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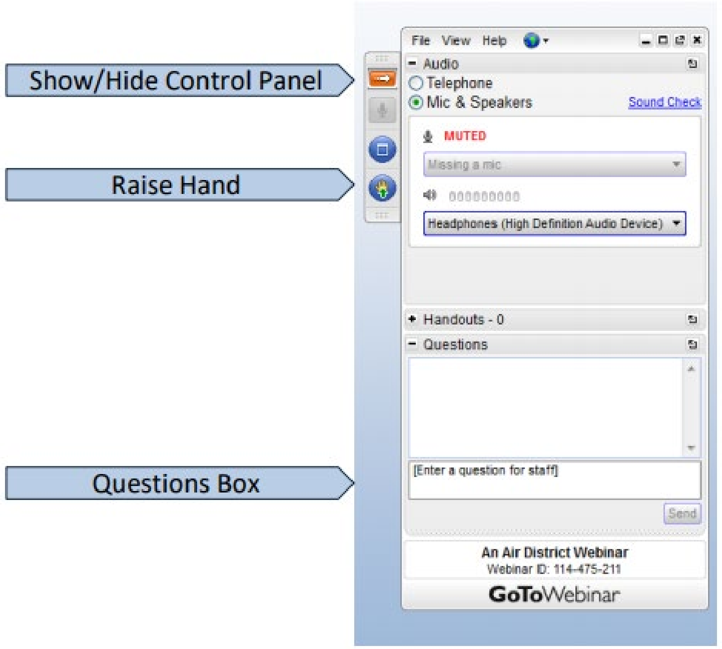
# Overview of Auditing Procedures of Fence-line Air Monitoring Technologies

Eric Stevenson
Air Monitoring Officer
Bay Area Air Quality Management District

# Webinar Information

- This webinar is being recorded and will be available along with the PowerPoints on the Air District's website
- Please mute your audio
- Staff will be monitoring
- Speakers contact information will be provided at the end of each PowerPoint

- You can type questions at any time in the questions box




**Please note that there will not be a break at 12:00 Pacific time**

# Brief History

- Two refineries in the Bay Area have fence line systems required through agreements with the city/county
- Systems had different performance characteristics
- Local communities around all refineries voiced concern regarding impacts from refineries
- After a major refinery accident, the Bay Area Air Quality Management District (Air District) Board took action to address monitoring at refineries, among other things

# Regulatory Action

- Bay Area Air Quality Management District Regulation 12, Rule 15
  - Requires near real-time measurement of BTEX, THC, $H_2S$ and other compounds that may increase risk
- EPA's Refinery Maximum Achievable Control Technology (MACT)
  - Requires passive sampling for benzene
- South Coast Air Quality Management District 1180
  - Similar to the above
- State of California SB 1377
  - Guidance from local air district

# Refinery MACT - Passive Sampling

***Advantages***

- Low Minimum Detection Limit (MDL) and capital cost
- Can be used for long-term exposure analysis

***Disadvantages***

- Only requires benzene be quantified
  - Other compounds can be analyzed, but are not required
- Meteorological impacts difficult to determine
- Release of data is well after collection

# Open Path Methodologies

***Advantages***

- Available in near real-time
- Can be used to measure a large number of compounds

***Disadvantages***

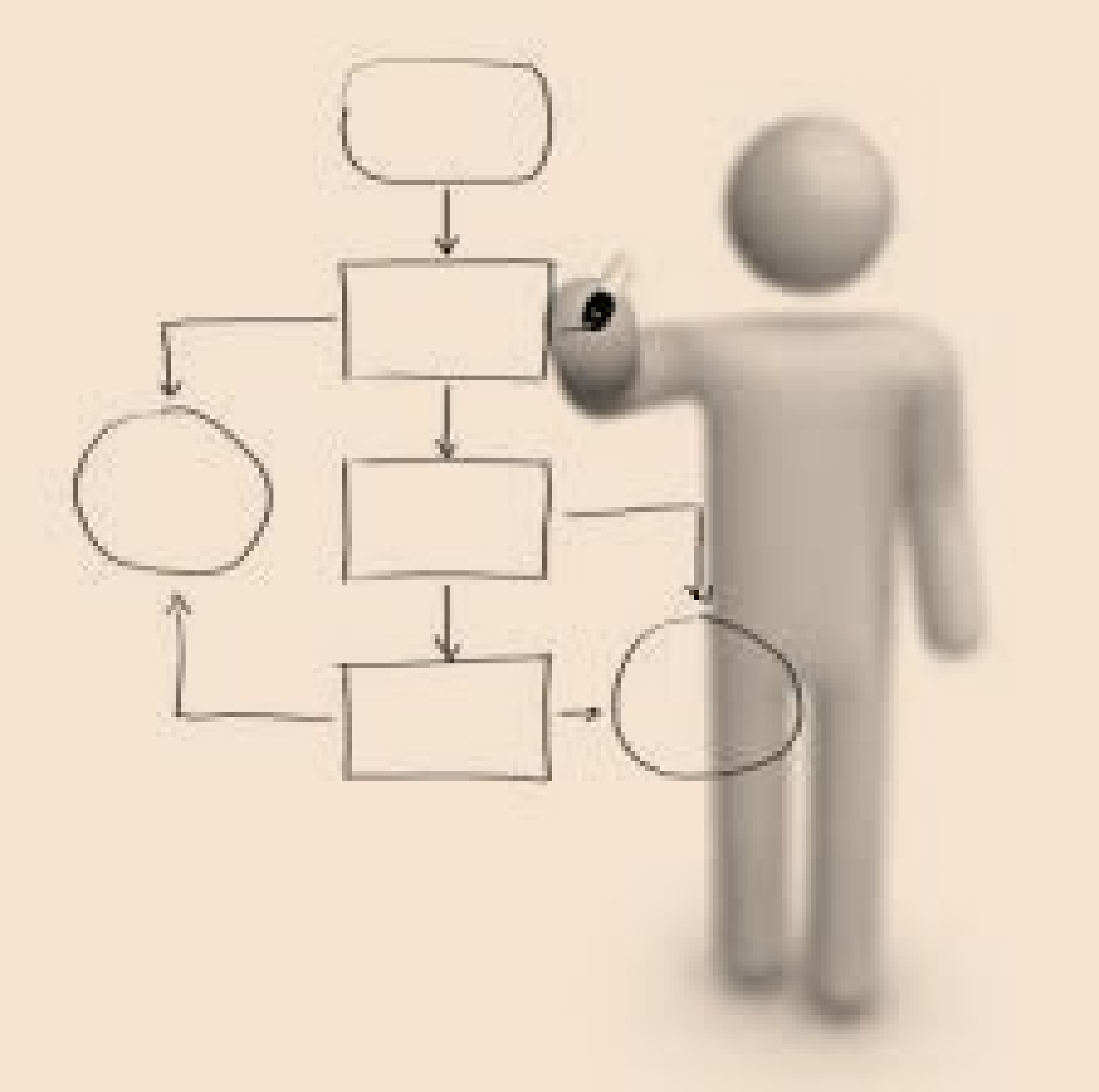
- MDLs related to path length
- Interferences from other compounds (water, ozone, etc.)
- Power is required
- High capital costs

# Regulation 12, Rule 15

- Regulation adopted in 2016 to expand Air Monitoring Guidance and include open path methodologies

- Guidance was designed to allow flexibility

- "Weight of evidence" is used to determine locations and compounds measured



# Experiences and Lessons Learned from Rule 12-15 Process

- Operational and MDL claims made based on laboratory performance and field operations were quite different
- Public expectations and knowledge required numerous public meetings to explain capabilities and limitations
- The public wanted data that was accurate, transparent and had the appropriate context

# Data Quality Requirements

- Operational and MDL claims made based on laboratory performance and field operations were quite different – Field verification is key
- QAPP required to describe data quality objectives, data quality indicators, and data validation criteria
- Provide public real-time data with appropriate QA/QC
- Completeness: 75% hourly, 90% quarterly

# Why do we need a standardized method?

- Data can be verified through metadata or other independent operational parameter
- Provides surety for both the refineries and to gain public trust
- TO-16 is specific to FTIR


Challenge for standardization:

- Each fence-line application may be unique

# QUESTIONS?

**Eric Stevenson**
**estevenson@baaqmd.gov**

ARGOS SCIENTIFIC

# Fence-Line Air Monitoring Systems:

# A Basic Overview

Presenter: Don Gamiles

November 12, 2019

# Objective of this Presentation

| | |
|---|---|
| Describe | Describe technologies and methods available for use as fence-line air monitoring systems. |
| Present | Present basic operational strategies for meeting quality assurance goals. |
| Highlight | Highlight the critical need to present the data in a manner that is understandable to end users. |
| Identify | Identify critical elements for evaluating the performance of fence-line systems. |

# Example of a Successful Air Monitoring Program

22 years ago, a single open-path air monitoring system was set up along the fence line of a refinery to monitor the air during a remediation activity at refinery.

System was comprised of a single UV open-path monitor and a meteorological station.

Set up to detect five gases:  Nitrous Oxide, Benzene, Sulfur Dioxide, Toluene, and Xylene.

# Source Identification

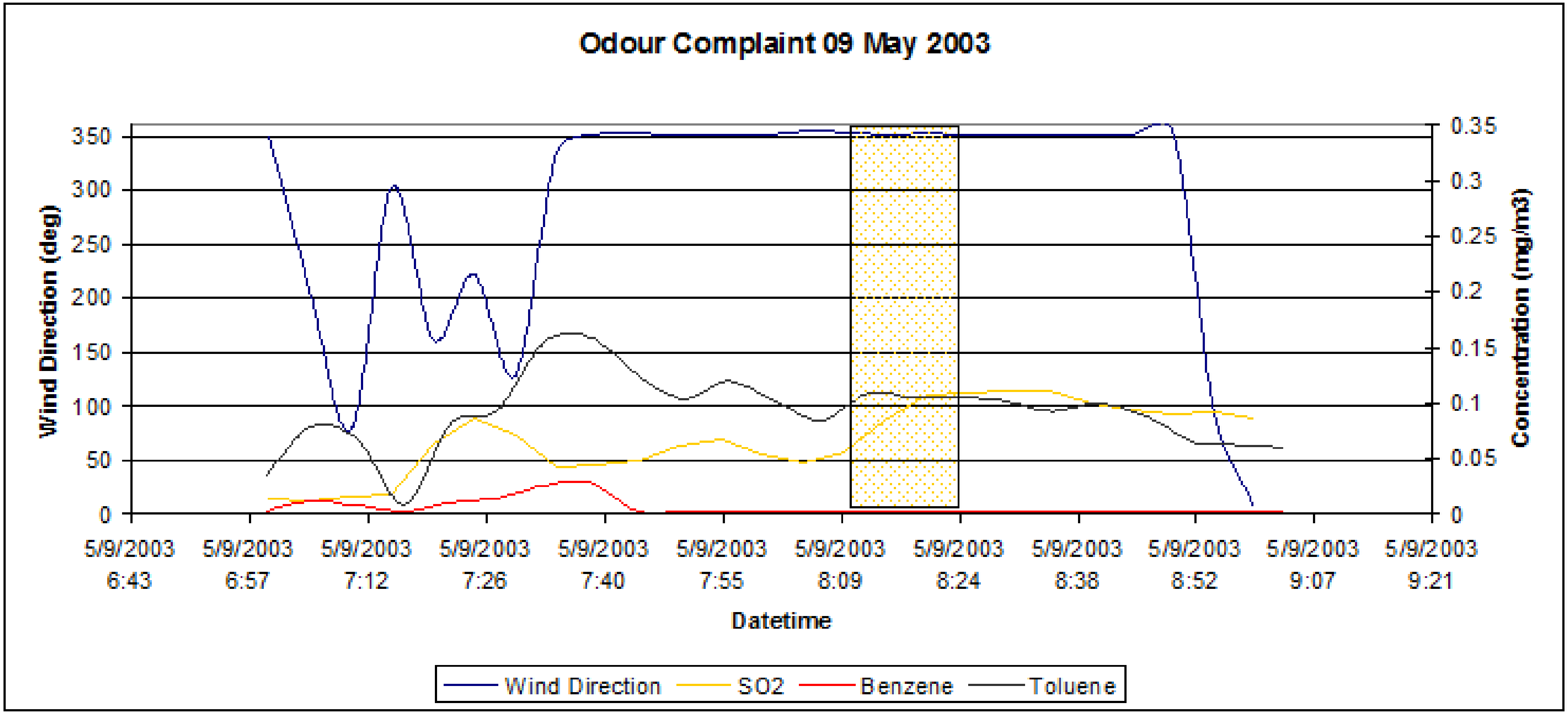
Nitrous Oxide - Vehicle traffic

Benzene, Toluene, Xylene - The refinery

Toluene, Xylene - Paint spraying operation

$SO_2$ - Ship traffic

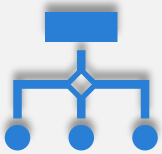
# Odor Identification



# Result of Monitoring:

We could easily identify sources.

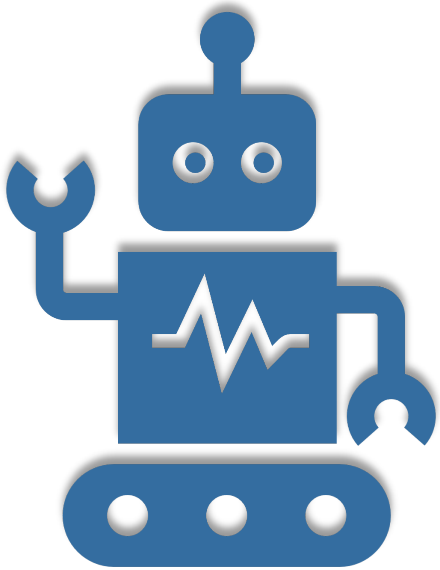
Over 40% of the odor complaints were identified as being from a source other than the refinery.



The refinery was able to schedule tasks in a manner to minimize exposure to the public.

# Lessons Learned

- A single air monitor paired with a meteorological station could accurately identify air pollution sources.
- Use indicator gases to track plumes.
- The refinery was able to show the community they were not the only source of odors.
- The odor event tracking software was critical in helping identify sources and relaying the information.



# BIGGEST Lesson Learned

You don't need a lot of technology to identify sources.

# Open-Path UV Air Monitoring Overview

## Key Advantages of Open-Path Air Monitoring Systems

- Real-time results for single gases or mixtures.
- Low detection limits – below health impact standards.
- The non-contact test method does not compromise the sample.
- There are no analytic costs associated with the data.
- The raw data can be stored and reviewed at a later date for unknown gases in the air.
- The presence of gases can easily be verified and presented to end-users.

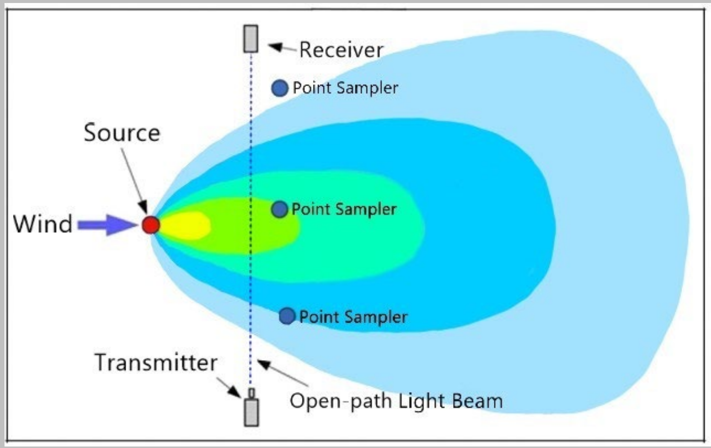
Argos SCIENTIFIC

# Open-Path Fence-Line Monitors

- Open-path air monitors are set up at the boundary of an industrial facility with light beams running parallel to communities downwind of the pollution source. The beam path is typically 100-1,000 meters.
- Beams can be different types of light sources including broadband infrared, broadband ultraviolet, or lasers.
- Advantages of broadband systems is you can look for more than one gas with the same system.
- Open-path FTIR, Open-path UV, Tunable Diode Lasers.

