VAPOR INTRUSION, AIR SAMPLING AT THE RIGHT TIME

SGS GALSON -SMART SENSE TECHNOLOGY

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WHEN YOU NEED TO BE SURE

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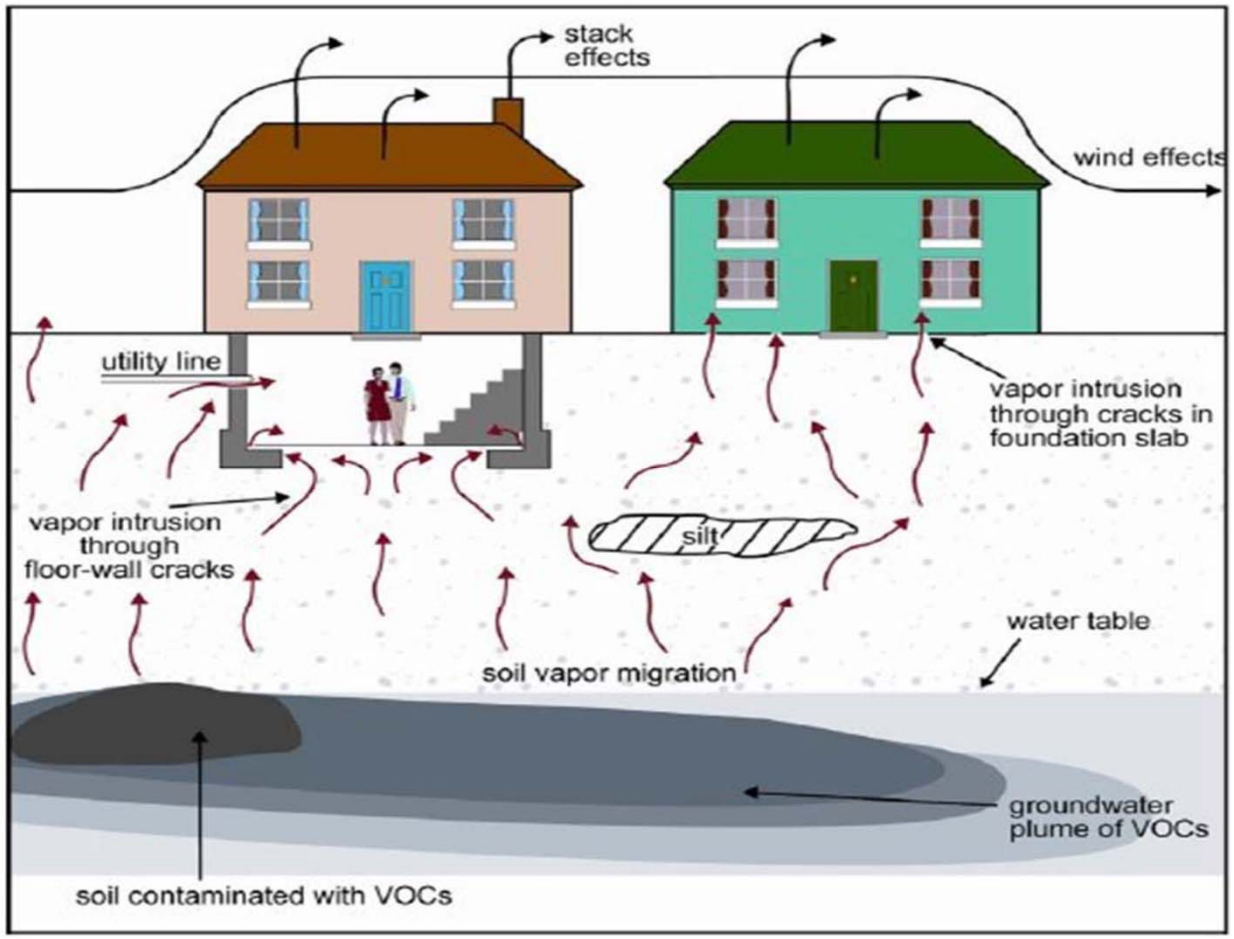
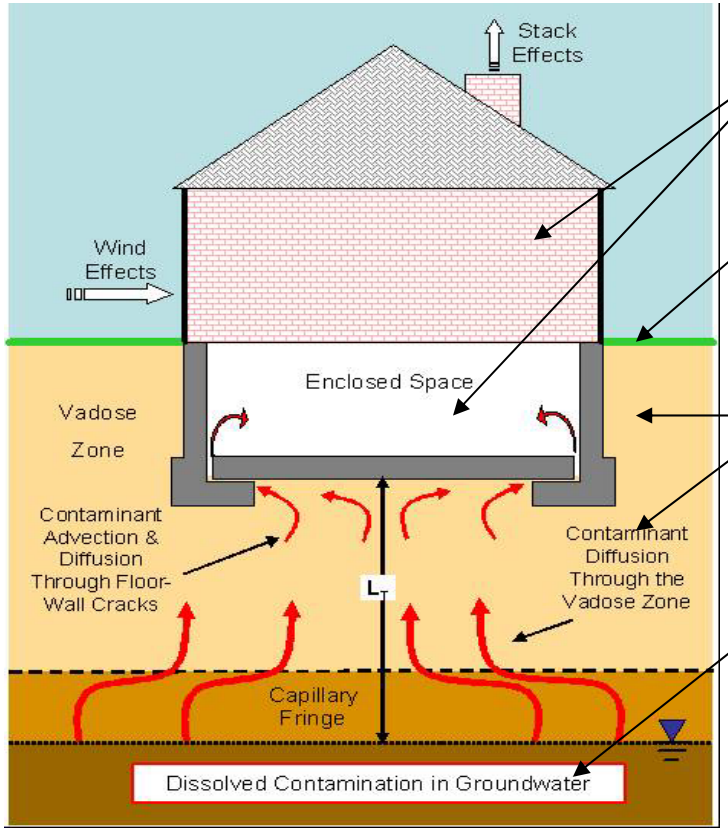
WHAT IS VAPOR INTRUSION?



