

HIGH ACCURACY MULTI-GAS MONITORING USING AUTOMATED SELF- CALIBRATION



SCENTROID is the global leader in sensory technology providing intelligent environmental solutions across a wide range of industries

Scentroid manufactures all its products in Canada and exports to 42 countries worldwide.

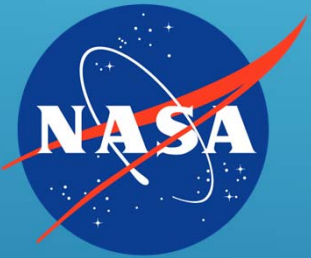
ABOUT SCENTROID

AECOM



Google

3M



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Honeywell



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SOME OF OUR CLIENTS

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PRODUCTS



Scentroid has 3 main types of chemical analyzer

- ▶ **Pollutracker** – Portable with up to 10 sensors
- ▶ **DR1000 Flying Lab** - can be attached to any drone and can be used to sample and analyze ambient air instantly
- ▶ **Scentinal SL50** - Compact Air Quality and odour Monitoring Station provides extreme accuracy using innovations in self-calibration and data analysis.

CHEMICAL ANALYZER

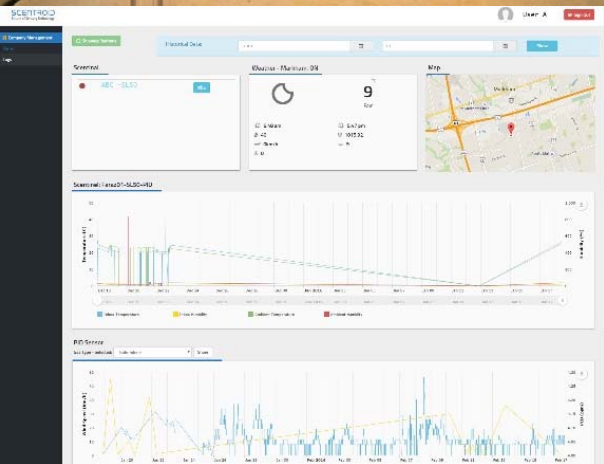
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CHALLENGE



A client is using data from a Scentinal as evidence in a litigation case. The question is:

- ▶ How do we know zero ppm means really zero?
- ▶ How do we know 10 ppb is really 10 ppb?

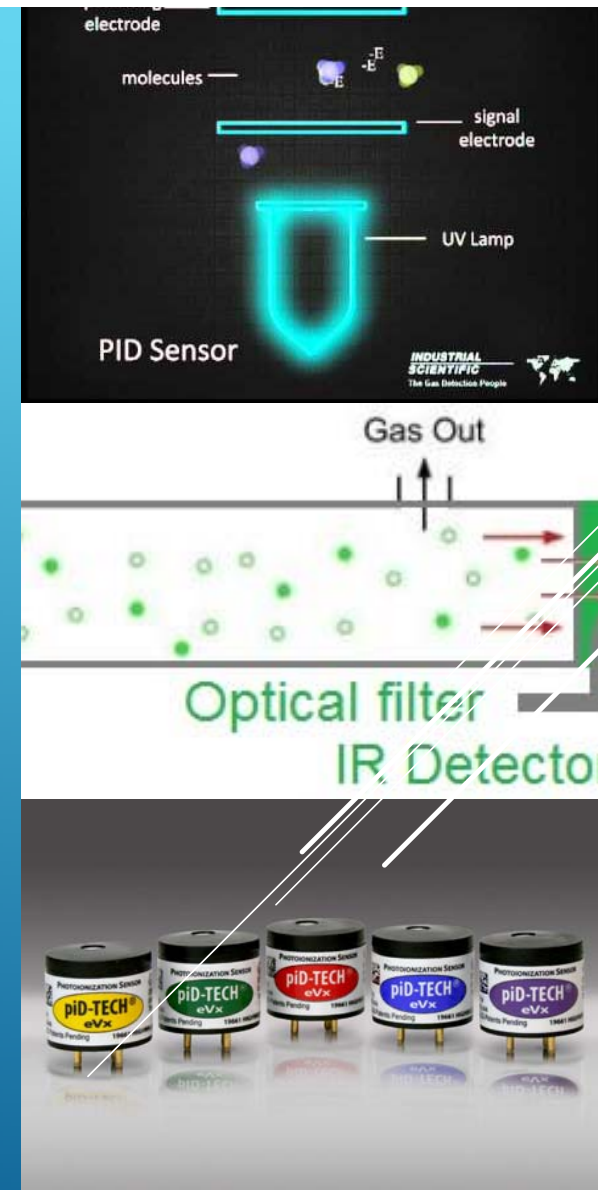


DATA RELIABILITY

Common Sensing Technologies

- ▶ Photo-ionization Detector (PID) – Detect VOCs in ppb by use of high energy UV photons.
- ▶ Nondispersive Infrared Sensor (NDIR) - Detect various compounds such as CO₂.
- ▶ Electro Chemical EC – detect a wide range of compounds by oxidizing the target gas at the electrode.

