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Landfill gas detection

Presentation
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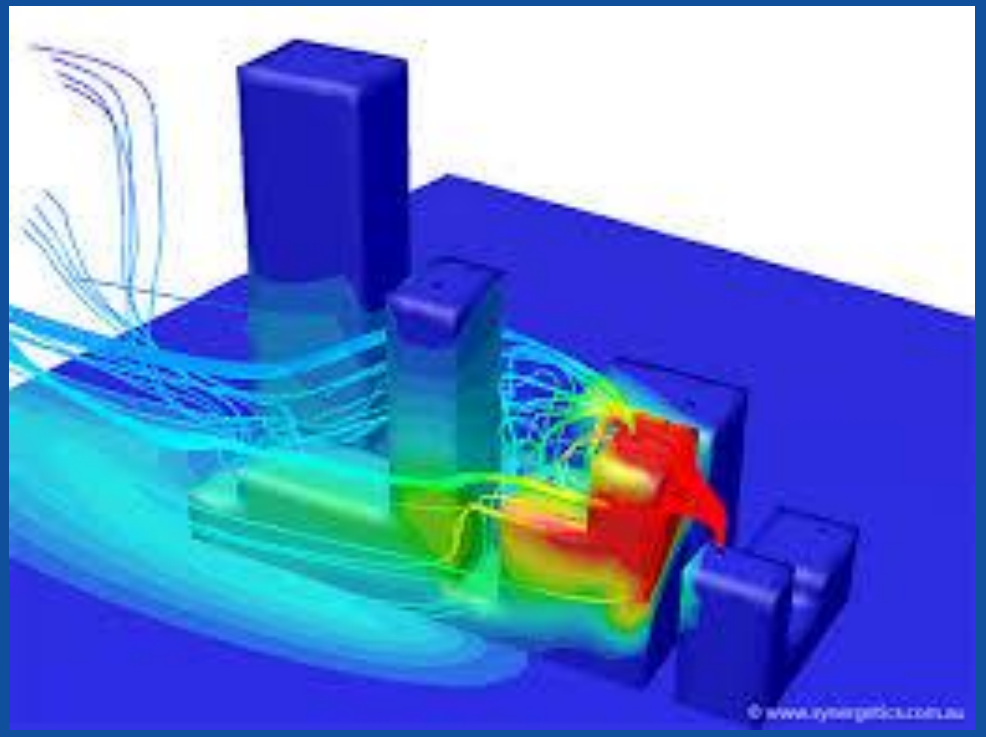
What is gas?

- Gas is a swarm of molecules moving randomly and chaotically
- Gases fill any available volume and will mix rapidly into any atmosphere



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Flame Safety Lamp (Davy Lamp)

- The **Geordie lamp** was a safety lamp for use in inflammable atmospheres, invented by George Stephenson in 1815 as a miner's lamp to prevent explosions due to firedamp in coal mines.

- The presence of dangerous amounts of firedamp in the incoming air would (by its combustion) reduce the oxygen concentration inside the lamp so much that the flame would be extinguished.

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Animals – In mines

- Canaries used in UK pits since 1911, two canaries employed by each pit.
- Canaries were not the only animals used – mice too.
- Tests conducted by the Bureau of Mines favoured canaries due to reaction to CO at low concentrations.
- 30th December 1986: Coal mine canaries made redundant in UK

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The Dräger Sensors

Electrochemical

Catalytic Bead

Infra red

- The Sensor is the most important part of any Gas Detector.
- Sensors uses physical and chemical properties like absorption, adsorption, electrochemical reaction, combustion, ultrasonic waves, photo ionisation etc. to measure the concentration of gas
- Sensors are selected based on the gas to be detected, application, environmental conditions and customer experience.

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Types of sensor elements and Life span of sensors

- Electrochemical sensors, are for toxic gases, they have a life span of 3-5 years
- Electrochemical sensors can be effected by chemicals and silicon.
- Electrochemical sensors are robust and can be knocked.

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Types of sensor elements and Life span of sensors

- Catalytic sensors have life span of 3-5 years, depending on the environment, other chemicals in the area and how much gas the sensors have come across.
- You use catalytic sensors for flammable gases
- Catalytic sensors are robust to being knocked, but can be poisoned by silicon's and other chemicals

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Types of sensor elements and Life span of sensors

- IR (Infrared) sensors have a life span of 5-7 years
- IR is used for Co2 and flammable gases
- IR sensors are less effected by chemical and not effected by silicons, but are not as robust can not be knocked.