When chemicals or petroleum products are spilled or leak from underground storage tanks, they can give off gases or vapors that can get inside buildings.

VAPOR INTRUSION PATHWAY SAMPLING



- **indoor Air. (Using SGS-Smart Sense Technology)**
- Soil Gas Sampling Exterior to Buildings.
- Sub-slab Soil Gas.
- Groundwater Sampling Near Buildings.

FACTORS EFFECTING VAPOR INTRUSION SAMPLING:

There are three key factors which determine equipment design for collecting soil gas samples for off site analysis:

- sample volume
- required flow rate
- required sampling duration

What about?

Atmospheric variable such as wind speed, barometric pressure or temperature

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SGS Clients around the World are deploying SGS SmartSense for:

- Investigating known or suspected air quality issues, in both indoor and ambient environments, including:
  - Vapour intrusion studies
  - Fenceline monitoring studies
- Supplementing traditional and regulatory defined monitoring methods with continuous monitoring data to improve understanding of overall conditions.
- Remotely and automatically capturing physical samples for lab analysis based on continuous data trends, when combined with the Sample Initiation System.

SAMPLING TIME

- Residential IA samples should be collected over a 24-hour period. For other sensitive use buildings, a sampling time less than 24 hours should NOT be considered unless there are very unique circumstances with clearly defensible technical justification. Otherwise, results from sensitive use buildings sampled less than 24 hours should be rejected.
- For non-residential settings, IA samples are typically collected over a 24-hour period. However, the investigator may shorten the sampling period to correspond to the average workday or the timeframe the building or floor of interest is occupied on a daily basis. The minimum sampling time is 8 hours with proper justification.

* From NJDEP VI Guidelines

SGS SMARTSENSE

Pre-calibrated replaceable sensor cartridges for easy maintenance

Nitrogen Dioxide (NO_2)

Particulates (PM1, PM2.5, PM10)

Temperature

Sulphur Dioxide (SO_2)

Nitric Oxide (NO)

Ozone (O_3)

Carbon Dioxide (CO_2)

Relative Humidity

Hydrogen Sulphide (H_2S)

Carbon Monoxide (CO)

Atmospheric Pressure

VOCs

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- Continuous monitoring with readings every 1 minute
- Interchangeable parameter configuration – select up to 6 air quality parameters in addition to Temperature, Humidity and Pressure.
- Various power source options – compatible with mains power supply, external battery, solar panel, or can be connected directly to supply from a street lighting column.
- Communications can be configured to use:
  - Local direct wi-fi connection
  - Internal SIM card
  - External 3G Hotspot
  - IoT gateway networks (LoRaWan, Zigbee, Sigfox)