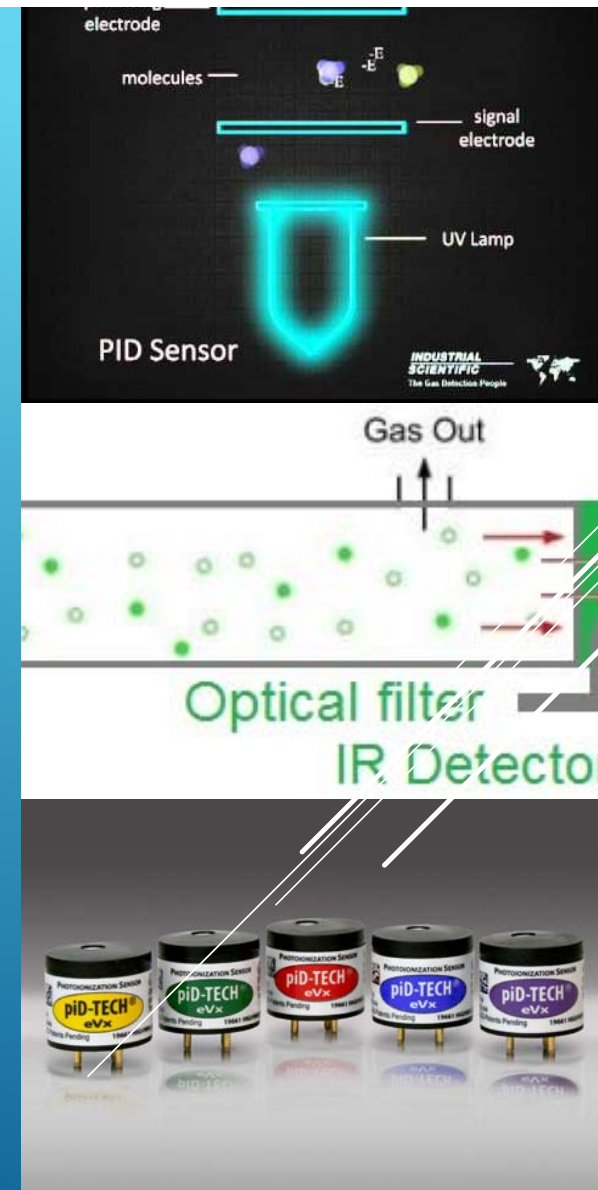
SENSING TECHNOLOGIES



Common Sensing Technologies

- ▶ Photo-ionization Detector (PID) – lamp will fail after X hours showing always zero ppm. Lamp can be coated with dust reducing sensitivity.
- ▶ Nondispersive Infrared Sensor (NDIR) - similar to PID.
- ▶ Electro Chemical EC – Slow drift of zero based on time and exposure. Change of sensitivity due to time, exposure, and other environmental parameters.