# How do the systems work?

- Open-path air monitoring systems use beams to light to detect gases.
- Light is generated using either a light bulb or a laser.
- Light is projected out into the air.
- At the other end of the path an analyzer examines the light to determine which gases were present in the light beam.



# Fence-Line Analyzers Specifics

There are a limited number of gases that can be routinely detected by fence-line systems.

- Open-path UV - $SO_2$, BTEX
- Open-path FTIR - Methane, VOCs, $NH_3$, Non-methane THCs
- Tunable Diode Lasers – $NH_3$, $H_2S$, HF, $CH_4$

# How do we know a gas is actually present in the air?

**Toxic gases have a unique fingerprint that we can compare to libraries of toxic gases.**

**If the fingerprint matches, then the gas is present in the air.**

# Gas Libraries

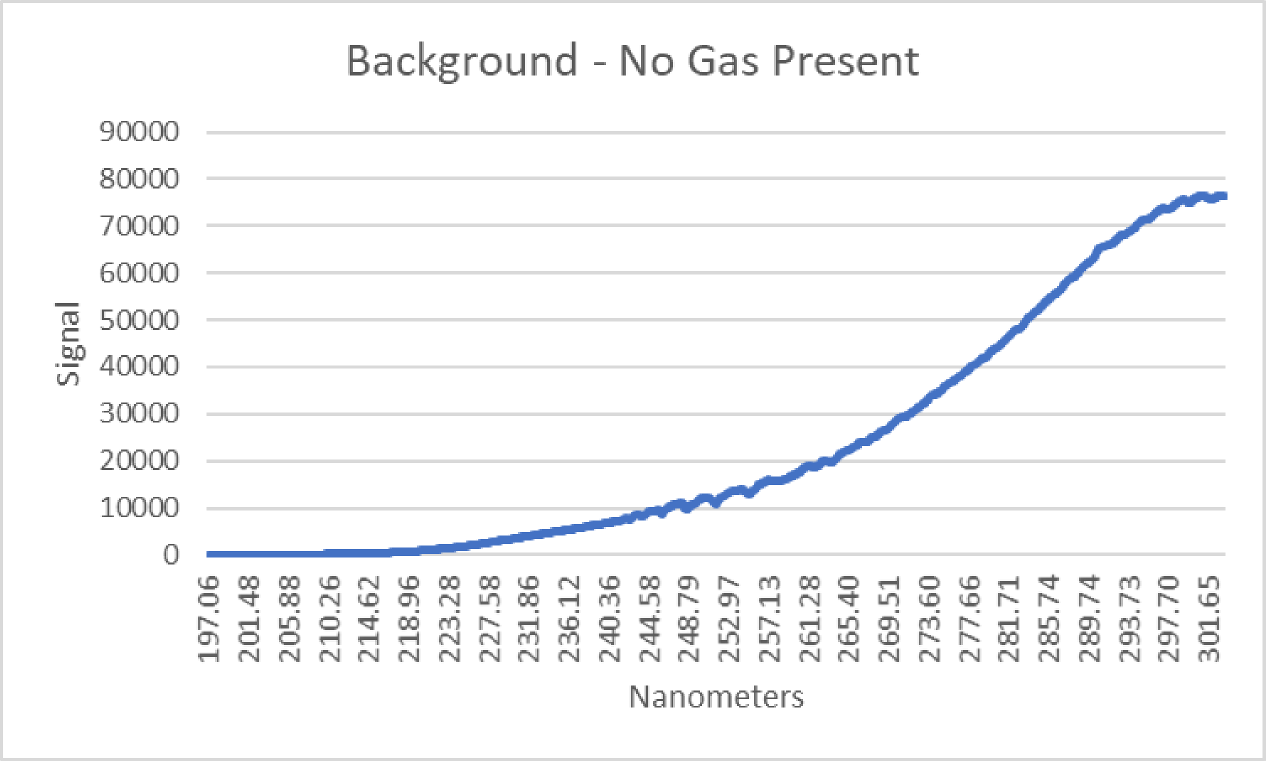
There are sets of libraries for gases that absorb light.

The systems process data to a point where the data from the systems are in the same format as the gas libraries.

We then compare the data output to the gas libraries and figure out what is in the field data.

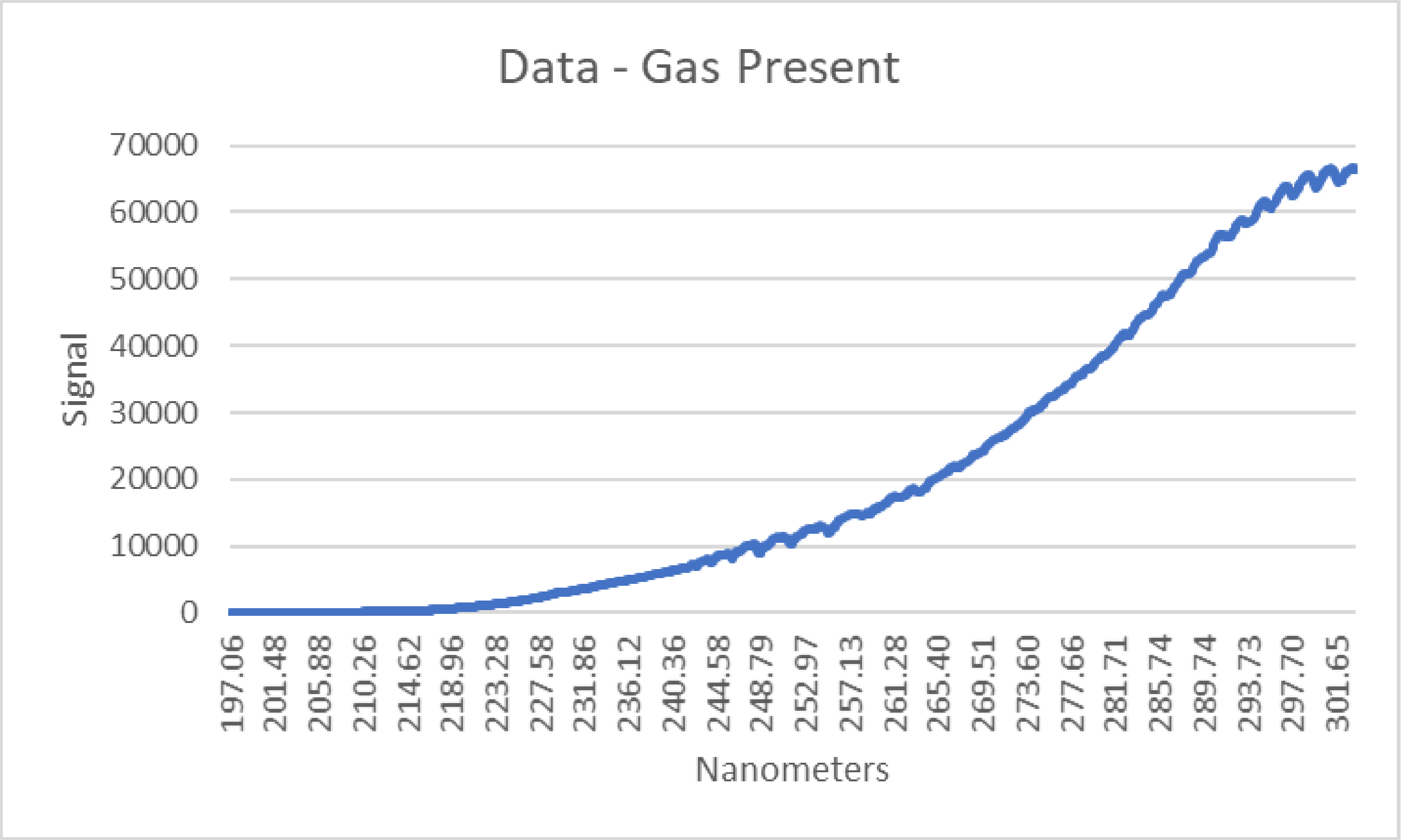
# Comparing Field Data to Gas Library – $SO_2$

## Background data – No gas present



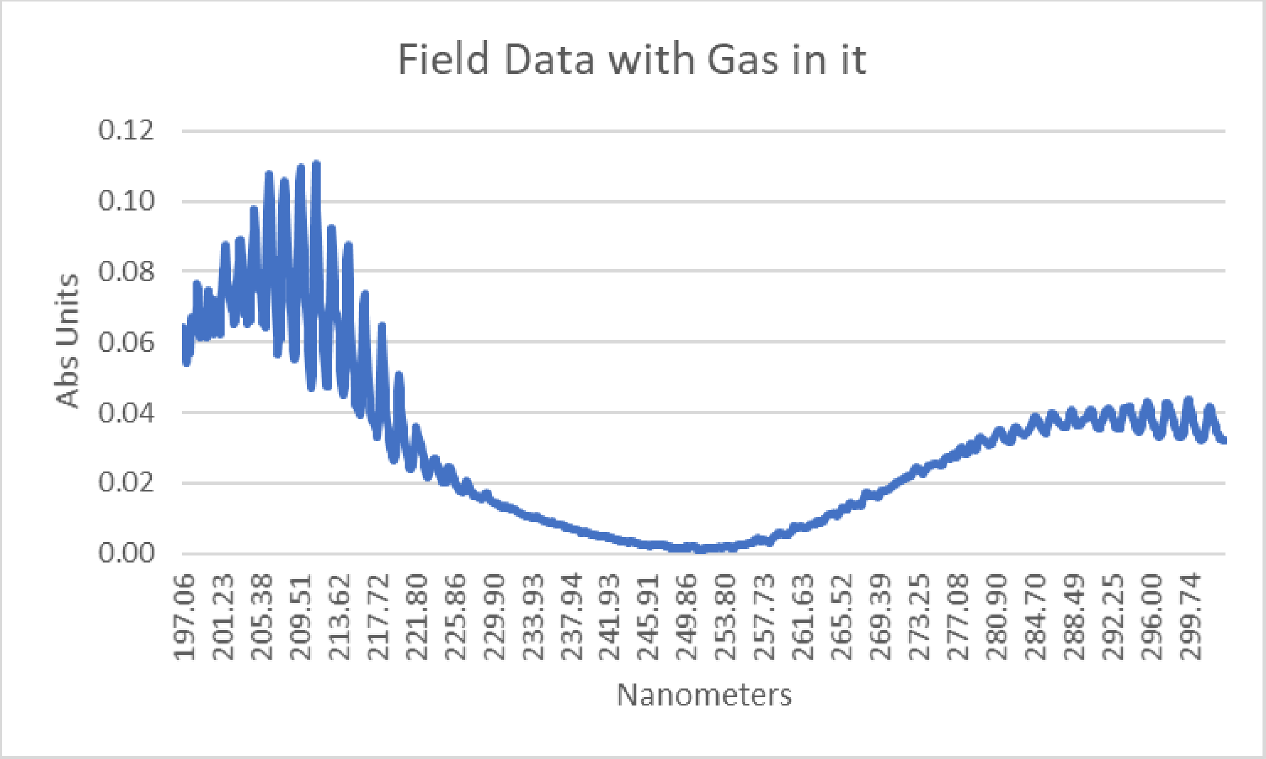
# Comparing Field Data to Gas Library – $SO_2$

