Cloud Based Real-Time Monitoring with Sample Initiation

NEMC 2019 Environmental Measurement Symposium

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WHEN YOU NEED TO BE SURE

SGS

LET'S SET THE STAGE FOR THE DISCUSSION

- Computing
  - Who saw Personal Computers evolving to today in 1980.
    - We can do on our smart phones what we did on the first PCs faster and easier
    - When is the last time you hand wrote a report.
  - What was a key to this – Microprocessors and Internet bandwidth.
- Communications
  - Who saw the power of phones evolving in 1990?
    - We can call almost anyone in the world with a battery operated device with no cords.
    - When was the last time you used a land line phone
  - What was a key to this – Cellular Technology
- Internet
  - Who saw Internet and its impact evolving to today?
    - We have instant information, Google.
    - When is the last time you stamped a letter or used a Fax machine?
    - When is the last time you went to a library to do research?
    - When is the last time you used a printed map?
  - What was a key to this – WWW Software, Computers and 4G 5G– Fiber Optics

Key Seminar Objectives

- Real-Time and IH Sampling
  - Defining Real-Time
  - Advantages
  - Key Elements in IH
- What is available today and what drove the changes – a trip back in time
    - Comparing 1980 to today
      - Understanding the technology
- The Next Generation Platform
  - Understanding how all the pieces fit
  - How you and IH fit

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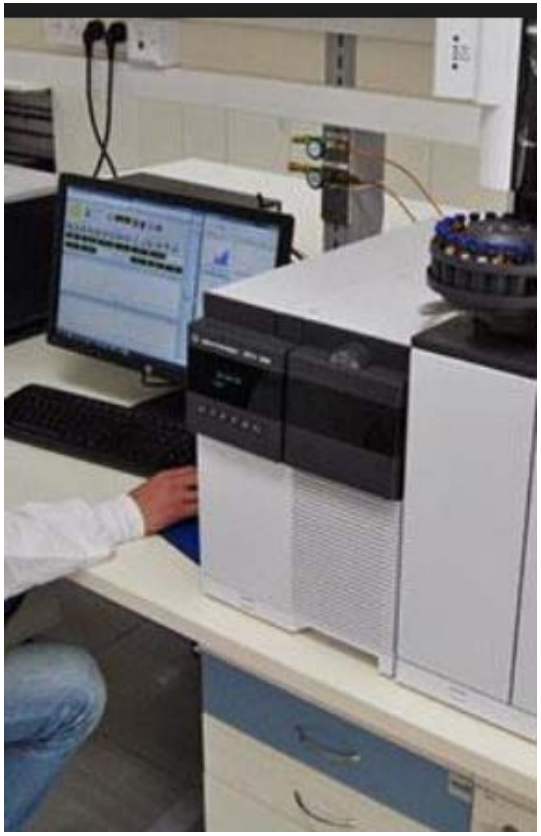
- Understand what is available today and what to expect in the near future by
  - Looking back in time and examine how IH Real Time technology has advanced to today
    - The Regulatory Drivers
    - The Technology Drivers
- Gain insight to the Future of Real Time Technology and its impact on our daily activity
  - Projecting forward based on what we learned from looking back
    - The Regulatory Drivers
    - The Technology Drivers

REAL TIME and IH Sampling

- Real-Time is instantaneous data readings
  - Ex: Looking at your phone and checking the time

VS

REAL TIME and IH Sampling



- Sampling-then waiting for lab results
  - Ex: Pulling air through collection media, submit samples to a lab then receive results at some specified TAT
  - A clear delay in data

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Advantages - The desire for real-time data

- Why wait if you can have instant data?
  - Advantages
    - Simpler process-reduce your chances of error
    - Trouble Shooting Tool
      - Instant evaluation of factors
    - Immediate corrective action
      - Immediate measure of corrective action working

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Key Elements for Use of Real-Time Systems

- World Standards
  - Devices – Should conform
    - Acceptance as a Standard against the Acceptable Goal
  - Screening
    - Methods that assist in diagnosing or locating source(s) causing non-compliance

Key Elements for Use of Real-Time Systems

Regulatory Compliance

- Devices should be accepted as “compliant”
  - Meet detection limits
  - Accuracy
  - Specificity
- Screening applications may not require true “compliance”

Performance

- Devices has to meet “user” requirements
  - User Interfaces
    - Display
    - Data Storage
    - “Ease of use”