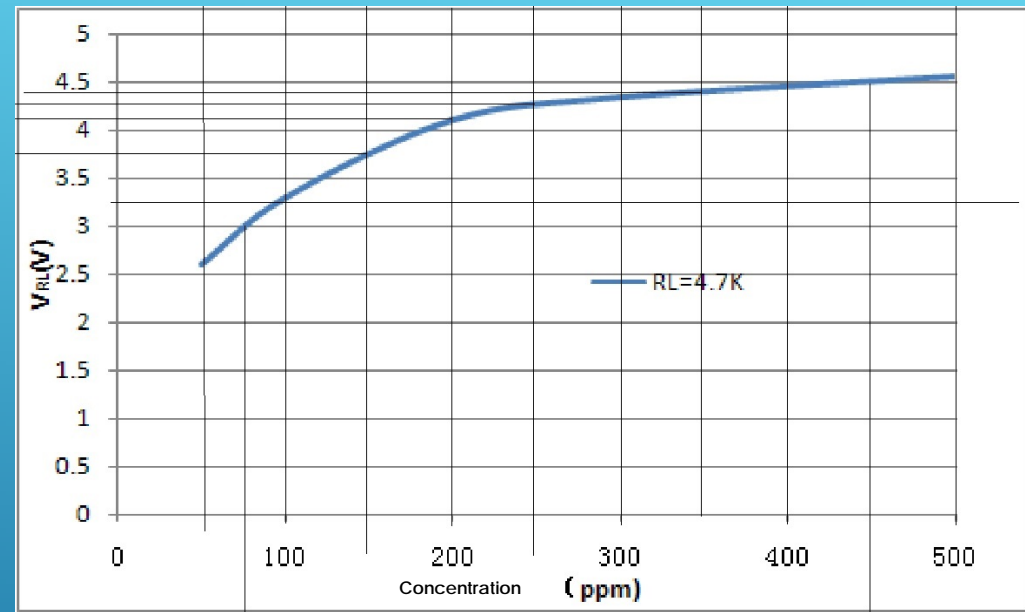
FAILURE MODES



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AUTOMATED CALIBRATION

- ▶ Zero Calibration– provide zero air to check and adjust the zero voltages.
- ▶ Full Span calibration – determine the non-linear curve of signal to gas concentration.
- ▶ Verification– check response of sensor to Minimum Detection Limit .



OBJECTIVE

Permeation Tube vs Calibration Gas

- ▶ **Transport** – Calibration gas is difficult to ship as a hazardous material.
- ▶ **Difficult to Source** - Gases are difficult to source in many countries.
- ▶ **Settling** – Gas cylinders must be shaken to ensure uniformity otherwise heavier gases may settle at the bottom of the cylinder and create a non-uniform concentration.