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Gases that might need to be detected at a landfill or Bio gas site

The 2 main gases that will need to be detected are Ch4 (Methane) and Co2 Carbon dioxide

There are other gases that could be present such as H2S (hydrogen Sulphide), and VOC's (Volatile Organic Chemicals)

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Ways to detect gas on site

There are 2 ways of detection.

portable
Fixed

The gas detection sensing device on site must be Ex rating

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Hand held portable devices

These can detect normally from 1 to 4 different gases
These devices are normally carried on the person walking around site
They will have 3 alarms forms, vibration, audible and visual
The batteries will last about 8 hours and should be calibrated every 6 months.
This device also log data

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Area portables

These devices that can be left on the ground, in the area you want to analyse. They will be able to detect many gases.
They can also send information wirelessly.
This device can be moved around site to detect different areas.

SIZE: 15.8 x 11.4 x 18.5 in. / 40.0 x 29.0 x 47.0 cm
WEIGHT: 17.6 lbs. / 8 kg
GASSAMPLING METHOD: Pumped or diffusion
GASSENSOR SLOTS: Up to 6
BATTERY: Rechargeable Li-ion battery (3.7V / 26.4 Ah)

CHARGING TIME: Less than 18 hours when instrument is powered off
RUNNING TIME: 8 weeks for low-power model; other models vary by configuration
KEYPADS: One-button operation and programming
DISPLAY: 3.5” 240 x 320 TFT colour LCD with white LED backlight
ALARM: Red/yellow/green LED alarm; buzzer alarm 108 dBA@ 1 m; on-screen indication of alarm conditions

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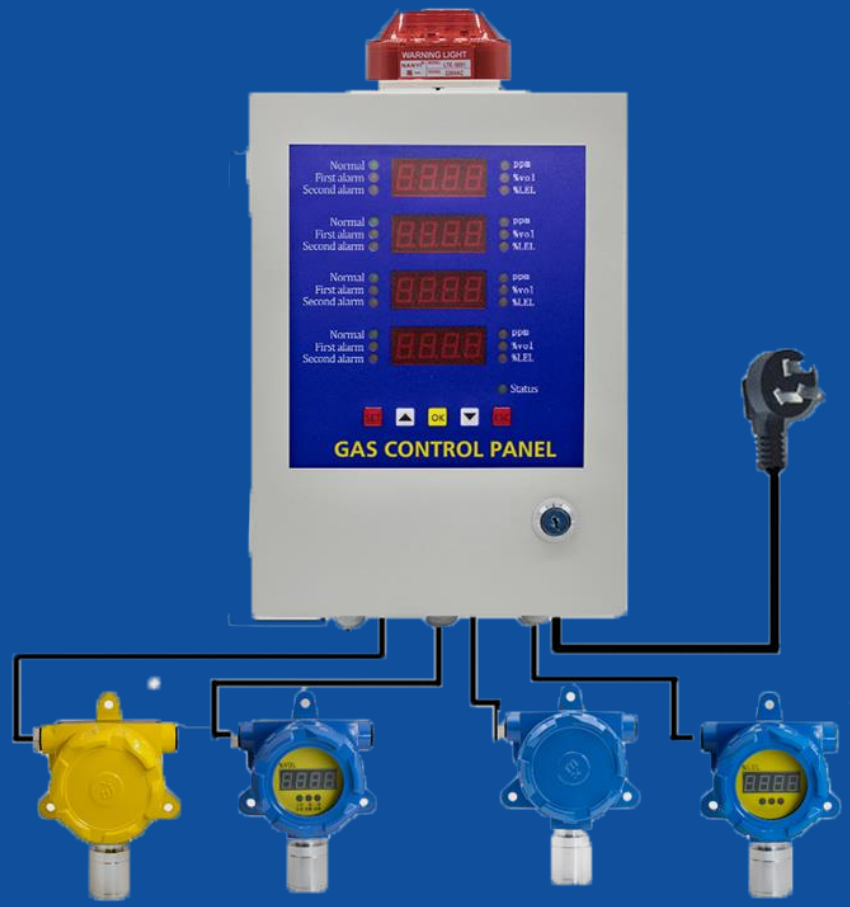
Fixed sensors

These can be sensors out in the field and wired back to a panel.
The sensors have to be ex rated and can have a display on the sensor, or no display.
The information that comes back from the field, can be disseminated in many ways.