## Field data – Gas present

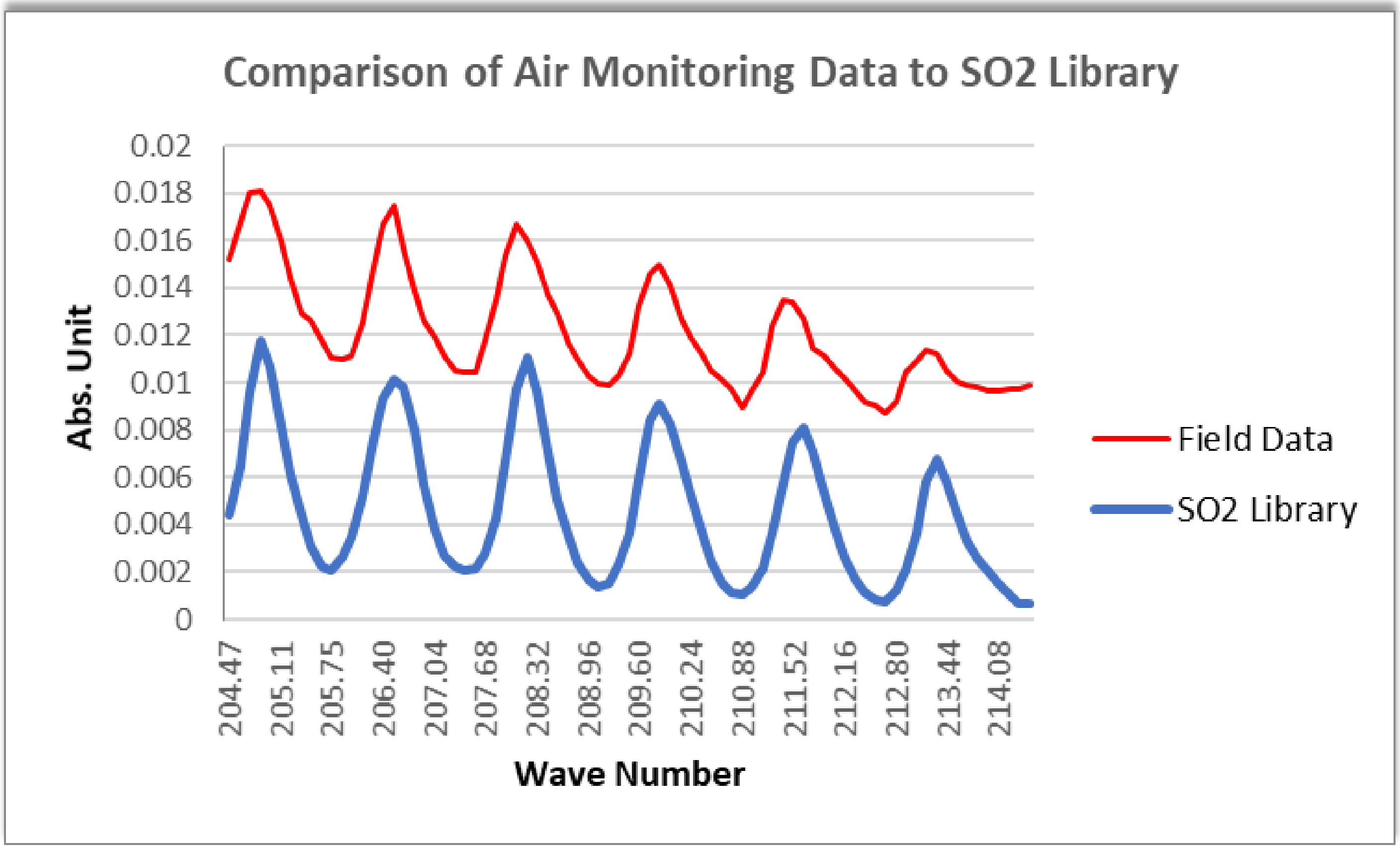


# Comparing Field Data to Gas Library – $SO_2$

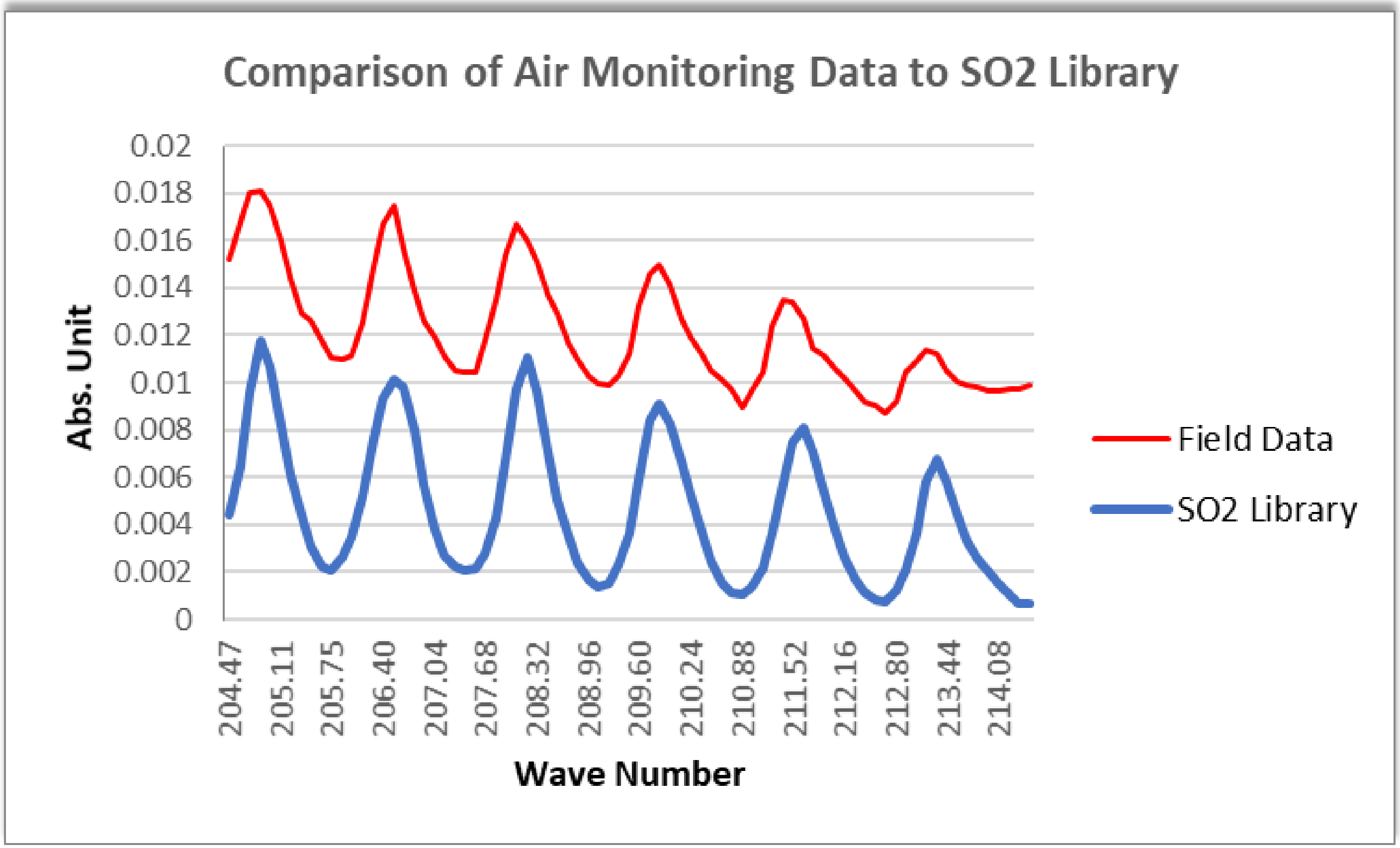
## Subtract the two files



# Comparing Field Data to Gas Library – SO2



# Comparing Field Data to Gas Library – SO2



# Sound Simple?

It isn't… There are all sorts of things that make the measurement process difficult.

- Cross interference of gases
- Temperature sensitivity of the analyzers
- Variation in the light signal
- Gases not included in the analytic software
- Improper maintenance

# Supplemental Sampling Systems

- Single Gas Point Analyzers - $NH_3$, $H_2S$, NOx, etc.
- Auto GCs – VOCs
- Black Carbon Monitor
- PM 2.5 Monitor
- Ozone Monitor

# The Goal of the Measurement Program:

Ensure the real-time results from the fence-line air monitoring system are as accurate as possible.

Maintain maximum operational performance.

Anticipate situations that could result in system downtime.

# How we achieve these goals:

Integrate Data Quality Checks published by the EPA with performance checks based on real-world experience.

Work with manufactures to identify specific operational performance boundaries for their technologies

Embed real-time system checks into the measurement process to track operational performance

Perform a graduated system review of system performance, data quantification. Checks occur in real-time, daily, weekly, monthly, quarterly and annually. Each set builds on prior checks.

# Real-time Checks

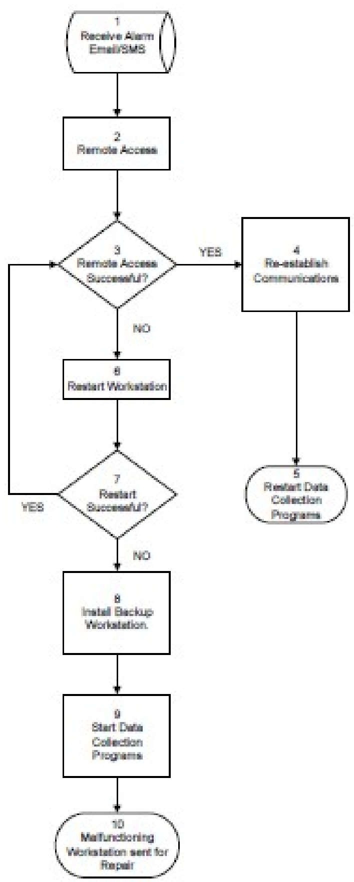
## Goal – Ensure data sent to real-time website is valid.

| Check Type | Check | Frenquency |
|---|---|---|
| Instrumentation | Light Signal from Optical Remote Sensors | Real-time |
| Instrumentation | Instrument Error Codes | Real-time |
| Instrumentation | Environmental Checks for UV | Real-time |
| Data | Quantitative/Qualitive Data Check | Real-time |
| Data | FTIR - Methane and N2O | Real-time |
| Data | UV - Oxygen and Ozone | Real-time |
| Program | Analyzer has low signal | Real-time |
| Program | Analyzer off-line | Real-time |
| Program | Workstation fails | Real-time |
| Program | Internet communication failure | Real-time |
| Program | Gas detected above alarm value | Real-time |

MDIN Argos-Scientific_MDIN Bazan Refinery Fenceline Monitoring Operational Guideline

| Title: Operational Event Scenario 4 | Compiled by: P. Mathew<br>Authorised by: | Doc.No: AgS_P005<br>Version: v1.1<br>Date: 12-03-19 |
|---|---|---|

Process flow: Field Monitoring Computer Workstation Down




| No. | Documents | Res. | Description |
|---|---|---|---|
| 1 | Operational Guidance Document (pg19) | Argos_Sci System | In the event a field monitoring computer malfunctions, Argos will be notified via email and Bazan personnel will be notified via page of the condition. Argos will begin the process of troubleshooting and an Argos local technician will attempt to restart the workstation. |
| 2 | | Remote Technician | Argos will attempt to remotely access the computer. |
| 3, 4 | | Remote Technician | Re-establish communication with the instrument. |
| 5 | | Remote Technician | Restart all data collection programs. |
| 6 | | SGS Technician | If Argos cannot establish a remote connection, then an Argos technician or a qualified subcontractor will be dispatched to restart the computer. |
| 7 | | Remote Technician | If the computer restart is successful, then all data collection programs will be restarted. |
| 8 | | SGS Technician | If restarting the computer is not possible, then Argos will install the backup field monitoring computer workstation. |
| 9 | | Remote Technician | Argos will start all data acquisition programs on that computer. |
| 10 | | Argos_Sci System | The malfunctioning workstation will be sent to Argos for repair. |

# Daily Checks

Goal – Ensure overall system is performing correctly and validate data collected by individual instrument.

| Check Type | Check | Frenquency |
|---|---|---|
| Data | Validate detects - FTIR and UV | Daily |
| Data | Negative detects - FTIR and UV | Daily |
| Data | Verifcation of detects above threshold | Daily |
| Program | Equipment operation | 3 x per day |
| Program | Website operation | 3 x per day |
| Program | Data logging | 3 x per day |
| Program | Message board update | 3 x per day |

# Real-time Validation of Detects

| Sample Date | Site Name | File Number | Path Length (meters) | Ben R2 (CLS) | Ben-PPB (PLS) | Detect |
|---|---|---|---|---|---|---|
| 7/31/2018 15:58 | UV5- QA | 42 | 900 | 0.01 | 1.06 | No |
| 7/31/2018 16:06 | UV5- QA | 43 | 900 | 0.16 | 1.18 | No |
| 7/31/2018 16:11 | UV5- QA | 44 | 900 | 0.99 | 36.74 | Detect |
| 7/31/2018 16:16 | UV5- QA | 45 | 900 | 0.99 | 48.37 | Detect |
| 7/31/2018 16:21 | UV5- QA | 46 | 900 | 0.99 | 48.36 | Detect |
| 7/31/2018 16:26 | UV5- QA | 47 | 900 | 0.98 | 14.65 | Detect |
| 7/31/2018 16:31 | UV5- QA | 48 | 900 | 0.18 | 1.51 | No |

# Weekly Checks

## Goal - Review data to ensure individual analyzers are working within normal operation parameters.

| Check Type | Check | Frenquency |
|---|---|---|
| Data | Data trends associated instrumentation performance | Weekly |
| Data | Differences between current data and historical data | Weekly |
| Data | Insert data in final QA/QC'd data base | Weekly |

# Monthly Checks

## Goal - Ensure the entire system is working correctly.

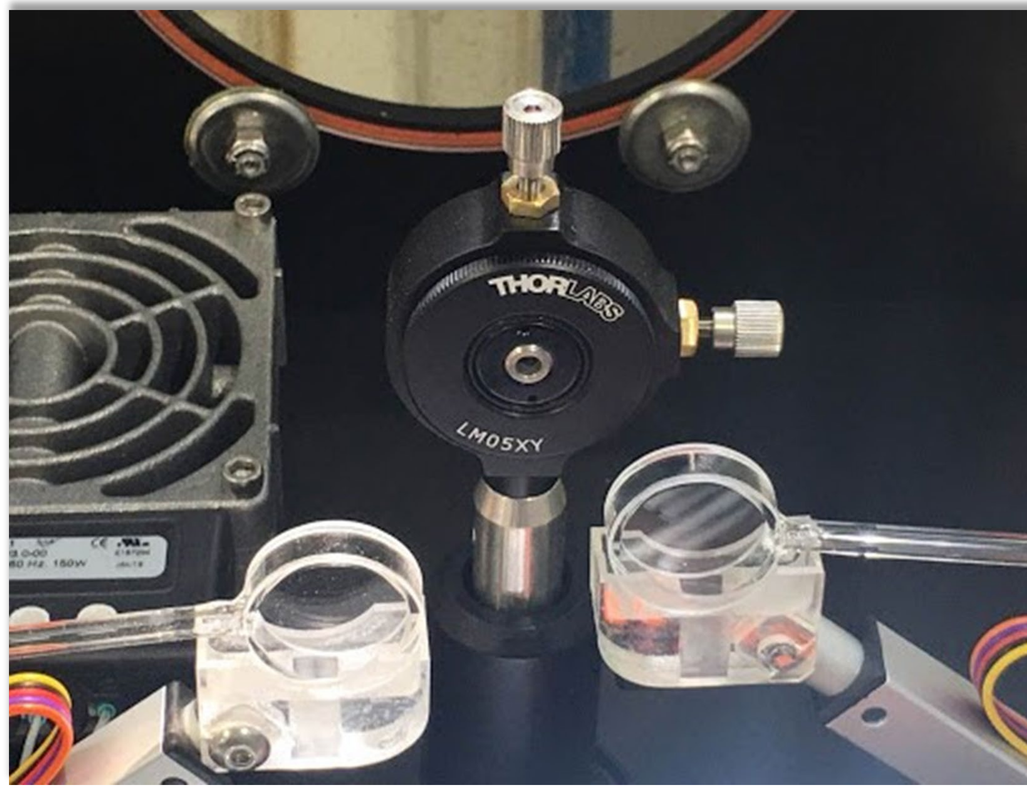
| Check Type | Check | Frenquency |
| --- | --- | --- |
| Instrumentation | System noise - FTIR and UV | Monthly |
| Instrumentation | Single point check - FTIR, UV | Monthly |
| Program | Summary of calibration and maintenance activities | Monthly |
| Program | Summary of problems and corrective actions | Monthly |
| Program | Monthly summary report with OSE updated | Monthly |
| Data | Full reconciliation of data | Monthly |
| Data | Supervisor check for data trends | Monthly |

# Quarterly and Annual Checks

## Goal – Ensure system continues to perform at factory specification levels.

| Check Type | Check | Frenquency |
|---|---|---|
| Instrumentation | Detection limit FTIR and UV | Quarterly |
| Instrumentation | Precision FTIR, and UV | Quarterly |
| Instrumentation | Accuracy FTIR, and UV | Quarterly |
| Instrumentation | Linearity FTIR, and UV | Quarterly |
| Instrumentation | Annual service FTIR, UV and OGD | Annual |
| Instrumentation | Certification system brought to factory spec | Annual |
| Program | Complete system audit | Annual |
| Program | Program evaluation and upgrde | Annual |

# Remote Calibration System



# Remote Data Check Example – Linearity

| Measurement | % in Beam | PPB |
|---|---|---|
| 1 | 100 | 42.2 |
| 2 | 100 | 42.3 |
| 3 | 100 | 42.2 |
| 4 | 100 | 41.4 |
| 5 | 100 | 40.4 |
| 6 | 100 | 40.3 |
| 7 | 60 | 24.8 |
| 8 | 60 | 23.5 |
| 9 | 60 | 24.6 |
| 10 | 60 | 23.6 |
| 11 | 60 | 24.7 |
| 12 | 60 | 23.1 |
| 13 | 25 | 10.9 |
| 14 | 25 | 10.6 |
| 15 | 25 | 10.5 |
| 16 | 25 | 10.9 |
| 17 | 25 | 10.6 |
| 18 | 25 | 10.5 |
| 19 | 5 | 1.9 |
| 20 | 5 | 2.1 |
| 21 | 5 | 2.2 |
| 22 | 5 | 1.9 |
| 23 | 5 | 2.0 |
| 24 | 5 | 2.5 |

# Key Points

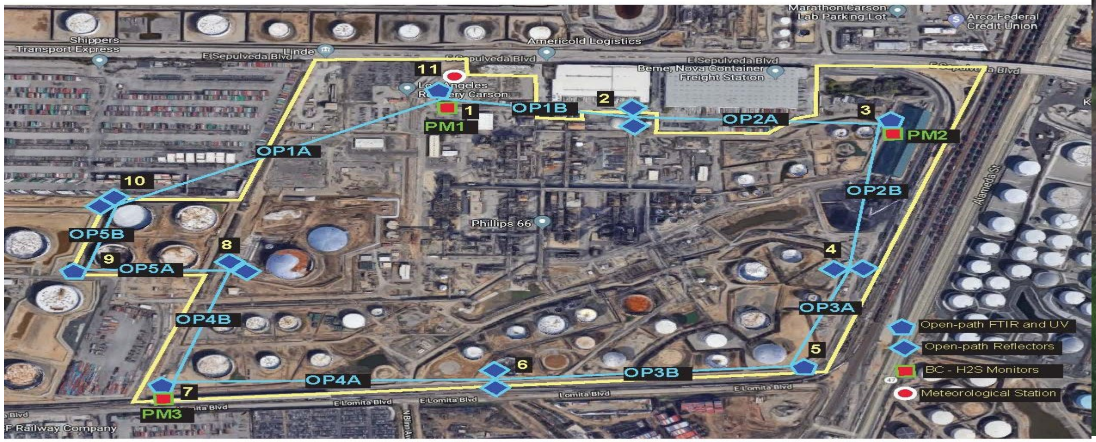
- The intent of the monitoring checks are to ensure the monitoring goals are met.
- The majority of the systems checks can be performed remotely using embedded hardware and software.
- Typical system performance goal is 99% + operational efficiency.

# CARB 2019

## Auditing of Operational Performance of Open-Path UV DOAS

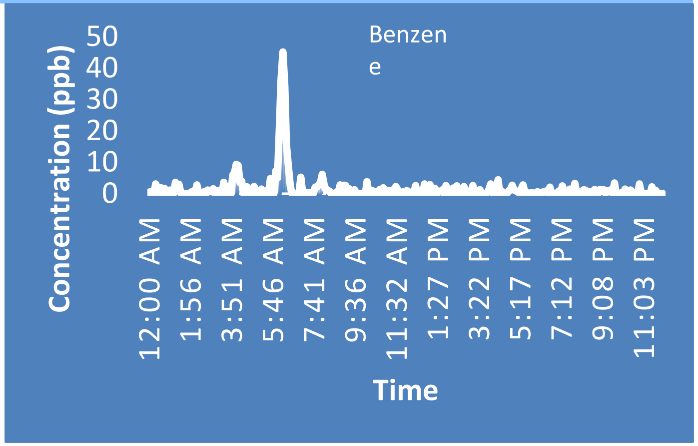
Mark Wicking-Baird, Argos Scientific Africa Inc.