Cost Effective

- Dependent on application

Cost Effectiveness

Model 405 nm $NO_2/NO/NO_x$ Monitor™

Direct Measurement of NO_2 by Absorbance

FEM-Approved for NO_2 Compliance Monitoring

The Model 405 nm NO_x Monitor ("nm" for "nanometer" and for "NO_x Monitor") is designed for the direct measurement of atmospheric nitrogen dioxide (NO_2), nitric oxide (NO) and total reactive oxides of nitrogen (NO_x = NO + NO_2) in the concentration range 0-10,000 ppb (0-10 ppm) for NO_2 and 0-2,000 ppb (0-2 ppm) for NO with high precision and accuracy. In this instrument NO_2 is measured directly by absorbance at 405 nm. NO is measured by selective conversion with ~100% efficiency using the highly selective reaction of NO with ozone (O_3). Total NO_x is obtained by addition of NO and NO_2.

Rental: $1500/Week
Accurate - PPB
Real Time

Nitrogen Dioxide Gas Detectors (NO_2 Detectors)

Nitrogen dioxide (NO2) is an extremely toxic byproduct of the burning of hydrocarbons. Major sources of NO2 are internal combustion engines (diesel engines), and thermal power stations. Other sources of nitrogen dioxide include petroleum and metal refining, electricity generation from coal-fired power stations, other manufacturing industries, and wastewater treatment plants. Regardless of industry or application, Industrial Scientific offers a wide range of nitrogen dioxide gas detection instruments including the Tango™ TX1 and GasBadge® Pro single-gas detectors, the Ventis™ Pro Series, Ventis™ MX4, MX6 iBrid™ multi-gas detectors, as well as the Radius™ BZ1 Area Monitor.

Rental: $200/Week
Accurate – PPM, w interferences
Real Time

NITROGEN DIOXIDE / CAS# 10102-44-0

Nitrogen dioxide	Nitrogen dioxide
FEE PER SAMPLE: $50.00	FEE PER SAMPLE: $50.00
Additional Analyte Fee:	Additional Analyte Fee:
METHOD:	METHOD:
ANALYTICAL TECHNIQUE: Color.	ANALYTICAL TECHNIQUE: IC
COLLECTION MEDIUM: Treated Molecular Sieve	COLLECTION MEDIUM: Treated Molecular Sieve
ORDER NUMBER: 226-40-02	ORDER NUMBER: 226-40-02
VOL. / TIME / AREA / MASS: 1.5-6 L	VOL. / TIME / AREA / MASS: 3.0 L
SAMPLING RATE: 0.025-0.2 LPM	SAMPLING RATE: 0.20 LPM
LOQ: 1.0 ug	LOQ: 2 ug

Rental: $50/Sample
Accurate - PPB
Lab Results

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1980 vs Now for Total Particulate Area Sampling

- 1980 - Pre-weighed filter from a lab where RH and temp are controlled and a means of generating a report.
  - Filter arrives from lab – do not contaminate.
  - Pump is charged in order to sample for a duration (batteries not rechargeable).
  - Calibrator – a rotameter or even worse
  - Run the sample as is designed.
  - Complete your sampling event .
  - Fill out your chain of custody by hand.
  - Ship the chain, samples, blanks to the lab.
  - Lab uses balance and QA process to generate data – total particles per volume.
  - Important to note there is no size fraction done.
  - Lab report completed and QA checked, ready to send – By fax or FedEx
  - Transcribe your report with a typewriter.

- Now - This time Real-Time.
  - Make sure instrument is calibrated
  - Make sure unit is charged
  - Turn power button on
  - Take readings near instantly
  - Download data for document with multiple points of data

1980 vs Now - Confined Space

- 1980 - Oxygen meters and a squeeze bulb explosivity meter – (two devices) – O2 meter and a Sniffer which you squeeze the bulb. No real way to measure CO and H2S. Odor was the last piece.
  - Make sure instruments are calibrated
  - Make sure unit is charged
  - Turn power buttons on
  - Take readings prior to entry
  - Have an attendant keep an eye on occupants

- Now – Automated Web Based Automation Chargin and Calibration station.
  - Turn power on
  - Automatic pump turns on and you see drop sampling hose into environment. Take readings instantly including H2S and CO.
  - Take Readings prior to entry and allow to run the entire time of entry.
  - Now there are remote monitoring that allows for remote attendants.