- Siren strobes
- Sms
- Graphs



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With a fixed sensor installation, you will need to have a weak point in the ground, so a hole must be made in the ground and the gases will go to the weak point to escape.
Place the sensor above the hole 200mm roughly.
These sensors will need to be connected to a panel, in the office/plant room.
The sensors can be connected either by individual cable runs, one sensor per cable, or on a daisy chain method, so numerous sensors on one cable.

Your draw back is that each sensor can only detect one gas, so if you have more than one gas to be detected, you require more than one sensor.

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Sampling system

- Wide range of sensor types
- 4 line alpha/numeric display
- Selectable sample line sequence
- Display of each sample line location
- Event logging / Modbus / RS232 / RS485
- Line blockage and pump fail monitoring
- Variable sample time for optimum cycle time
- Monitor up to 2 gas types, 4 as special build
- Centralised one man calibration offers minimum running costs
- Auto flood cut off
- Max length 200m specials 300m+

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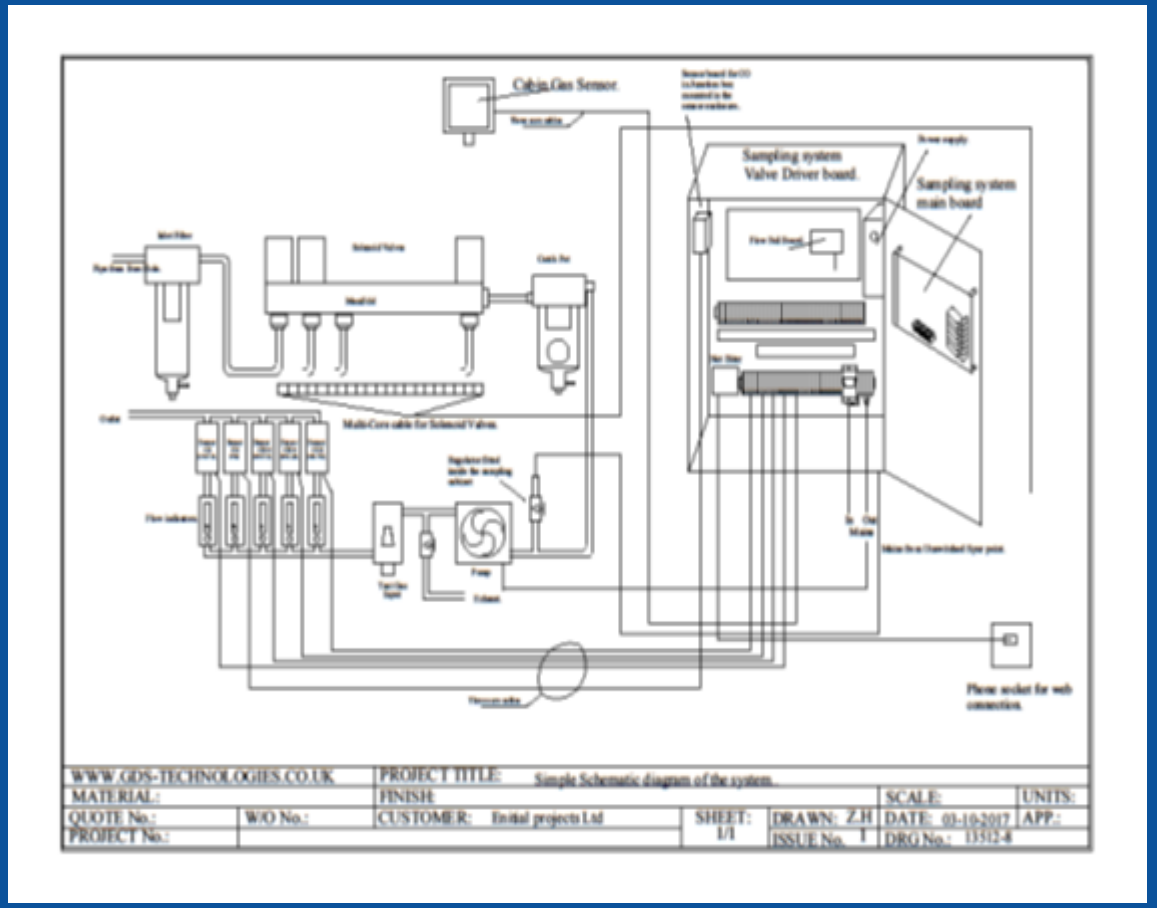
Sampling systems

