FEEDBACK

- An environmental engineering consultant/professional engineer (PE), calls the AIHR Shark: ***"A simply genius technology."***

- An environmental engineer at a large Gulf Coast refinery says: ***The Shark is by far the best, most cost-effective tool we have used to date."***

AIHR SHARK SOLUTION SET

- THE FLOW OF UTILIZING THE AIHR SHARK

  - ORDERING
    - DETERMINE COMPOUNDS OF INTEREST
    - DETERMINE LOCATIONS FOR DEPLOYMENT
    - SAMPLING PLAN WITH MEDIA REPLACEMENT
    - DESIGN MOUTING NEEDS (FIXED OR TRIPOD)
    - DETERMINE DATA REQUIRMENTS – EDD

  - DEPLOYMENT
    - AIHR SHARKS DEPLOYED WITH MEDIA
    - AIHR SHARKS ARE INSTALLED (LAT & LONG NOTED)
    - MEDIA REMOVED AT END OF SAMPLING PERIOD

  - LAB PROCESSING
    - MEDIA ARRIVES, SAMPLE CONFIRMATION EMAILED
    - RESULTS IN 5 BD OR FREE
    - PDF REPORT AND EDD EMAILED

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