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Sensor Specifications

Parameter	Display Unit	Measurement Range	Precision	Sensor Type
Temperature	°C or °F	-20 to 50 °C	-	-
Relative Humidity	%	0-100 %	-	-
Atmospheric Pressure	hPa	950-1050 hPa	-	-
Particulates (PM1, PM2.5, PM10)	$\mu g/m^3$	0-3000 $\mu g/m^3$	±4 $\mu g/m^3$	Optical
Nitrogen Dioxide (NO_2)	ppb or $\mu g/m^3$	0-5 ppm	±3 ppb	Electro-chemical
Sulphur Dioxide (SO_2)	ppb or $\mu g/m^3$	0-5 ppm	±5 ppb	Electro-chemical
Nitric Oxide (NO)	ppb or $\mu g/m^3$	0-5 ppm	±5 ppb	Electro-chemical
Ozone (O_3)	ppb or $\mu g/m^3$	0-5 ppm	±6 ppb	Electro-chemical
Carbon Dioxide (CO_2)	ppm	0-5000 ppm	±10 ppm	NDIR
Hydrogen Sulphide (H_2S)	ppb or $\mu g/m^3$	0-2 ppm	±2 ppb	Electro-chemical
Carbon Monoxide (CO)	ppb or $\mu g/m^3$	0-8 ppm	±10 ppb	Electro-chemical
VOCs	ppb eq. Isobutylene	0-5 ppm	±5 ppb	PID

SGS SMARTSENSE

Access, trend, compare, and export device data via a dedicated SGS SmartSense Web Dashboard

View device locations on a map, and select to see latest real-time data feeds

Create personal e-mail notifications to flag when particular devices exceed certain air quality parameter thresholds.

SGS SmartSense Demonstration Site available at:

- https://sgs.i-comesure.com
- Username: SGS-Global-Air
  - Password: password

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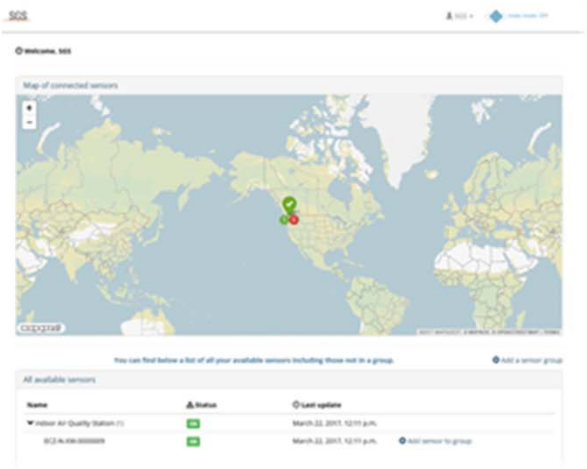
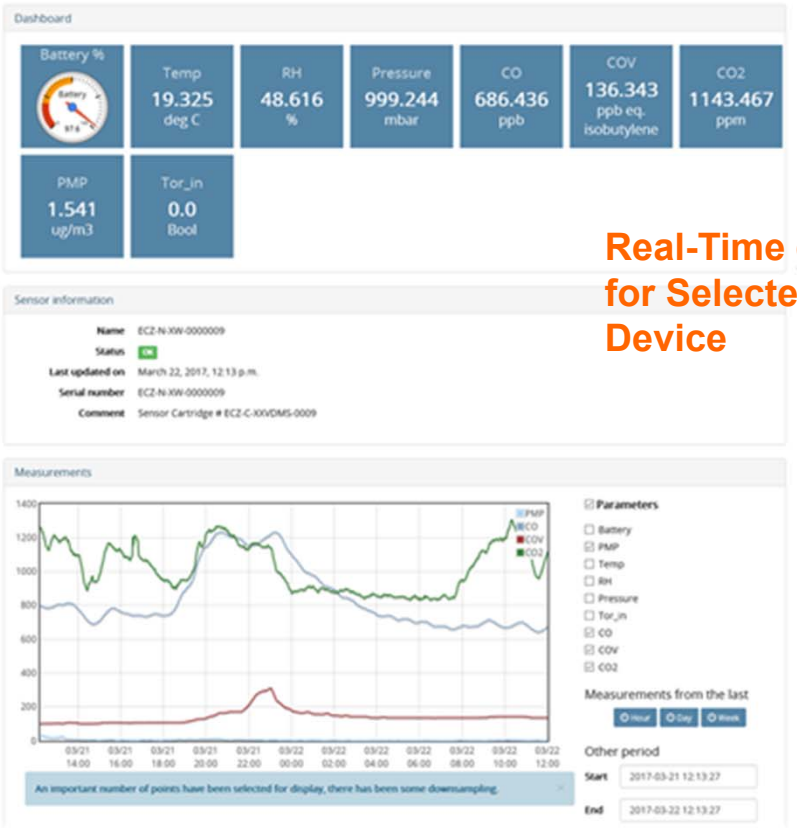
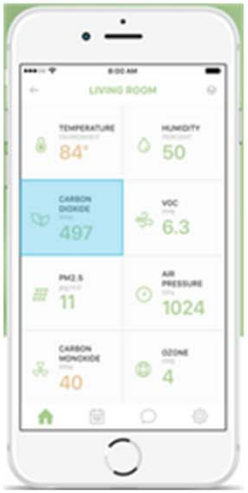
Device Locations with Current Status