There is a cabinet, that holds the sensors, that needs to detect the gases on site.
There are sampling lines that go out into the field to the areas that need to be detected.
There are valves in the cabinet, that open, every minute one by one and allow an area to be tested.
You may have many sample lines, but only one sensor for all the lines, or you could have numerous sensors per sampling line.



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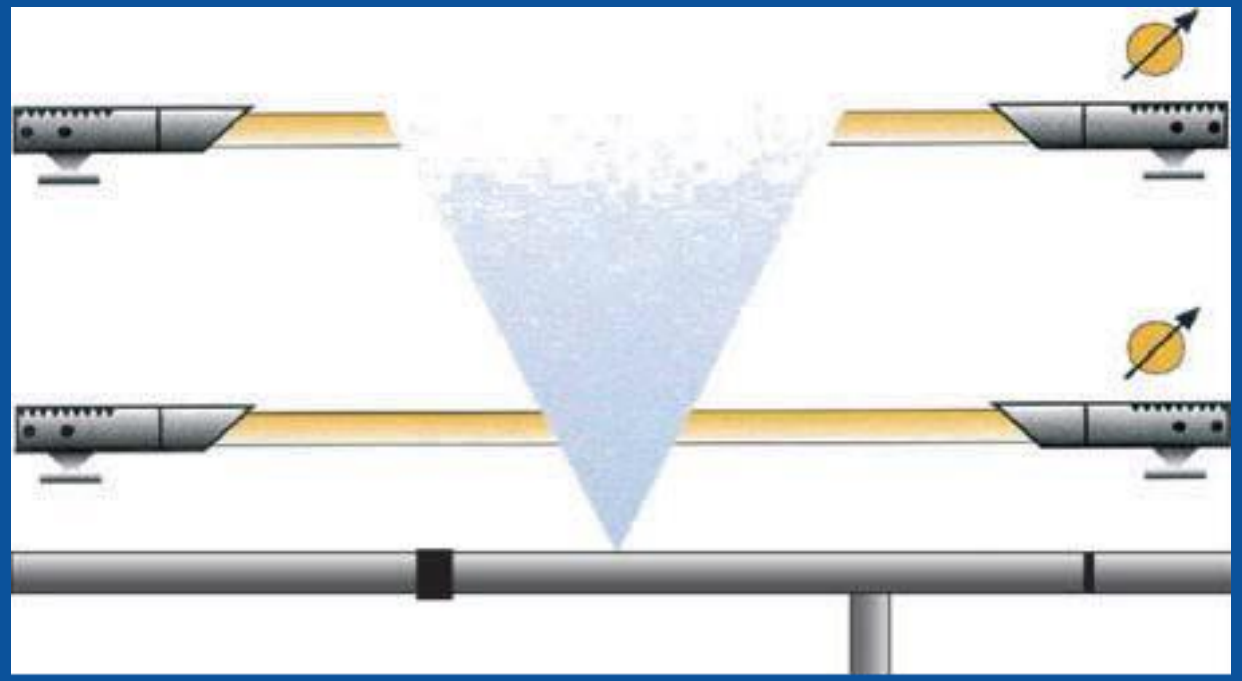
Open path detection

You have a receiver and transmitter
These devices can cover a straight line of between 50 to 250m, but the cloud of gas must break the beam, for an activation, and just like the fixed sensors this information can go back to a panel.
The beam is narrow.