# Open Path System: Field Laboratory


# How do we know the number is …

- Traceable
- From a system operated:
  - According to a validated method
  - By competent people
  - With calibrated equipment
- Reported consistently

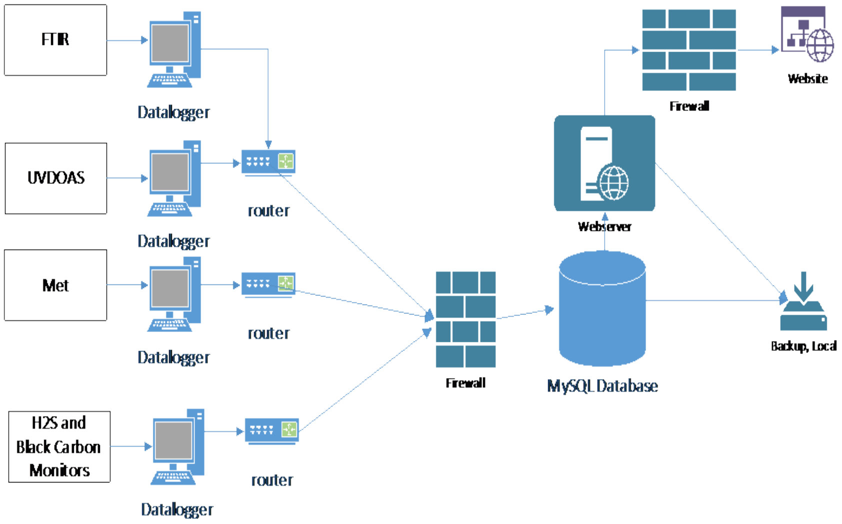



# How do we check the number …

- ISO 17025 Vertical Assessment
  - What are we auditing
  - Training
  - Equipment
    - Calibrations
    - Maintenance
  - Use of Method
  - Validity of Results
  - Reported Results

# What are we auditing …

- Raw data
- Traceability to person performing
- Authorized records
- Calculations
- Data transfer




# Competence of personnel

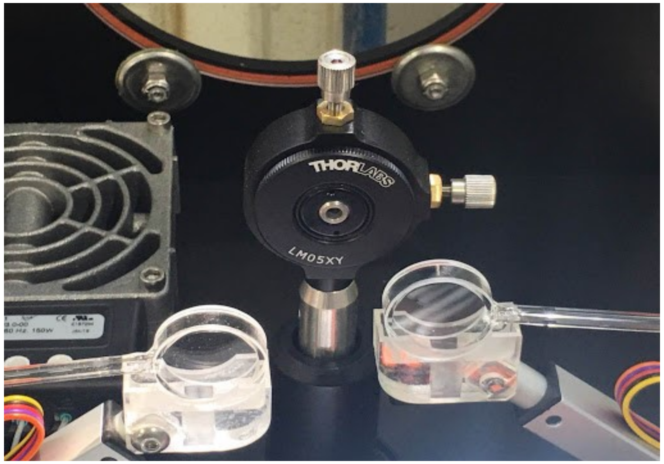
- Operators identified as competent:
  - Training records
  - Competency modules
  - Qualifications
- Is the method of competency determination appropriate

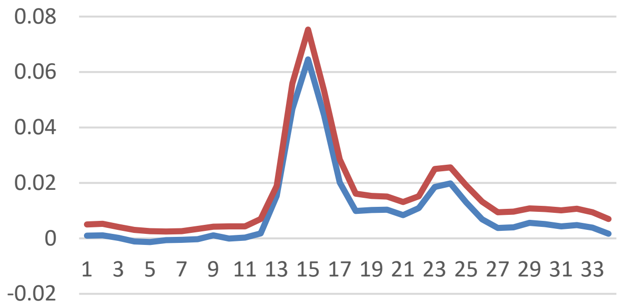
# Use of Method

- Type of method:
  - Standard method
  - Laboratory developed method
  - Non-standard method
- Method validated
- Method relevant for measured range
- Method uncertainty
- Statement of tolerances
- Assurance of validity of results:
  - Data records
  - Control limits
  - Evidence of root cause analysis of breaches


# Calibration of Equipment or Standards

- Do the programs cover measurement range
- Records up to date
- In-house verification sufficient
- Suitable application of correction factors
- Traceability to CRM
- Competence of external calibration providers
- Transfer standards traceable




# Maintenance of Equipment

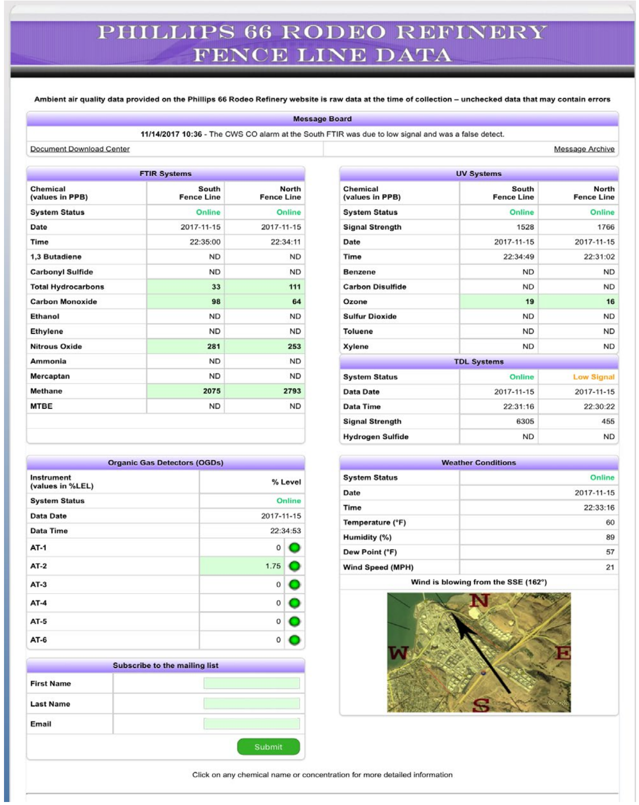
- Do instructions exist for use and maintenance
- Are records complete
- Is contamination prevented when:
  - Handling
  - Transporting
  - Use


# Test Reports

- Title
- Name and address of laboratory
- Unique identifier (report number)
- Name and address of the customer
- Identification of the method used
- Description of the items tested
- Date range for the reported results
- QA results
- Name, signature and function of person authorizing the report

# Test Reports

- Deviations, additions specific test conditions stated
- Statement of compliance with method
- Statement of measurement uncertainty
- Opinions and interpretations



PHILLIPS 66 RODEO REFINERY
FENCE LINE DATA

Ambient air quality data provided on the Phillips 66 Rodeo Refinery website is raw data at the time of collection – unchecked data that may contain errors

**Message Board**

11/14/2017 10:36 - The CWS CO alarm at the South FTIR was due to low signal and was a false detect.

Document Download Center | Message Archive

**FTIR Systems**

| Chemical (values in PPB) | South Fence Line | North Fence Line |
|---|---|---|
| System Status | Online | Online |
| Date | 2017-11-15 | 2017-11-15 |
| Time | 22:35:00 | 22:34:11 |
| 1,3 Butadiene | ND | ND |
| Carbonyl Sulfide | ND | ND |
| Total Hydrocarbons | 33 | 111 |
| Carbon Monoxide | 98 | 64 |
| Ethanol | ND | ND |
| Ethylene | ND | ND |
| Nitrous Oxide | 281 | 253 |
| Ammonia | ND | ND |
| Mercaptan | ND | ND |
| Methane | 2075 | 2793 |
| MTBE | ND | ND |

**UV Systems**

| Chemical (values in PPB) | South Fence Line | North Fence Line |
|---|---|---|
| System Status | Online | Online |
| Signal Strength | 1528 | 1766 |
| Date | 2017-11-15 | 2017-11-15 |
| Time | 22:34:49 | 22:31:02 |
| Benzene | ND | ND |
| Carbon Disulfide | ND | ND |
| Ozone | 19 | 16 |
| Sulfur Dioxide | ND | ND |
| Toluene | ND | ND |
| Xylene | ND | ND |

**TDL Systems**

| | | |
|---|---|---|
| System Status | Online | Low Signal |
| Data Date | 2017-11-15 | 2017-11-15 |
| Data Time | 22:31:16 | 22:30:22 |
| Signal Strength | 6305 | 455 |
| Hydrogen Sulfide | ND | ND |

**Organic Gas Detectors (OGDs)**

| Instrument (values in %LEL) | % Level |
|---|---|
| System Status | Online |
| Data Date | 2017-11-15 |
| Data Time | 22:34:53 |
| AT-1 | 0 |
| AT-2 | 1.75 |
| AT-3 | 0 |
| AT-4 | 0 |
| AT-5 | 0 |
| AT-6 | 0 |

**Weather Conditions**

| | |
|---|---|
| System Status | Online |
| Date | 2017-11-15 |
| Time | 22:33:16 |
| Temperature (°F) | 60 |
| Humidity (%) | 89 |
| Dew Point (°F) | 57 |
| Wind Speed (MPH) | 21 |

Wind is blowing from the SSE (162°)

N W E S

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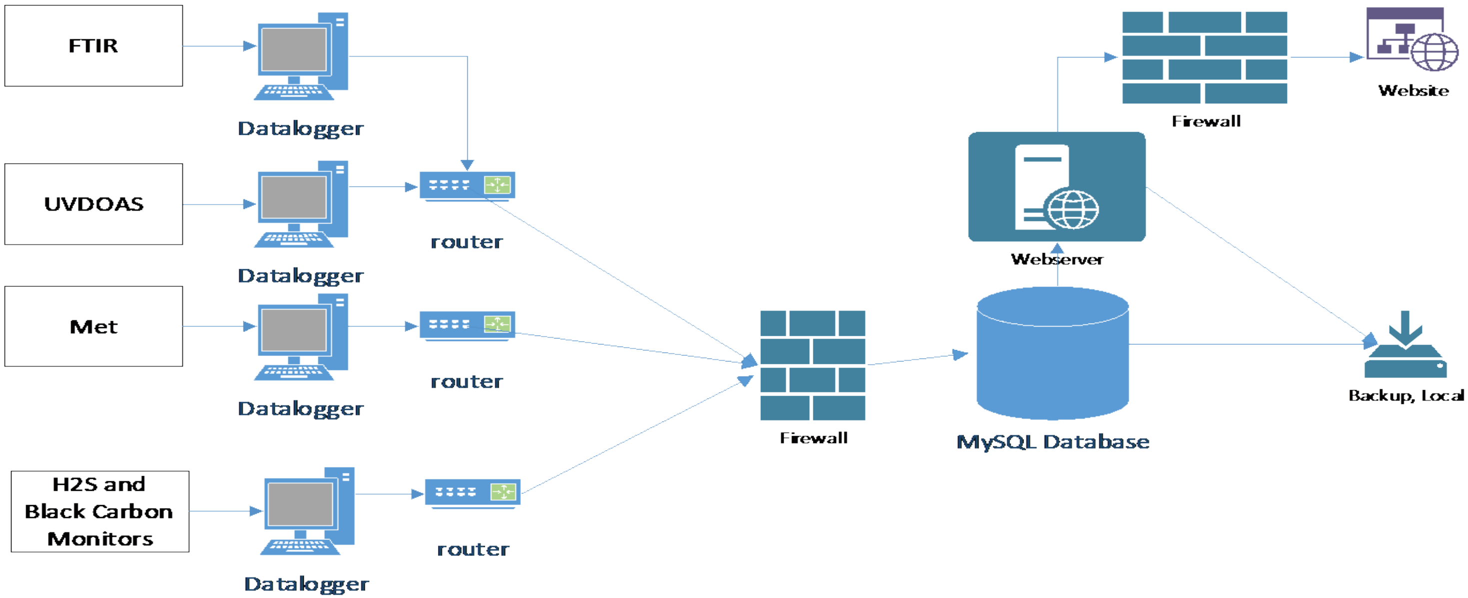
Click on any chemical name or concentration for more detailed information

# Calibration Certificates

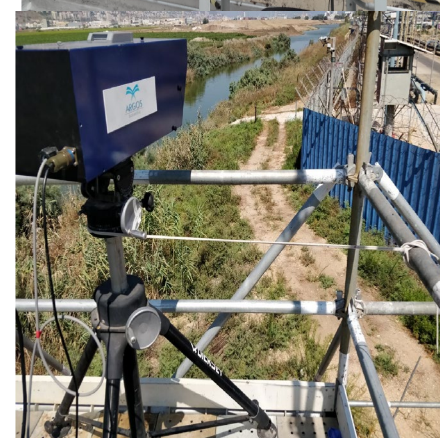
- Conditions that affect results
- Uncertainty
- Evidence of traceability
- Calibration interval
- Results before and after calibration

# Data Transfer




# Accommodation and Environmental Conditions

- Are the method environmental limitations met:
  - Operation range of spectrometer
  - Environmental conditions measured
  - Operational range of other equipment



# Auditing an air quality measurement system

Quentin Hurt

# Agenda

- Background
- Introduction to the ISO Management System
- Components of the ISO 17025 Management System
- Auditing in ISO 17025 systems

SKYSIDE

# Why ISO systems

- A story of air monitoring
- Moving an airshed from 130 tpd $SO_2$ to less than 20 tpd (metric)
- No significant changes in legislation

# My home town: Durban South Africa

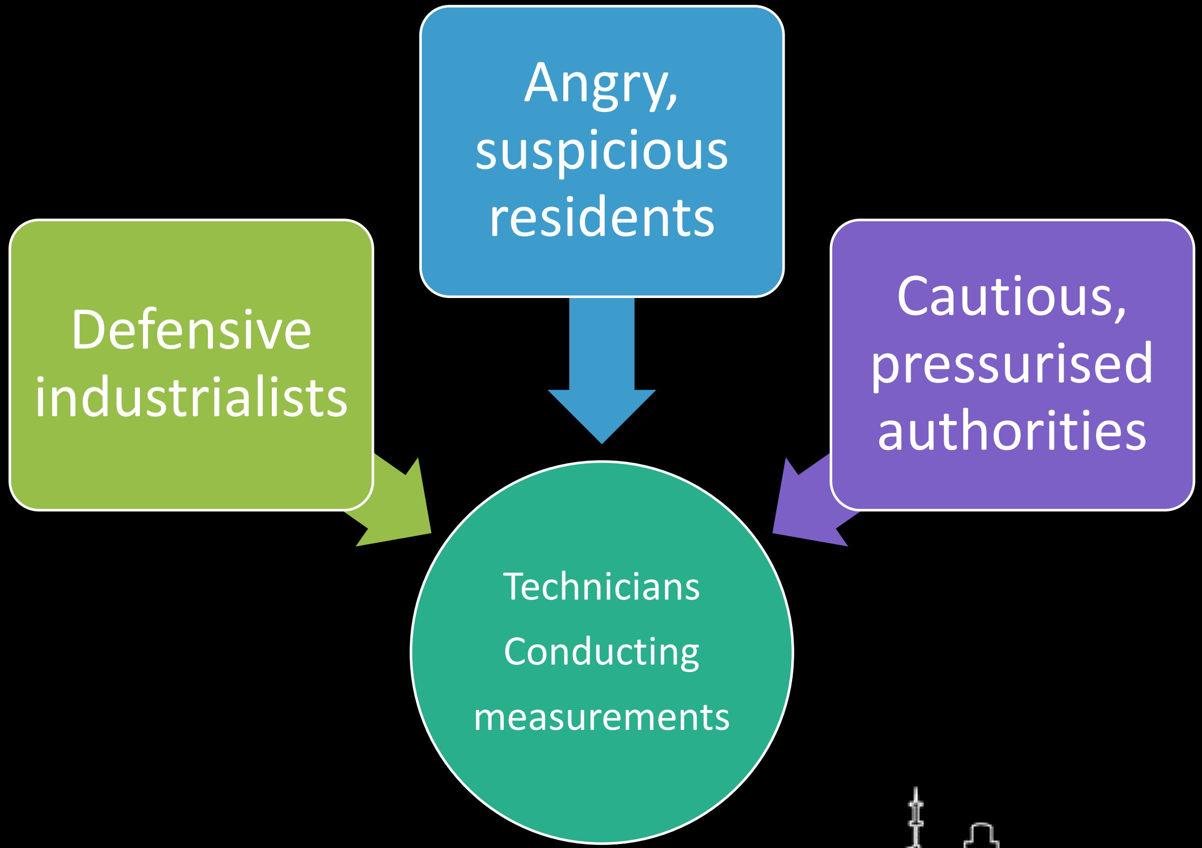

President Nelson Mandela opens Engen Refinery, Durban, South Africa, 1995

Image courtesy Southlands Sun


Image courtesy of Friends of the Earth

The President addresses protestors outside the refinery

# Competing data



# Outcomes

- Credible data led to
  - Considered debate
  - Certainty for engineering planning
  - Reliable benchmaring
  - Trustworthy progress assessment

# What is ISO 17025

Components and features

# What is ISO?

## International Standards Organisation

1. ISO standards respond to a need in the market
2. ISO standards are based on global expert opinion
3. ISO standards are developed through a multi-stakeholder process
4. ISO standards are based on a consensus

# WHAT IS ISO 17025?

- An **international standard** for **testing and calibration laboratories**.
- Designed to help establish the correct **management** and **technical** requirements to achieve accurate results.
- Laboratory accreditation confirms that:
    - organisations have demonstrated that they are **technically competent** and able to produce precise and accurate test and/or calibration data.
    - organisations have the correct **quality systems** in place to manage everything from administration to technical operations.