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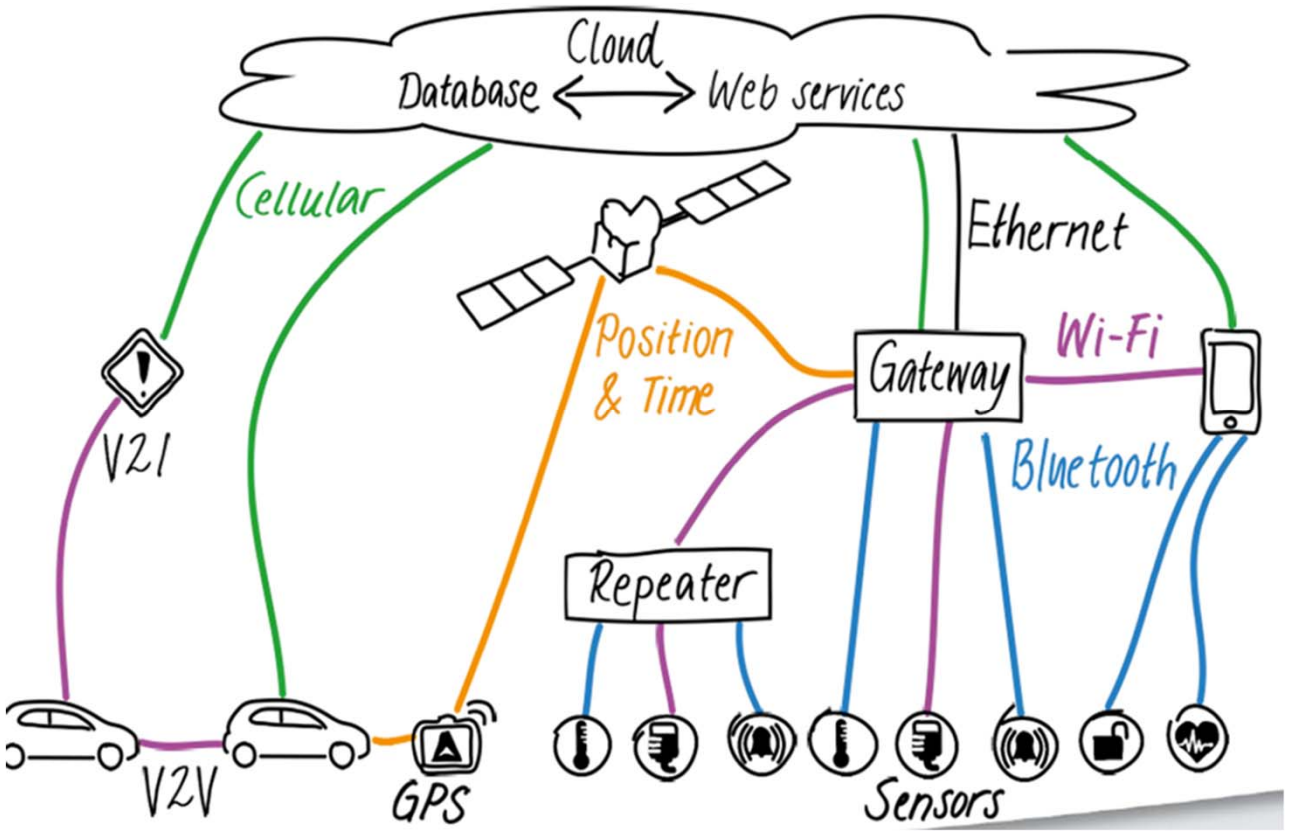
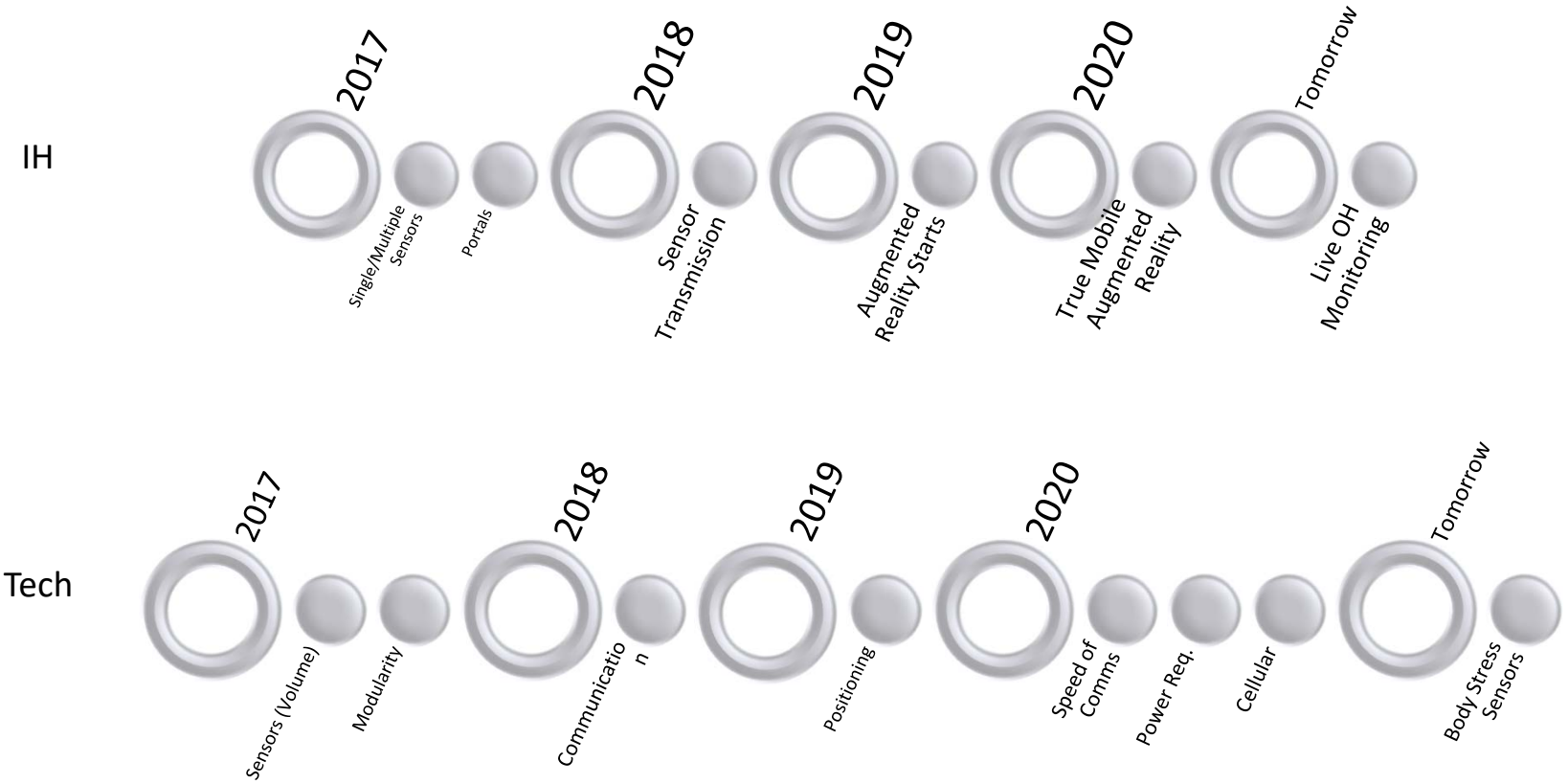
  - How will you integrate IOT?