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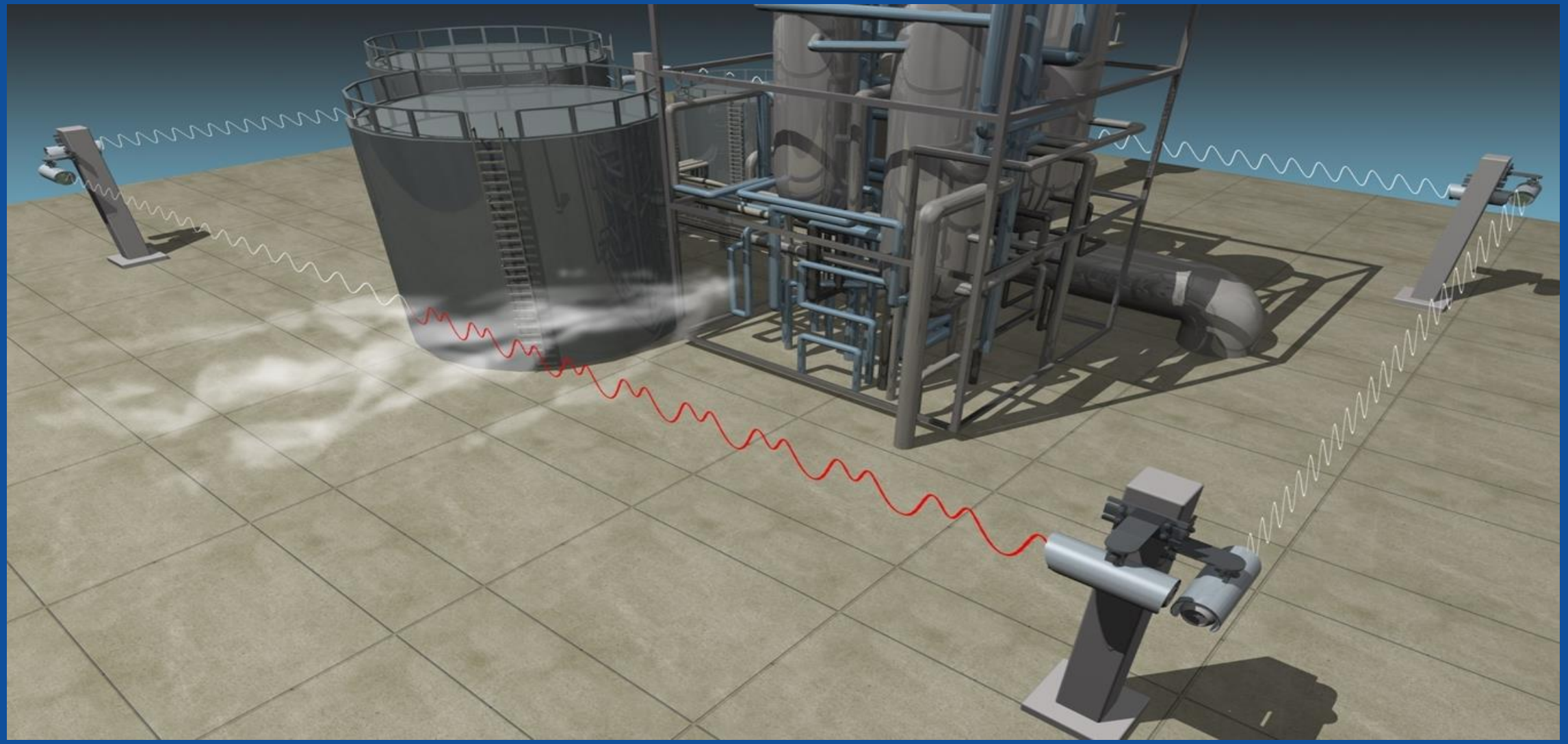