# OBJECTIVES OF ISO 17025

- To **establish quality** in testing and reliability;
- To **reduce risk**;
- To **detect deviations**;
- To **correct errors**;
- To **improve efficiency**.

# ISO 17025 Benefits

- Structured Peer Review
- International Recognition
- Sound Management System
- Prevent Defective Data
- Increased Accuracy
- Cost Savings
- Reduce Wastage

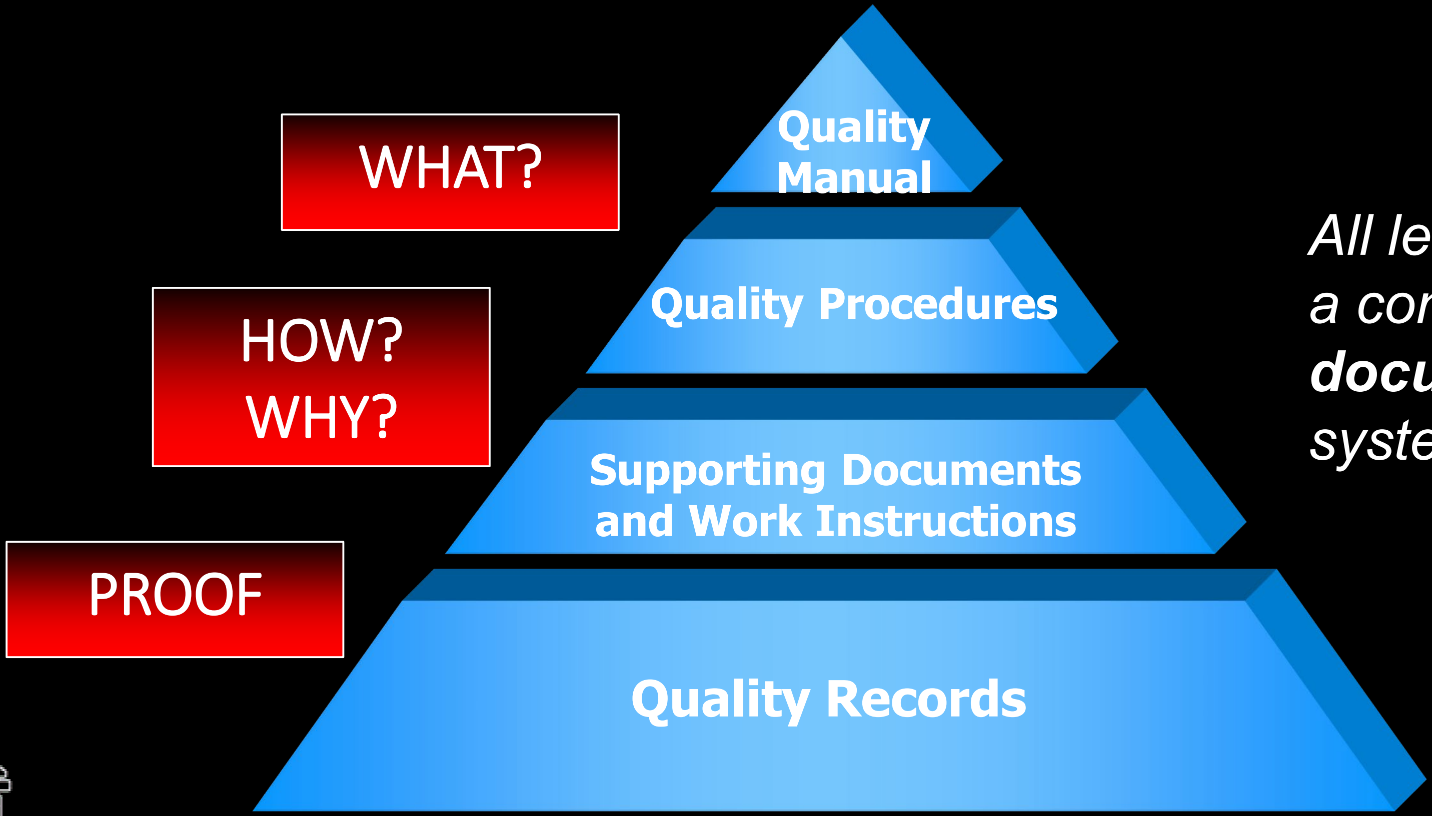
# WHAT IS ACCREDITATION?

- **Process to determine an organisation’s competence to carry out specific tasks:**
  - By independent 3rd party accreditation body
  - Recognised via a certificate and scope of testing, comparable to similar organisations
  - Requires periodic monitoring or performance and regular reassessment
  - Pre-requisite: Compliance with ISO/IEC 17025

# Three critical thoughts

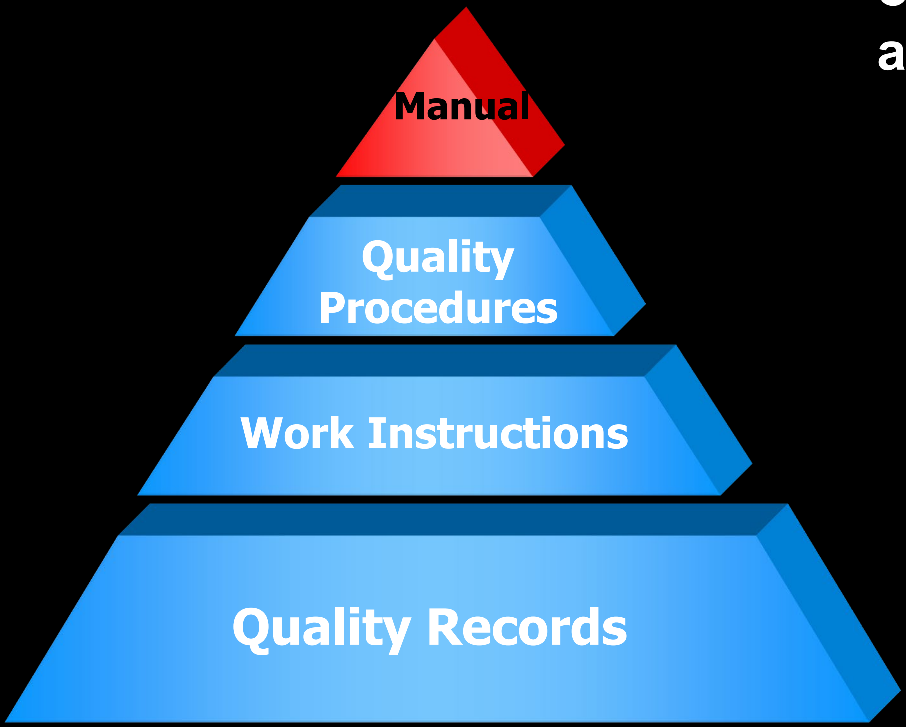
- Does the laboratory “say” what they do?
  - Is there written documents (policies, procedures, arrangements) that meet the requirements of ISO 17025?
- Does the laboratory “do” what they say?
  - Are they in compliance with their own quality system, test methods and ISO 17025?
- And can they “prove” it with their records?
  - Ranging from having training records to standards preparation to work books to client reports to audit reports and everything in between?

# Tiers of documentation




*All levels are **integrated** to form a comprehensive and cohesive **documentation network** via a system of cross referencing*

# The Quality Manual



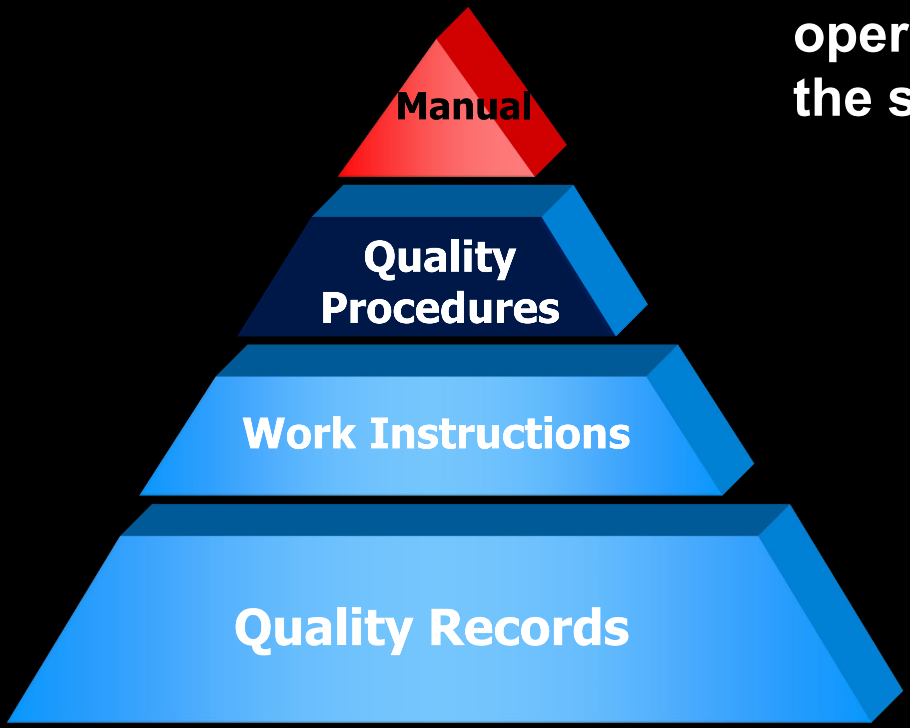

**A strategic document that outlines the organisation's system of providing quality assurance to achieve customer satisfaction.**

Defines

- Policy of the company,
- Organisational structure,
- Functions,
- Responsibilities,
- Procedures,
- Instructions,
- Processes and resources for implementing the quality management system.

SKYSIDE

# Quality procedures

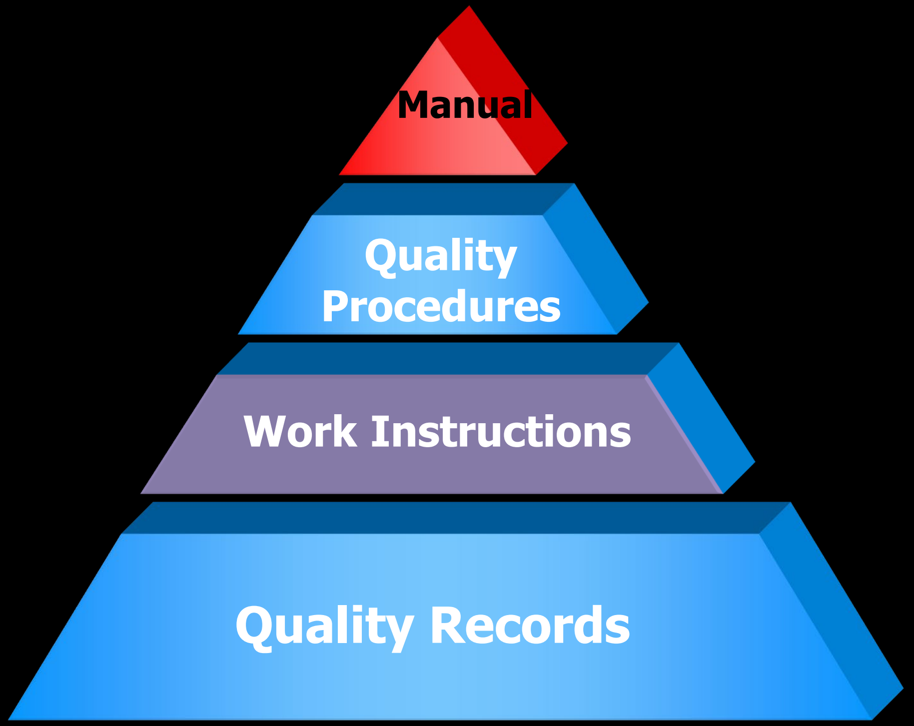



**Tactical documents that outlines the activities or operations of the organization in implementing the stated quality policies.**

The quality procedures are needed to enable every employee to work individually and collectively to achieve the organisation's quality objectives.

SKYSIDE

# Work instructions




**Operational documents containing instructions specifying how the activities are performed or products are accepted.**

Work instructions guide staff in performing a specific function or task.

They are easy guides for the operator to confirm each step in executing a task.

# Records


**Results, charts and data pertaining to activities performed, such as inspections, testing, survey, audits, reviews, etc.**

Records must be maintained as evidence to demonstrate:

- Conformance to specific requirements;
- The effective operation of the quality system.