Cloud Connect



Projecting Forward



Sensor Technology

PM sensor (optical) of PM 2.5 and PM 10	Continuous and simultaneous measurement	
CO2 (electrochemical)	0 to 20 ppm	15 ppb
CO (electrochemical)	0 to 20 ppm	15 ppb
NO2 (electrochemical)	0 to 20 ppm	15 ppb
H2S (electrochemical)	0 to 20 ppm	15 ppb
VOCs (Photo Ionization Detector)	0 to 2k ppb	15 ppb
SO2 (electrochemical)	0 to 20 ppm	1 ppb
O2		
O3		
Temperature, Humidity and Barometric Pressure		
Dimensions	H5 x L3.5 x D1.5″ (H128 x L85 x D38 mm), plugged into the Smart Sense	

Best Option-Real-Time and Sampling Kits

System automatically activates a Suma air sample or a pump to draw air through the appropriate media so you can obtain

- Meet detection limits
- Accuracy
- Specificity

California Wild Fires

- Sampling post wildfire.
- Project length: 3 months to 1 year.
- Locations: Perimeter outdoor and classroom.
- 14 monitors
- Sensors: CO2, NO2 & PM 2.5 & 10.
- Outdoor units in protective cases.
- Plug-in power plus external battery
- Connectivity: School District Network