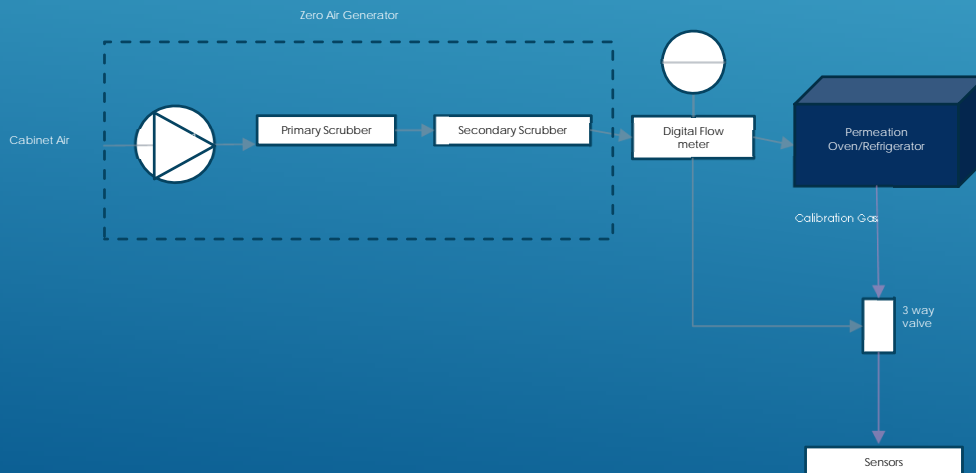
CREATING REFERENCE GAS



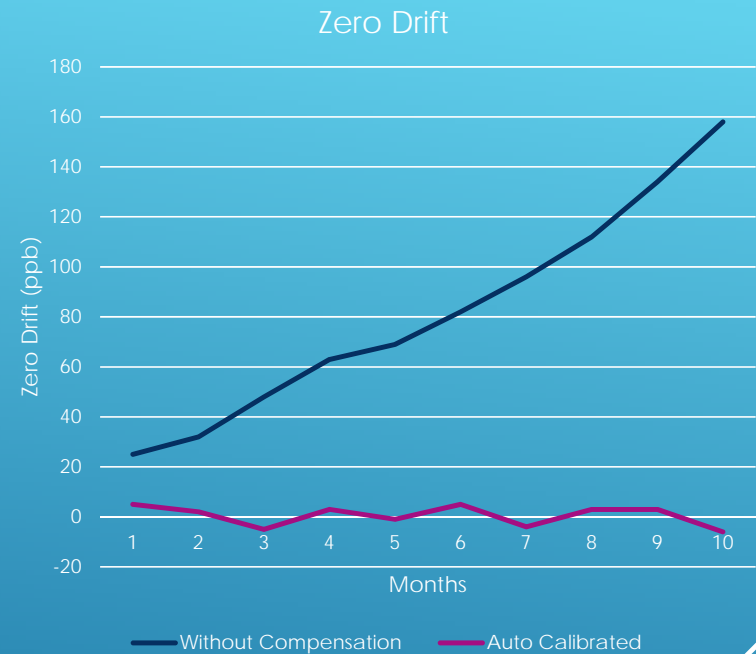
CALIBRATION SYSTEM

System Overview

- ▶ **Zero Air Generator** – A miniaturized zero air generator provides clean air for zero reference. Flow is digitally monitored to ensure accuracy.
- ▶ **Permeation Oven/Refrigerant** – temperature controlled permeation oven can achieve any temperature between -10 to +45C. Oven can take up to 8 permeation tubes (default 4) for complex gas mixtures.
- ▶ **Control System** – The oven is controlled by a dedicated microcontroller. Adjusting temperature and flow can create mixtures of any concentration. At 3C the permeation tube is in stasis to prolong service life.

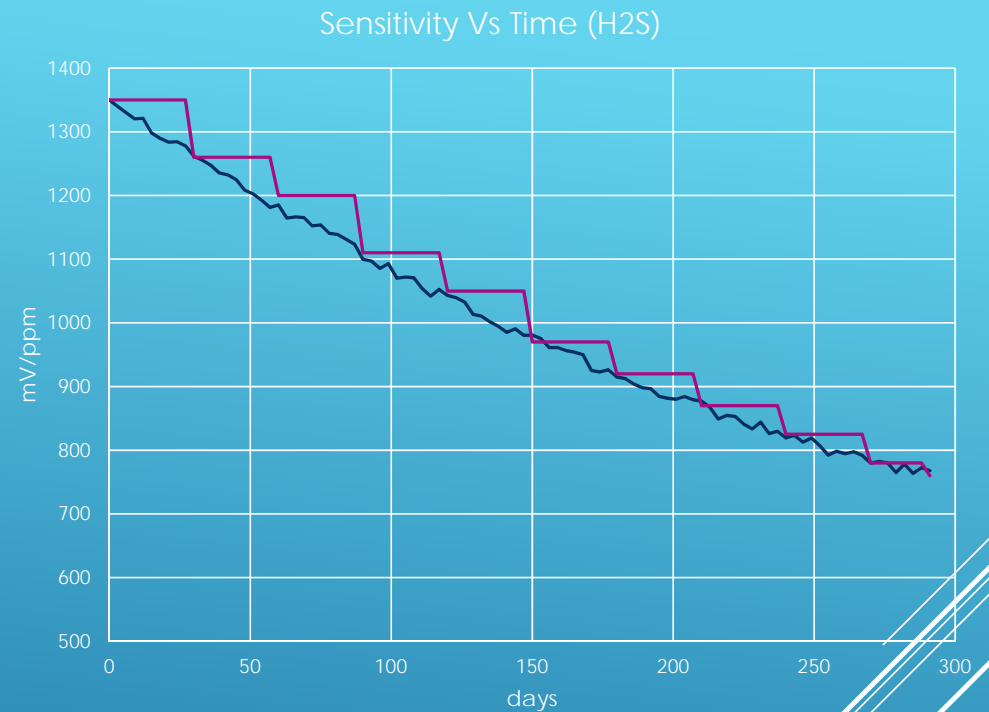


- ▶ **Drift compensation** – The following graph shows the zero voltage in equivalent ppb of H₂S over 10 months. With zeroing every 12 hours the drift is fully compensated for. Drift over 12 hours is less than detection limit.



RESULTS FOR ZERO CALIBRATION

- ▶ **Sensitivity Change** – The following graph shows the sensitivity calculated manually every month for 10 months as well as sensitivity calculated by instrument every 72 hours.
- ▶ Typical loss is 20-25% per year in laboratory conditions
- ▶ This instrument was exposed to H₂S levels of 200-800 ppb continuously.



RESULTS FOR SENSITIVITY

- ▶ Automated Calibration can provide:
 - ▶ Fault Detection: Sensor faults are detected almost instantly.
 - ▶ Higher accuracy: adjusting for sensor drift and loss of sensitivity accuracy can reach those achieved in the laboratory.
 - ▶ Higher reliability: documented response of sensors will provide proof the sensors are always working within specifications.
- ▶ The Automated calibration can allow the “low cost” sensing solutions to perform similar to much more expensive analyzers.

CONCLUSION

SCENTROID
Future of Sensory Technology

THANK
YOU