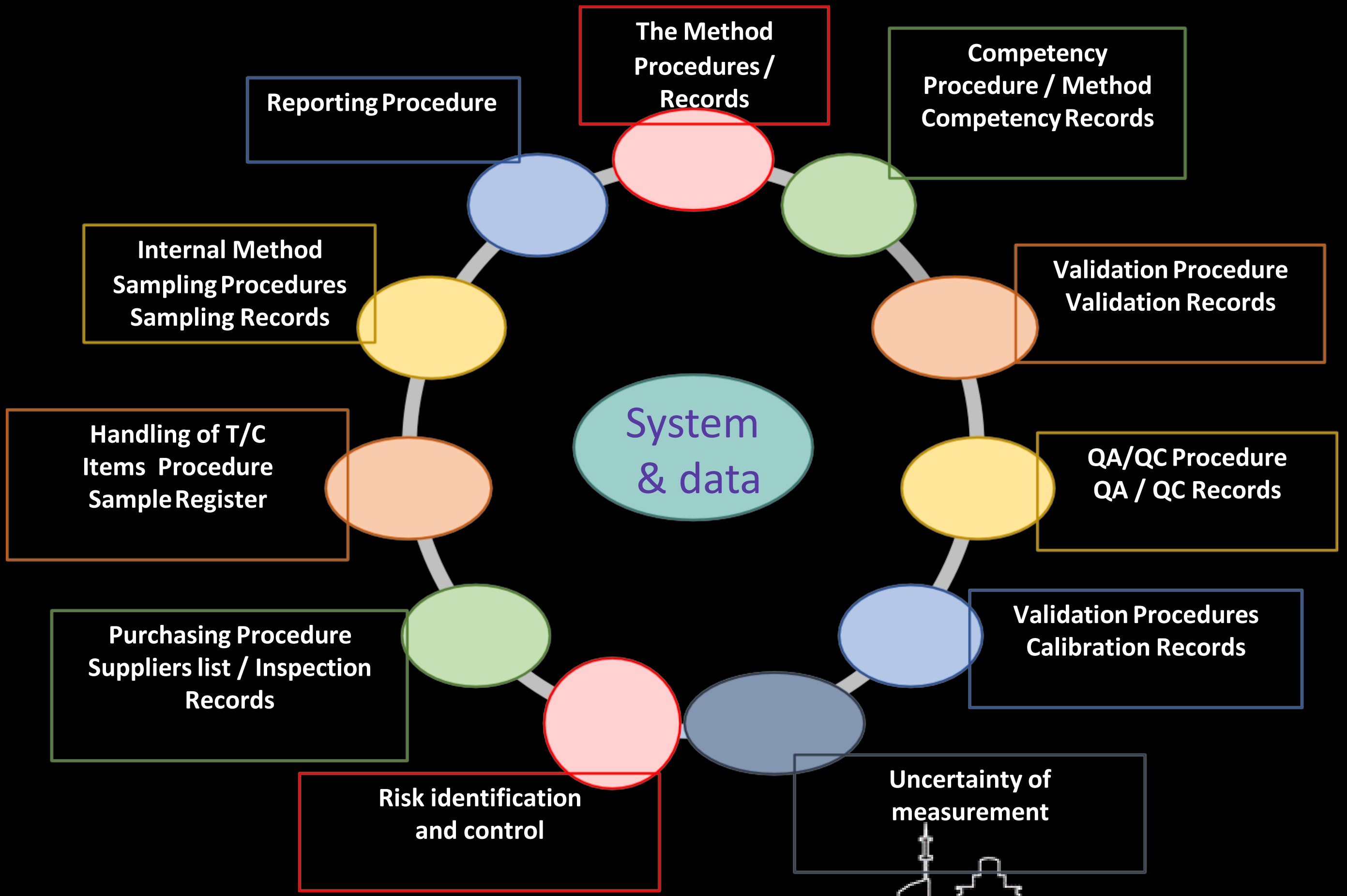
SKYSIDE

# Auditing air monitoring systems

Options and approaches

SKYSIDE

# Audit considerations




SKYSIDE

# Types of audits

**External audit (your registrar is your auditor):**

- Carried out by an external independent agency to assess compliance usually for the purpose of certification. (E.g. SANAS, SABS etc.).
- Performed by accrediting organisations
- System compliance audits
  - Look at products - both good and services
  - Look at processes

**FIRST PARTY AUDITS**

**LABORATORY**

**THIRD PARTY AUDITS**

**SECOND PARTY AUDITS**

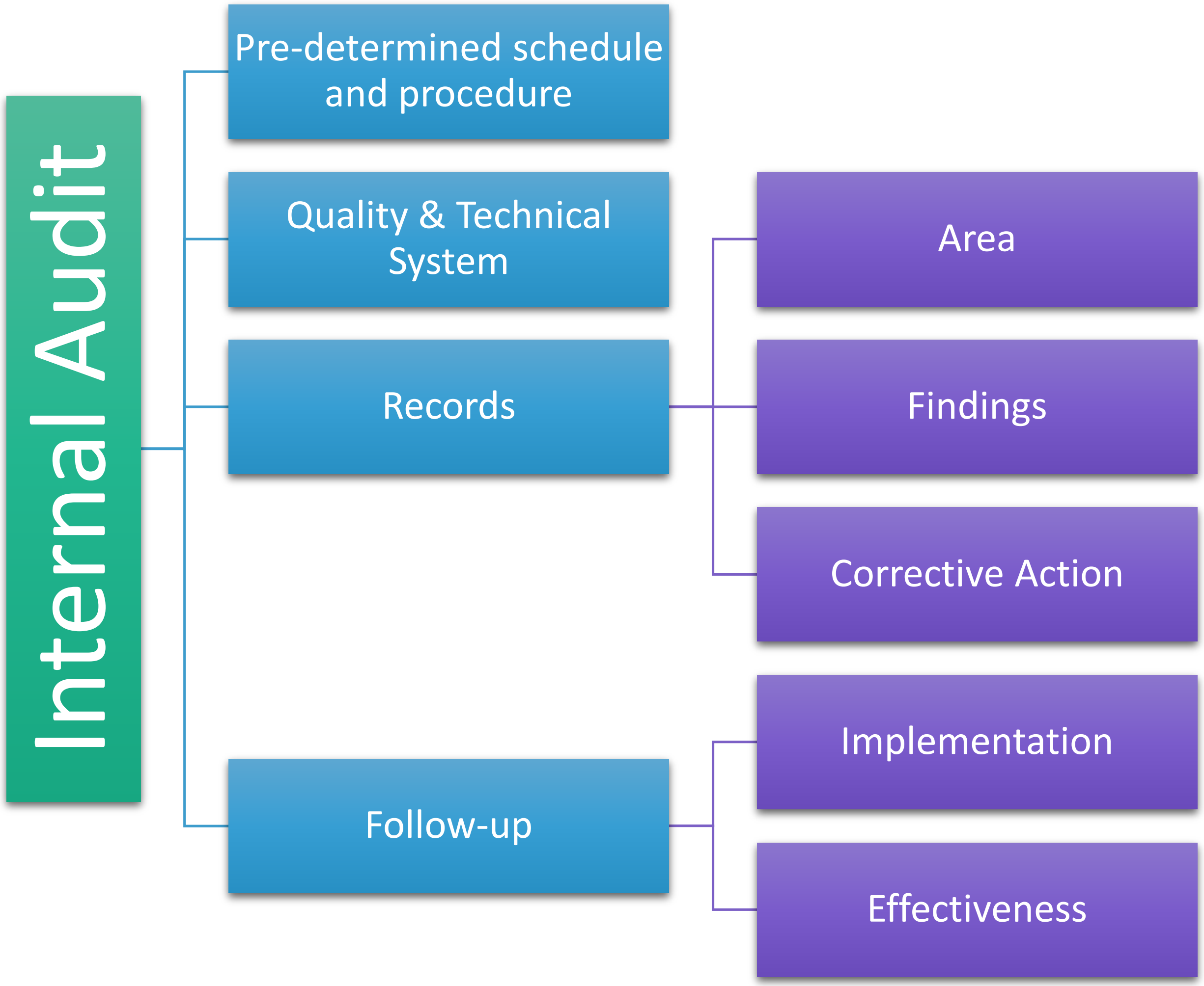
**You are your auditor (internal auditor):**

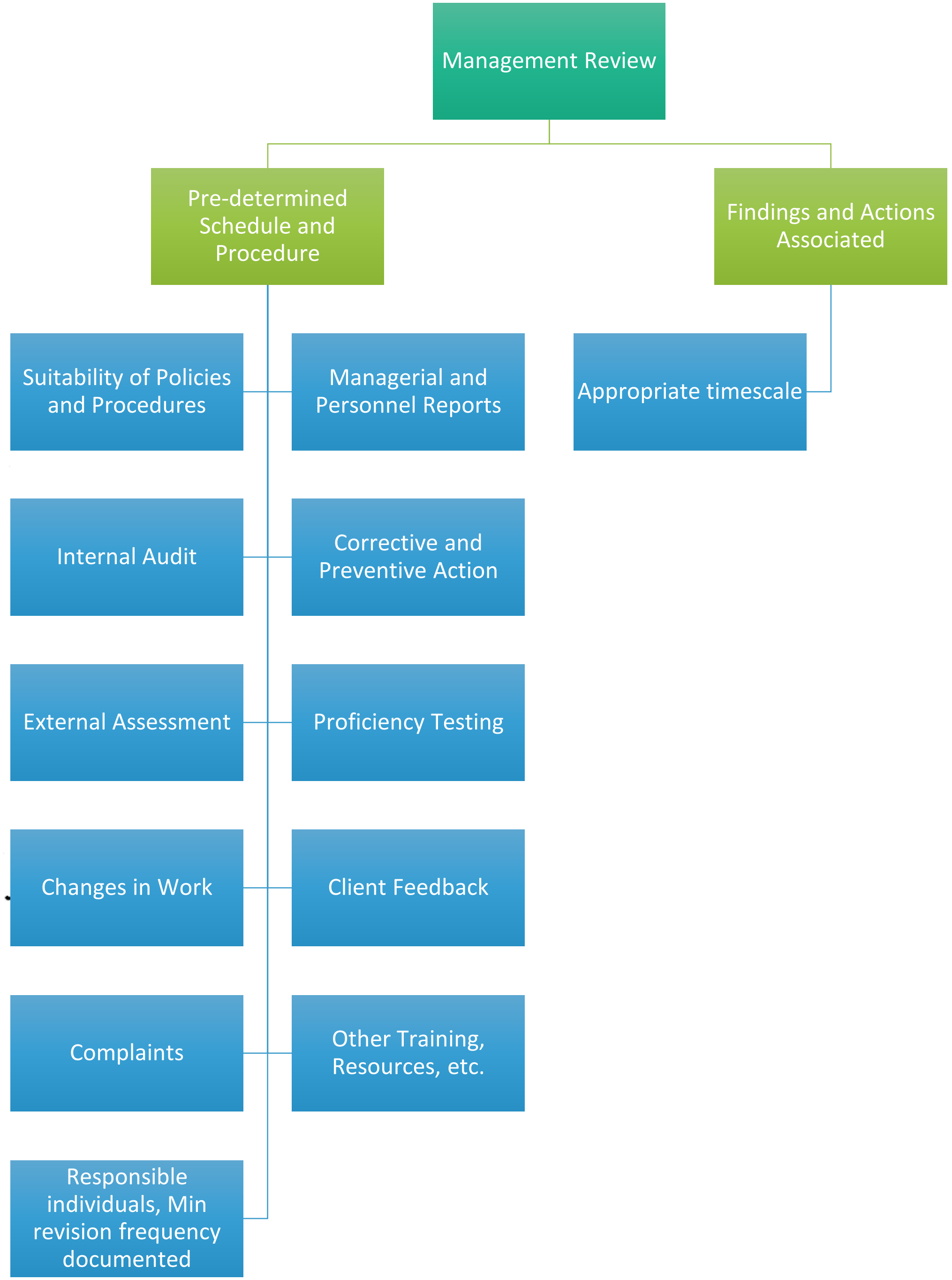
- Carried out by people of the organisation or on behalf of the organisation itself to examine its own quality system.
- Also know as internal audit
- Performed within your own company or facility

**Audit by customer or external audit (your customer is your auditor):**

- Carried out by the customer on the organisation or by organisation on the suppliers to examine the quality of suppliers.

SKYSIDE


Internal Audit
Pre-determined schedule and procedure
Quality & Technical System
Records
Area
Findings
Corrective Action
Follow-up
Implementation
Effectiveness


Management Review
Pre-determined Schedule and Procedure
Findings and Actions Associated
Suitability of Policies and Procedures
Managerial and Personnel Reports
Appropriate timescale
Internal Audit
Corrective and Preventive Action
External Assessment
Proficiency Testing
Changes in Work
Client Feedback
Complaints
Other Training, Resources, etc.
Responsible individuals, Min revision frequency documented

# Internal audits vs management review

These are two distinct activities:

- **Internal audits** **verify conformance** to the documented system and **confirms** the management system is in **compliance** with the standard

- **Management reviews** determine if the management system policies and procedures **are suitable and effective** in generating quality data, meet the objectives of the laboratory  and if ***improvements*** to meet changing needs are required

SKYSIDE

# Using the system

Benefits and considerations

SKYSIDE

# Structure to measurements

- Bringing a clinical approach to the field
- Understanding error and uncertainty
- Communicating supporting data effectively
- Scheduling calibrations and checks efficiently
- Managing traceability

# Credibility

- Independent review
- Internationally-recognised status of ISO systems
- Symbolism of conformity

# Conclusions

- ISO 17025 is an independently recognised programme
- Guiding good practice in measurement and analysis
- Allowing for third-party, peer and specialist assessment
- Creating a framework for trustworthy data

# CARB 2019

# Implementing an ISO 17025 at an Oil Refinery

Mark Wicking-Baird, Argos Scientific Africa Inc.

# Introduction

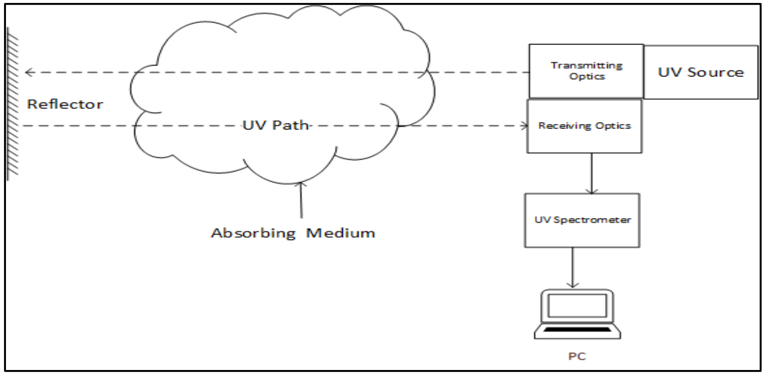
- Quality Framework
- Describe Monitoring System
- Organisation of Project
- Tasks performed
  - How
  - By who
- QA and validation

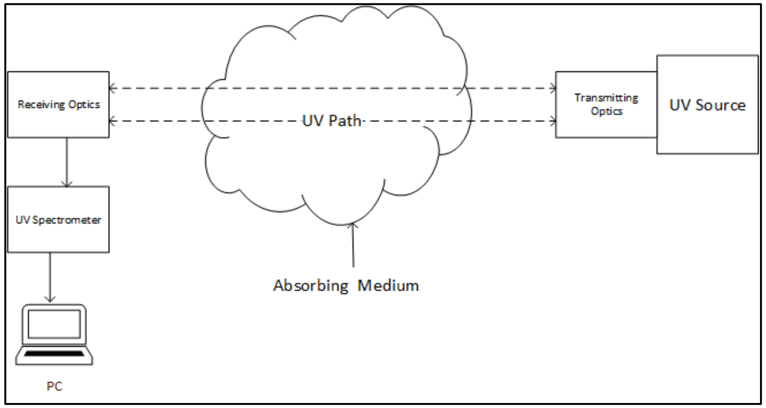
# ISO 17025

- General requirements for competence for testing and calibration laboratories
  - Covers:
    - Standard methods
    - Non-standard methods
    - Laboratory developed methods
  - Traceability to Primary Standard (NIST)
  - Execute method in a consistent manner
  - Continually improve

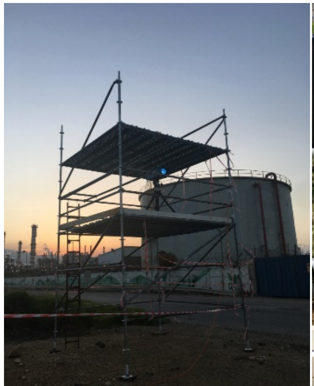
# UV Method

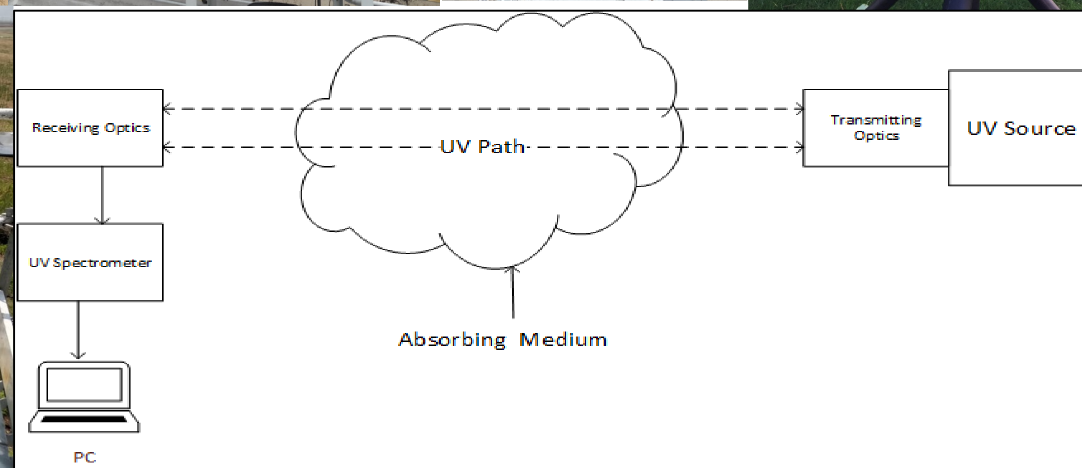
- The system should be capable of making spectral absorption measurements along an open-air optical path.
- The system must be able to produce and save a single beam spectrum.
- The system must be able to operate at 0.14 nm wavenumber resolution over the range 185 to 300 nm.
- The system must be capable of acquiring data by co-adding individual, single beam scans in single scan increments. At a minimum, the system must be able to co-add single beam spectrums, so that a five-minute average can be obtained.
- The system must have a mechanism where a gas cell of known concentration can be installed in the UV path, so that the whole beam passes through the cell.