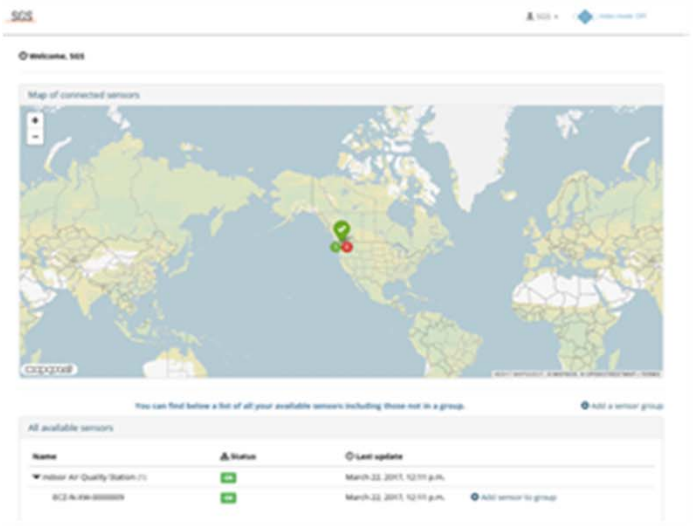
Warehouse Example

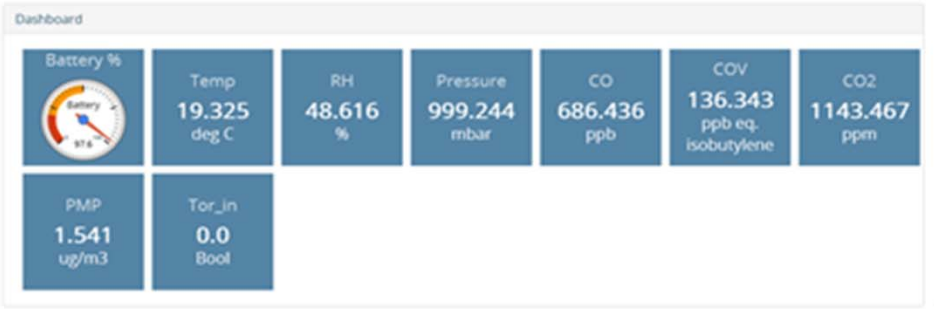
- Concern: Fuel cell folk-lifts inside a large warehouse.
- Pitched roof perfect for VOC collection.
    - Off-gas for fuel cell technology is Hydrogen
    - What's the concern?
    - Smart Sense units hoisted to the 50' high.
        - VOC readings high
        - Solution-Larger ventilation points

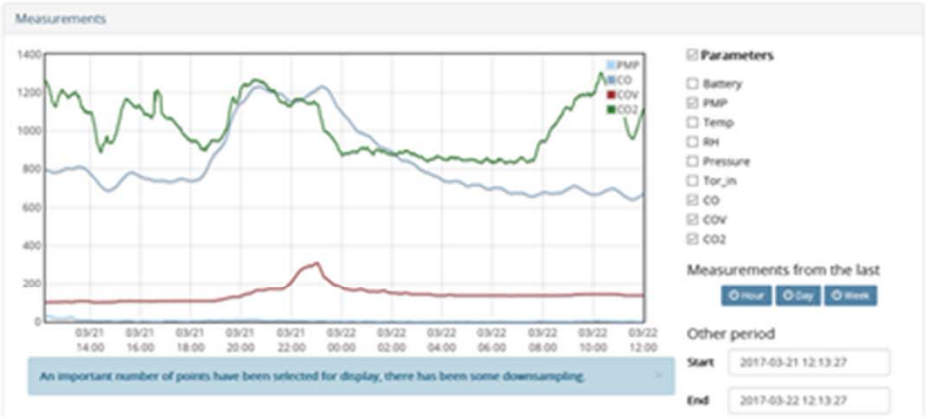
Hospital Example

- Odor complaints upon opening
- Units placed on roof/top 2 floors
- VOC sensor alert set at 300 ppm
- Emergency helicopter logs reviewed
- Smart Sense alerting data/times review
- Coloration of takeoffs/landing vs. alerts

User Interfaces







Time Series Data Example

ECM - **SGS0001-CL-1.56b**

Home | Time series | Download | Warnings | Reports

Time series

Date	9 minutes ago	an hour ago	an hour ago	an hour ago	an hour ago
Temp (deg F)	81.710	81.728	81.765	81.821	81.931
RH (%)	30.222	30.034	30.006	29.971	29.997
Pressure (mbar)	1003.536	1003.675	1003.655	1003.730	1003.824
CO (ppb)	207.390	176.652	172.880	166.446	173.252
NO2 (ppb)	13.860	6.628	6.557	7.010	7.888
SO2 (ppb)	0.000	0.000	0.000	0.000	0.000
VOC (ppb)	1836.344	1836.344	1836.344	1836.344	1836.344
CO instant (PPB)	207.390362324	191.443383868	191.739052209	192.182967865	152.835915013
NO2 instant (PPB)	13.8600220917	8.63776861528	6.9126136741	5.19691519054	5.2536391084
VOC instant (PPB - Isobutylene)	1836.34440104	1836.34440104	1836.34440104	1836.34440104	1836.34440104

More Information

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