Real-Time data for Selected Device



Key Data Events & Reporting via Mobile App



Time Series Charts by Parameter for Selected Devices

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SGSSMARTSENSE
can be combined with the SGS Sample Initiation System

Allows clients to capture validation samples for laboratory analysis.

Sampling can be initiated automatically based on data-driven air quality events (e.g. above threshold concentrations), or sampling can be triggered remotely by an engineer.

SGS SMARTSENSE

- SGS Sample Initiation System can be configured to:
  - Collect an instantaneous air sample with a Summa Canister
  - Initiate a pump system to collected a time delineated sample
- Trigger levels can be defined for multiple parameters, and can be duration weighted – e.g. trigger sample when concentration exceeds 1000ppm for 30 minutes.
- Samples can be initiated:
  - Automatically based on pre-defined trigger criteria; or
  - After client authorisation – system sends e-mail to client when exceedance criteria are met, client logs in to dashboard, reviews live data, and can then remotely trigger the sample collection.
- Samples can then be retrieved by local technician, with replacement of new sampling media, and samples dispatched to an SGS laboratory under a standard CoC.

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CASE STUDY: Investigating potential Vapour Intrusion events inside a Gas Station shop building.

ISSUE: Complaints of hydrocarbon odours in shop building, with toilet plumbing identified as potential pathway. Previous onsite inspections failed to align with an odour event, and installation of RAE Systems PID could not distinguish between possible vapour events and regular cleaning schedule.

SOLUTION: Installation of SGS SmartSense unit with Sample Initiation System for period of 1 month. VOC trigger alert set at 600ppb to send e-mail alert to engineer who reviews data online, confirms with shop staff that cleaning not in progress, and can then remotely fire a validation sample.

RESULT: Three validation samples collected for lab analysis during month, and all clearly indicate that hydrocarbon related vapours are present. Confirmation that vapour intrusion is occurring, and site progressed to a remedial action plan.