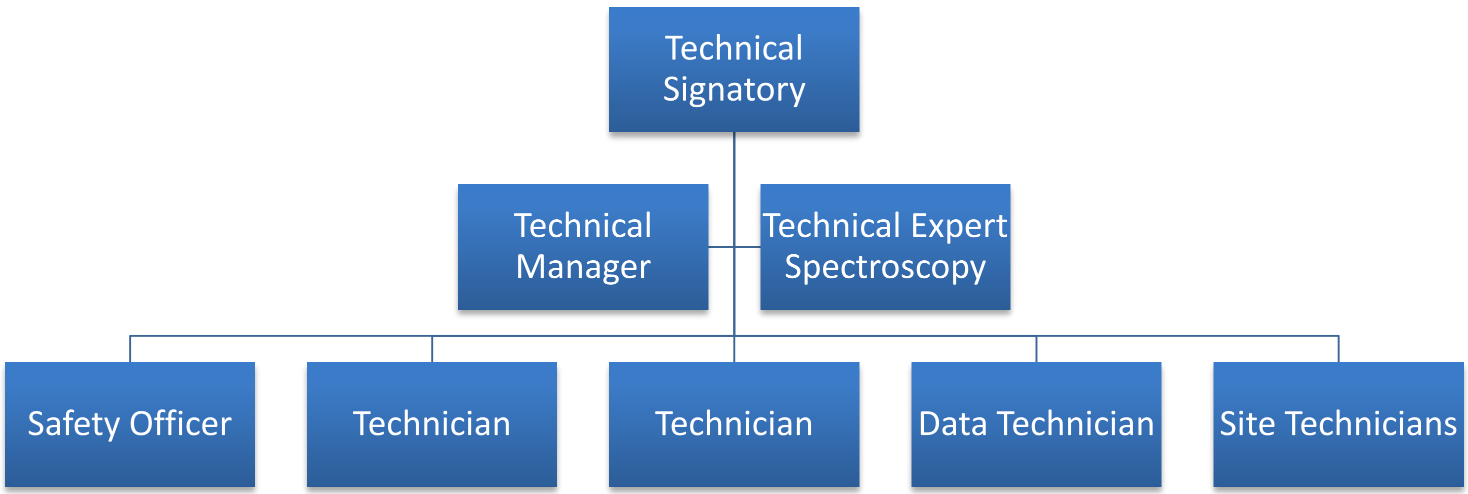




# Open Path System: Field Laboratory





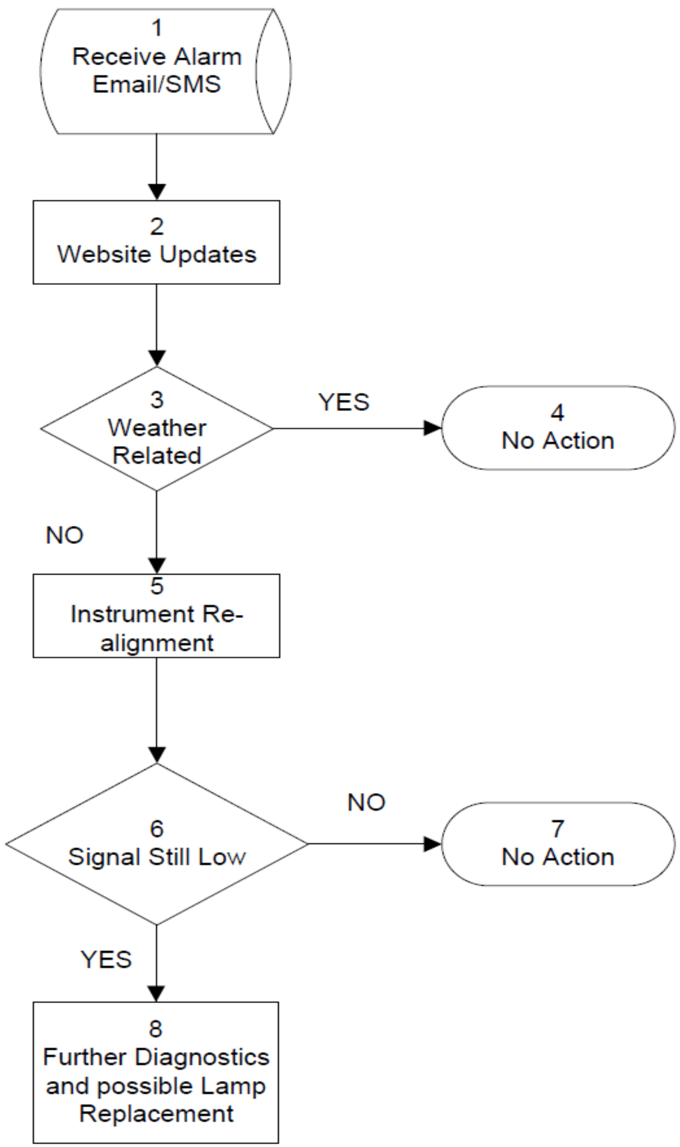

# Project Organization

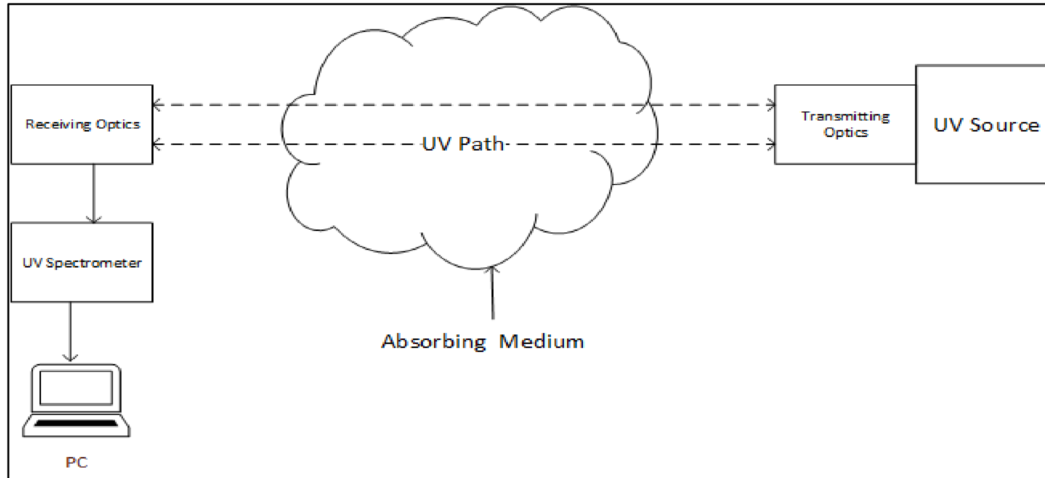



# Tasks: Level 0

| Check Type | Check | Frequency | Reference Doc | Roles and Responsibilities |
|---|---|---|---|---|
| Level 0 | | | | |
| Instrumentation | Light Signal from Optical Remote Sensors | Real-time | FLM-QLT-GUI-001 Operations Guidance Document, FLM-QLT-SOP-002 Low Signal Alarm Response | Site Technician |
| Instrumentation | Instrument Error Codes | Real-time | FLM-QLT-SOP-001 General Alarm Response | Data Technician |
| Instrumentation | Environmental Checks for UV | Real-time | Meteorological Data display on website, Wind Speed and Wind Direction for Alarm Detection | On website and automated alarms |
| Program | Analyzer has low signal | Real-time | Email and text of Low signal alarm. Alarm Ranges defined in FLM-QLT-GUI-001 Operations Guidance Document, FLM-QLT-SOP-002 Low Signal Alarm Response | Data Technician, Site Technician |
| Program | Analyzer off-line | Real-time | Email and text for offline alarm. FLM-QLT-SOP-001General Alarm Response | Data Technician, Site Technician |
| Program | Workstation fails | Real-time | FLM-QLT-SOP-004 Field workstation malfunction | Data Technician, Site Technician |
| Program | Internet communication failure | Real-time | Email and text for offline alarm. FLM-QLT-SOP-001 General Alarm Response | Data Technician, Site Technician |
| Program | Gas detected above alarm value | Real-time | Email and text alarm for detection, FLM-QLT-SOP-006 for Manual Validation of Data | Data Technician |

# Low Signal Alarm Response

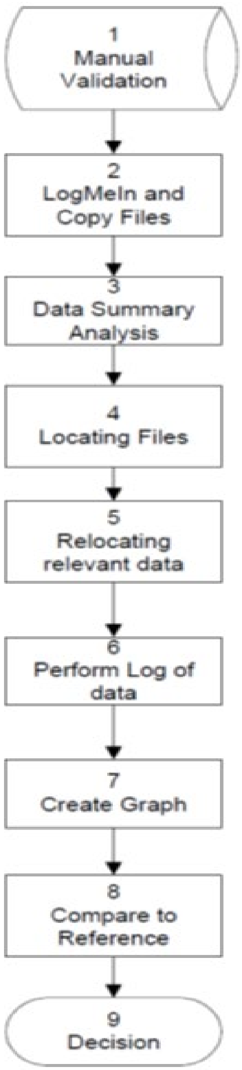


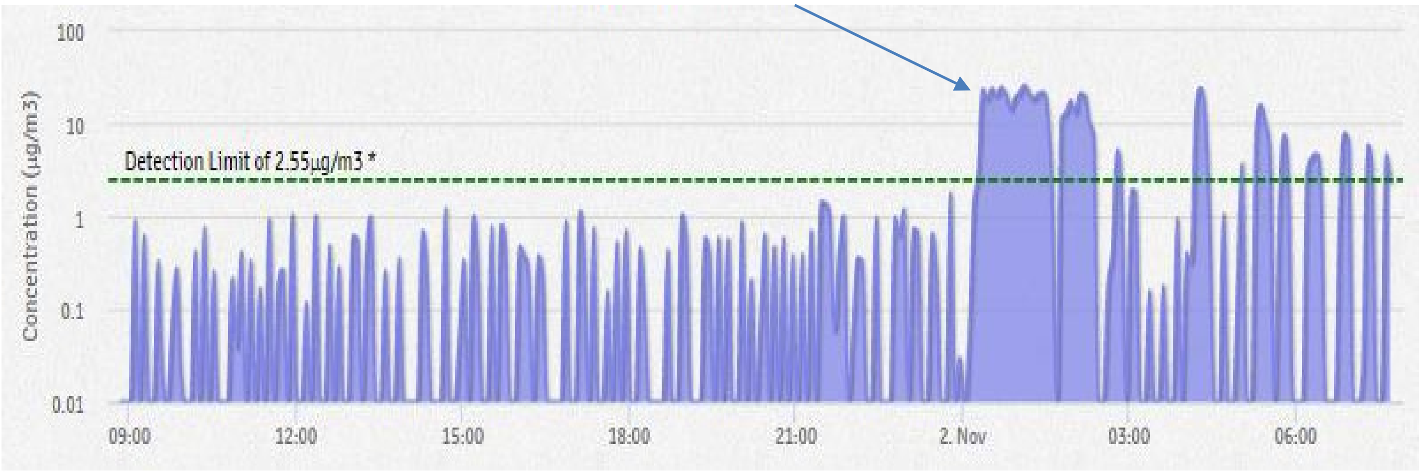



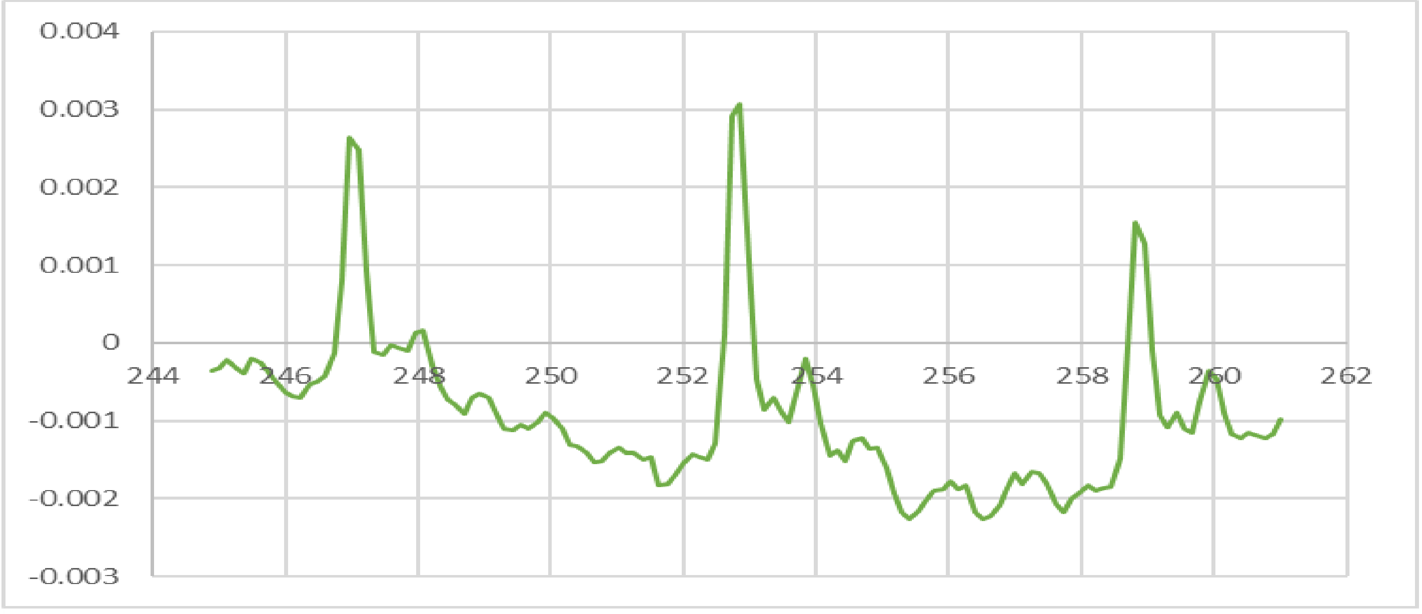

# Tasks: Level 1

| Check Type | Check | Frequency | Reference Doc | Roles and Responsibilities |
|---|---|---|---|---|
| Level 1 | | | | |
| Instrumentation | System noise - UV | Monthly | FLM-QLT-SOP-007 MDL Determination | Technical signatory |
| Instrumentation | Single point check - UV | Monthly | FLM-QLT-SOP-008 Fenceline QA checks | Data Technician |
| Data | Validate detects - UV | Daily | FLM-QLT-SOP-006 for Manual Validation of Data | Data Technician |
| Data | Negative detects - UV | Daily | FLM-QLT-SOP-006 for Manual Validation of Data | Data Technician |
| Data | Verification of detects above threshold | Daily | FLM-QLT-SOP-006 for Manual Validation of Data. Daily Report on detections | Data Technician |
| Program | Equipment operation | 3 x per day | SMS and email alarms repeat every 4 hours | |
| Program | Website operation | 3 x per day | SMS and email alarms repeat every 4 hours | |
| Program | Data logging | 3 x per day | SMS and email alarms repeat every 4 hours | |
| Program | Message board update | 3 x per day | | |

# Manual Validation of Data



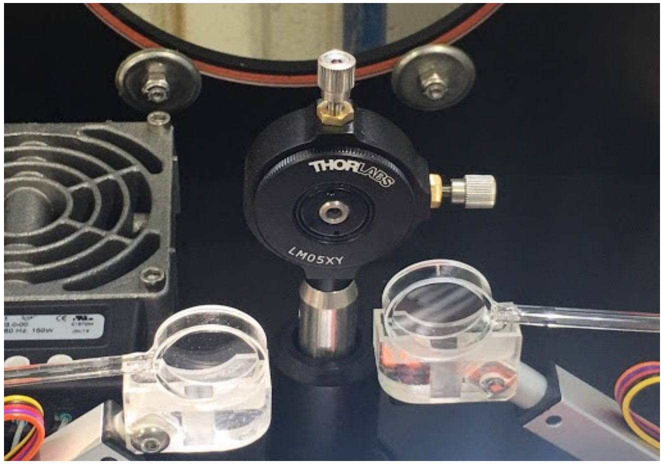



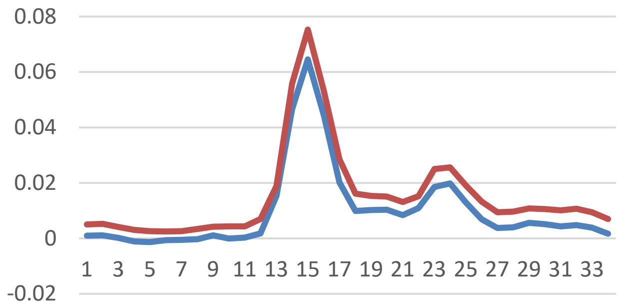
# Tasks: Level 2

| Check Type | Check | Frequency | Reference Doc | Roles and Responsibilities |
|---|---|---|---|---|
| Level 2 | | | | |
| Instrumentation | Detection limit FTIR and UV | Quarterly | FLM-QLT-QAPP-001 for Validation and Verification of Fenceline UV DOAS Systems, FLM-QLT-SOP-007 MDL Determination | Technical signatory |
| Instrumentation | Precision FTIR, UV, and OGD | Quarterly | FLM-QLT-QAPP-001 for Validation and Verification of Fenceline UV DOAS Systems, FLM-QLT-SOP-011 Determination of Precision | Technical signatory |
| Instrumentation | Accuracy FTIR, UV, OGD | Quarterly | FLM-QLT-QAPP-001 for Validation and Verification of Fenceline UV DOAS Systems, FLM-QLT-SOP-009 Determination of Accuracy | Technical signatory |
| Instrumentation | Linearity FTIR, UV, OGD | Quarterly | FLM-QLT-QAPP-001 for Validation and Verification of Fenceline UV DOAS Systems, FLM-QLT-SOP-010 Determination of Linearity | Technical signatory |
| Data | Data trends associated instrumentation performance | Weekly | FLM-QLT-SOP-006 Manual Data Validation | Data Technician |
| Data | Differences between current data and historical data | Weekly | | Technical signatory |
| Data | Insert data in final QA/QC'd data base | Weekly | FLM-QLT-SOP-013 MSQL Validation Upload | Data Technician |
| Program | Summary of calibration and maintenance activities | Monthly | FLM-QLT-SOP-008 Fenceline QA checks, Spectrometer Details Form, QA Check sheet | Data Technician |
| Program | Summary of problems and corrective actions | Monthly | Monthly Alarm Log, IMS-QLT-MAN-010 for Corrective Action, Corrective action report, IMS-QLT-MAN-008 for complaints and Compliments | Data Technician |
| Program | Monthly summary report with OSE updated | Monthly | FLM-QLT-SOP-014 Monthly Reporting | Technical signatory |

# Traceability

- Create reference spectra using reference system.
- Fill sealed cells with gases for field spiking.
- Validate concentration of cell with reference system.
- Validate concentration of cell in the field.




# Verification and Validation Model

| Parameter | Method Acceptable | Site-specific Method Acceptable | Unacceptable |
|---|---|---|---|
| Relative Bias | <= 10% | Between 10% and 30% | > 30% |
| Precision | Relative Standard Deviation (RSD) <=20% | | RSD > 20% |
| MDL | N/A | N/A | N/A |
| Accuracy | <= 15% | | > 15% |
| Linearity | $R^2$ >= 0.9 | | $R^2$ < 0.9 |
| Robustness Temperature | <= 1% | | > 15% |
| Robustness Signal Strength | <= 15% | | > 15% |
| Robustness Sample Time | <= 15% | | > 15% |

# Results

| Parameter | Value | Status |
|---|---|---|
| Relative Bias | 2% over 5 systems | Method Acceptable |
| Precision | 1.9% over 5 systems | Method Acceptable |
| MDL | 0.475 | > 0.09 |
| Accuracy | 5% | Method Acceptable |
| Linearity | 0.92 | Method Acceptable |
| Robustness Temperature | 3% from 9 to 45 deg C | Method Acceptable |
| Robustness Signal Strength | 0.74% | Method Acceptable |
| Robustness Sample Time | !0% from 0.5 min to 30 min | Method Acceptable |

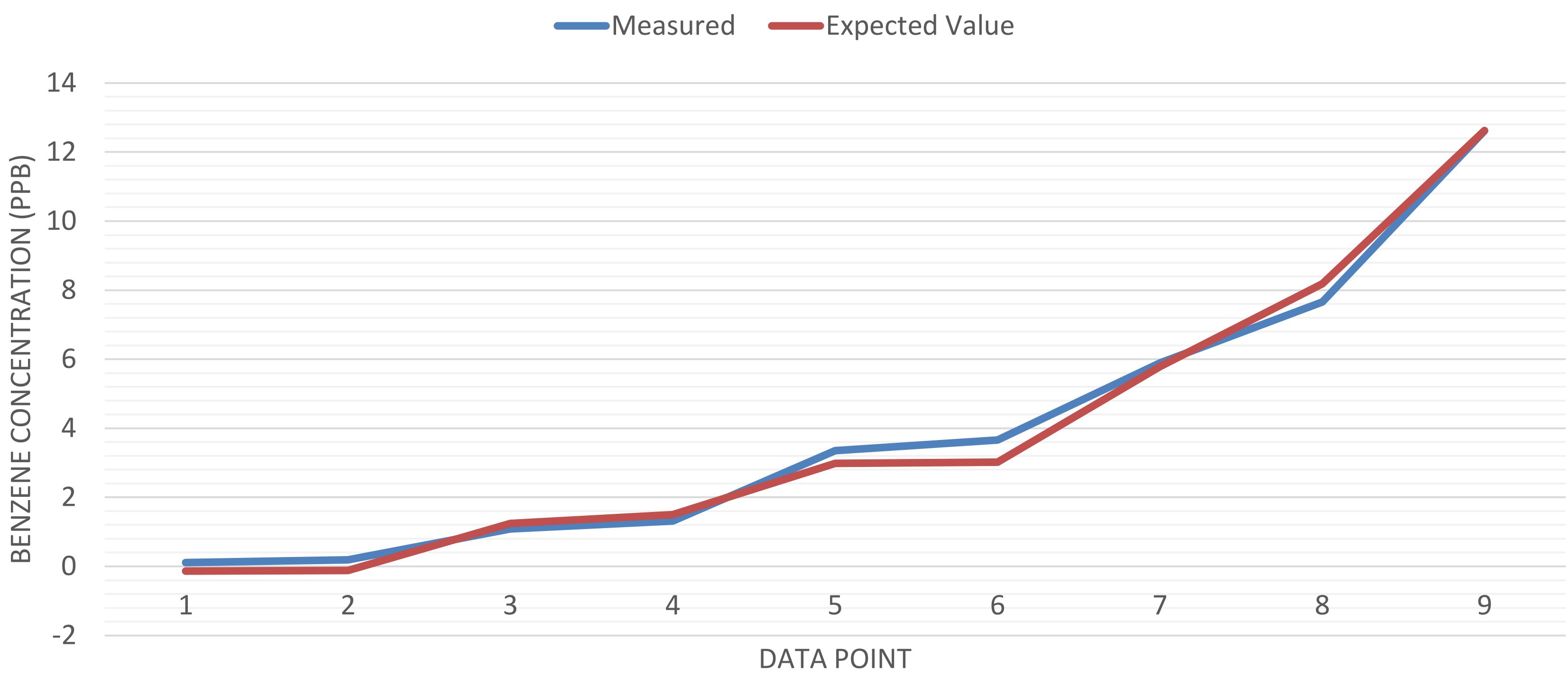
# Precision

| Data Point | Benzene (ppb) | Data Point | Benzene (ppb) |
|---|---|---|---|
| 1 | 55.54 | 14 | 58.33 |
| 2 | 55.57 | 15 | 58.89 |
| 3 | 56.16 | 16 | 59.22 |
| 4 | 56.52 | 17 | 58.98 |
| 5 | 57.37 | 18 | 58.89 |
| 6 | 57.59 | 19 | 59.4 |
| 7 | 57.28 | 20 | 59.53 |
| 8 | 58.36 | 21 | 59.12 |
| 9 | 58.07 | 22 | 59.87 |
| 10 | 58.00 | 23 | 60.03 |
| 11 | 58.62 | 24 | 60.13 |
| 12 | 58.76 | 25 | 60.21 |
| 13 | 58.24 | | |
| | | | |
| Average (ppb) | 58.35 | | |
| Std. Dev. | 1.35 | | |
| % RSD | 2.31 | | |

# Signal Robustness

| % of Max Signal | Measured Value (ppb) |
|---|---|
| 79.1 | 15.01 |
| 67.1 | 15.32 |
| 45.6 | 15.29 |
| 29.5 | 15.34 |
| 14.4 | 15.35 |
| 6.9 | 15.36 |
| 3.5 | 15.26 |
| 1.3 | 15.26 |

# Linearity



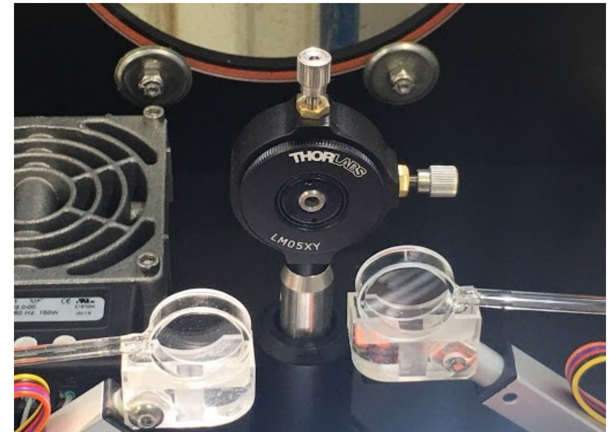
Measured
Expected Value
BENZENE CONCENTRATION (PPB)
14
12
10
8
6
4
2
0
-2
1
2
3
4
5
6
7
8
9
DATA POINT

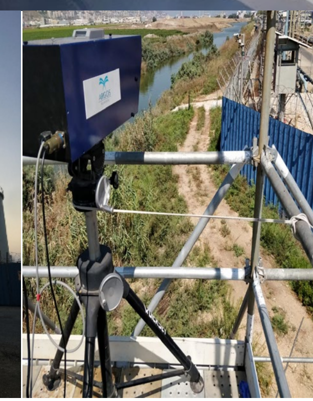

# Tasks: Level 3

| Check Type | Check | Frequency | Reference Doc | Roles and Responsibilities |
|---|---|---|---|---|
| Level 3 | | | | |
| Instrumentation | Annual service FTIR, UV and OGD | Annual | FLM-QLT-SOP-005 for Planned Maintenance, Critical Spares Tracking List | Technical signatory |
| Instrumentation | Certification system brought to factory spec | Annual | FLM-QLT-SOP-014 Monthly Reporting | Technical signatory |
| Data | Full reconciliation of data | Monthly | FLM-QLT-SOP-014 Monthly Reporting | Technical signatory |
| Data | Supervisor check for data trends | Monthly | FLM-QLT-SOP-014 Monthly Reporting | Technical signatory |
| Program | Complete system audit | Annual | Internal Audit Plan | Technical signatory |
| Program | Program evaluation and upgrade | Annual | Annual Management Review | Quality Manager |

# Areas of Improvement

- Proficiency Testing
- More frequent MDL
- Accreditation Process
- Lower Detection Limits
- Increase trust in Data




ARGOS SCIENTIFIC

# Fence-Line Air Monitoring Systems:

# Project Resources

Presenter: Don Gamiles

November 12, 2019

# Objective of this Presentation

| | |
|---|---|
| Describe | Describe the process for getting ISO 17025 accreditation |
| Present | Present the resources needs to implement the ISO 17025 program |
| Summarize | Summarize the resource costs |

# Create a Management System

- Create Management system
- Check alignment with ISO17025 requirements
- Create documents for Management system
- Staff Training in Management system

# Develop the Technical Method

- Develop Method
- Develop operational SOP's
- Develop QA SOP's
- Create Validation Plan (EPA 301)
- Initial Validation of Method

# Audits

- Internal Audit
- Clear Internal Audit findings
- Preparation and participation in ISO17025 Audit
- Accreditation Visit Technical Auditor
- Accreditation Visit Lead Auditor
- Clear Audit Findings

# Summary of Resource Needs

| Task | Hours |
|---|---|
| | |
| Management System | 95 |
| UV Technical System | 108 |
| FTIR Technical System | 93 |
| Point Monitors | 56 |
| Audits | 235 |
| | |
| **Total** | **587** |

CALIFORNIA
AIR RESOURCES BOARD

# Next Steps
# CARB & Air District Collaboration

Refinery Monitoring Working Group Chairs:


| | |
|---|---|
| Russ Bennett, | Monitoring and Laboratory Division, |
| Charles Pearson | Incident Air Monitoring Section |

# Refinery Emergency Air Monitoring Assessment Report Background

- 2012 Richmond Chevron fire raised concerns about prevention and emergency preparedness
- Governor directed a statewide interagency refinery task force (IRTF) to improve worker and public safety around California's major refineries
- Reaction to 2015 ExxonMobil explosion drove related legislation:
  - AB 1646 – Requires integrated alerting and notification system
  - AB 1647 – Requires fenceline and community monitoring systems
  - AB 1649 – Makes IRTF a permanent collaboration with biannual public meetings

# REAMAR Scope and Clients

- Air monitoring
- Modeling
- Communication and coordination
- Refinery monitoring working group

- Clients: IRTF, BAAQMD, SCAQMD, SJVAPCD, SLOAPCD, local response agencies, refineries, and surrounding communities

# Approaches

## Layered Air Monitoring Strategy

- **Inside facility**
  - Personal badges, handheld monitors, process unit monitoring
- **Fenceline monitoring**
- **Community / agency monitoring**
- **Portable / mobile monitoring**

## Combined Routine/Emergency Monitoring

- **Dual use**
  - One system for routine / emergency monitoring
  - Refinery staff will use systems they use everyday for emergency response
  - Public interested in routine emissions
- **Legislation in place – AB 1647/617**
  - Enhanced leak detection and repair?

## Modeling

- **Likely release scenarios**
- **Use in training, drills, and exercises**
- **Symposium**

## Coordination

- **Involve air districts in emergency planning/training**
- **Technology inventory**
- **Operating status web page**

# Data Quality Control

| Routine Air Monitoring | Vs | Emergency Air Monitoring |
|---|---|---|

**Routine Air Monitoring**

- **Defensible Data**
- **Used for Regulatory Purposes**
- **AB 617, AB 1647, BAAQMD Reg 12-15, SCAQMD Rule 1180**
- **District reviews monitoring plans**

Vs

**Emergency Air Monitoring**

- **Timely Information**
- **Used to protect public in emergency**
- **REAMAR**
- **SCAQMD Aliso Canyon real time monitoring disclaimer**

**"Data taken directly from the SCAQMD automated monitoring system have not been validated extensively and, therefore, are subject to change. The results from these monitors alone cannot be used to infer health effects, but they do provide a general sense of how much natural gas is in the community at a given time."**

# Refinery Emergency Air Monitoring Assessment Report Background

**Cal EPA**

**CUPA Forum**

**Interagency Refinery Task Force**

- Refinery Safety and Information Office
- State level coordination and liaison for environmental safety
- CalOES
- CalOSHA
- Local Response Agencies

**Refinery Monitoring Working Group**

- Refinery Air Districts and CARB
- Liaison for refinery monitoring to U.S. EPA, IRTF, CUPA Forum, and others

CALIFORNIA AIR RESOURCES BOARD

# QUESTIONS?

**Russ Bennett**
**Russ.bennett@arb.ca.gov**