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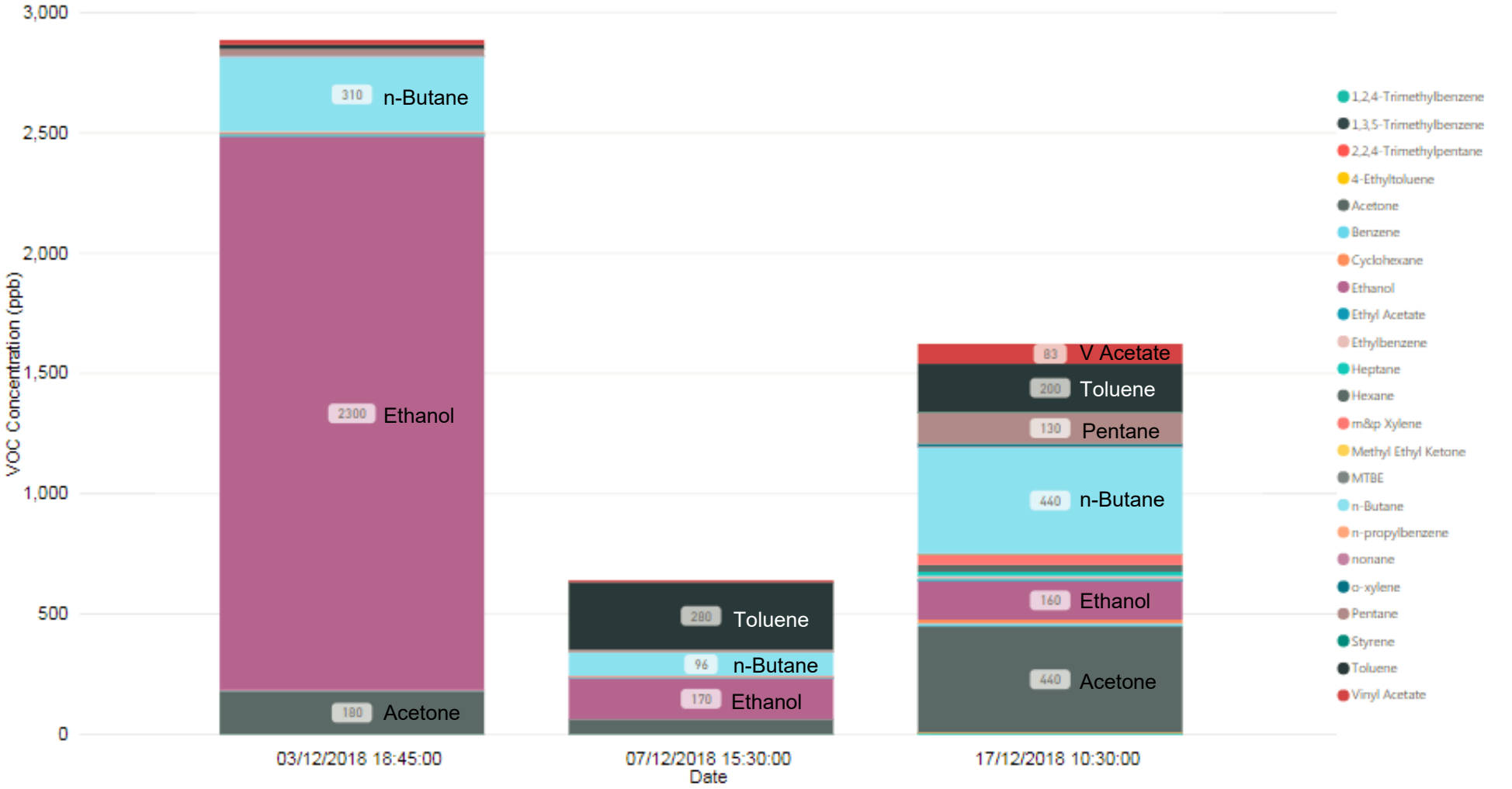
VOC Concentrations of Lab Samples captured by the Sample Initiation System



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SGS SmartSense Includes?

1. Supply, installation and ongoing technical support and maintenance of the SGS SmartSense monitoring units and SGS Sample Initiation Systems.
2. Access to the SGS SmartSense Dashboard for real-time data feeds, trending and downloading of data
3. E-mail notification service for threshold exceedances, and ability to remotely activate a sample collection.
4. Data reviews and advanced reporting options by SGS Air Quality experts.
5. Lab Analysis and Reporting of samples captured by the SGS Sample Initiation System.

EXPEDITED VI ASSESSMENTS

- Can see pattern within days
- Can determine if from VI or indoor source
- Can determine cause-and-effect relationships to support the development of a conceptual site model (CSM) for vapor fate and transport
- How often and time of day above screening level
- Background contributions to indoor air (household products)
    - Long Term Canister Sample
        - One number over sampling period
        - Can't see the pattern
        - No real-time feedback
        - Costly if multiple rooms, multiple events
    - Smart Sense VI
        - Can determine duration: hours? Days?
        - Can see the pattern! Day vs night? HVAC?
        - Immediate response – H&S to occupants

EXPEDITED BUILDING REMEDIES

- Can try various remedies & see effects
  - HVAC modifications
  - Fans on/off
  - Air filtration units
  - Sealing sumps & cracks
- Remediation & Mitigation System Monitoring
  - Thermal Heating
  - Sub-Slab Depressurization Systems
  - In-Situ GW/Soil Remediation

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For further information about SGS SmartSense, or to get a quote or demonstration, please contact:

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