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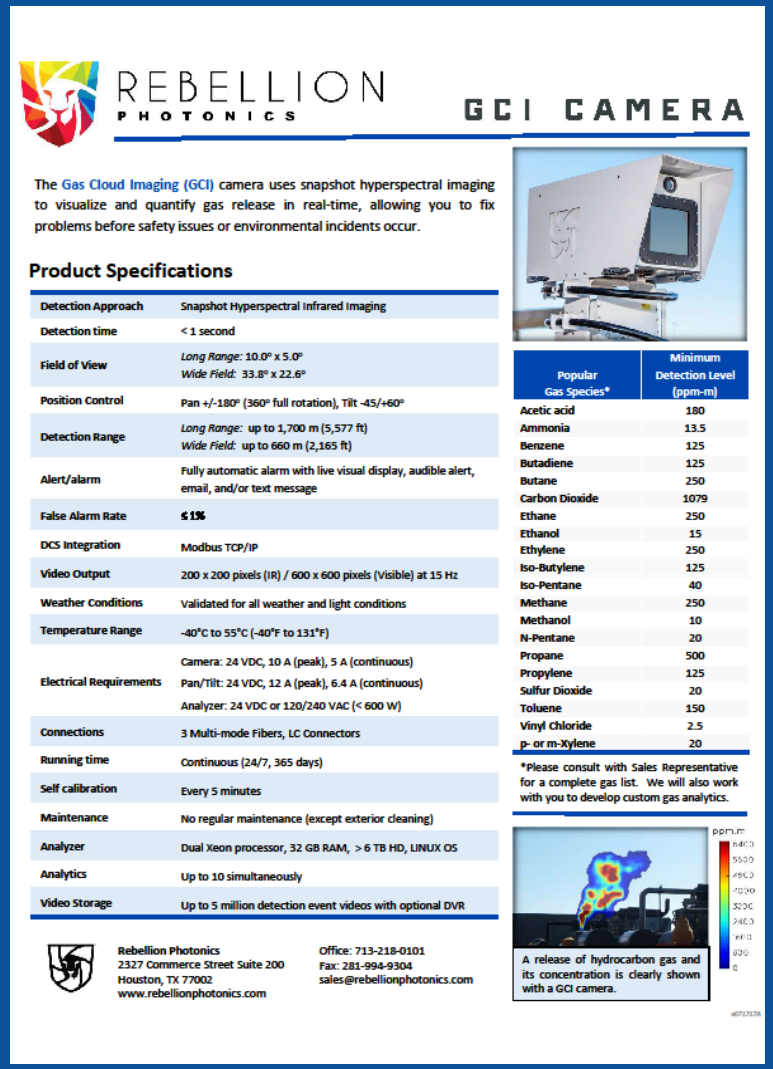
Cloud imaging

Detection Approach : Snapshot Hyperspectral
Infrared: imaging
Detection time: 1 second
Field of View: Long Range: 10.0o x 5.0o
: Wide Field: 33.8o x 22.6o
Position Control Pan +/-180o (360o full rotation), Tilt - 45/+60o
Detection Range - Long Range: up to 1,700 m (5,577 ft)
- Wide Field: up to 660 m (2,165 ft)
Alert/alarm -Fully automatic alarm with live visual display, audible alert, email, and/or text message
False Alarm Rate
DCS Integration Modbus TCP/IP
Weather Conditions Validated for all weather and light conditions
Temperature Range -40°C to 55°C (-40°F to 131°F)



REBELLION PHOTONICS

GCI CAMERA

The Gas Cloud Imaging (GCI) camera uses snapshot hyperspectral imaging to visualize and quantify gas release in real-time, allowing you to fix problems before safety issues or environmental incidents occur.

Product Specifications

Detection Approach	Snapshot Hyperspectral Infrared Imaging
Detection time	< 1 second
Field of View	*Long Range:* 10.0° x 5.0° *Wide Field:* 33.8° x 22.6°
Position Control	Pan +/-180° (360° full rotation), Tilt -45/+60°
Detection Range	*Long Range:* up to 1,700 m (5,577 ft) *Wide Field:* up to 660 m (2,165 ft)
Alert/alarm	Fully automatic alarm with live visual display, audible alert, email, and/or text message
False Alarm Rate	≤ 1%
DCS Integration	Modbus TCP/IP
Video Output	200 x 200 pixels (IR) / 600 x 600 pixels (Visible) at 15 Hz
Weather Conditions	Validated for all weather and light conditions
Temperature Range	-40°C to 55°C (-40°F to 131°F)
Electrical Requirements	Camera: 24 VDC, 10 A (peak), 5 A (continuous) Pan/Tilt: 24 VDC, 12 A (peak), 6.4 A (continuous) Analyzer: 24 VDC or 120/240 VAC (< 600 W)
Connections	3 Multi-mode Fibers, LC Connectors
Running time	Continuous (24/7, 365 days)
Self calibration	Every 5 minutes
Maintenance	No regular maintenance (except exterior cleaning)
Analyzer	Dual Xeon processor, 32 GB RAM, > 6 TB HD, LINUX OS
Analytics	Up to 10 simultaneously
Video Storage	Up to 5 million detection event videos with optional DVR

Popular Gas Species*	Minimum Detection Level (ppm-m)
Acetic acid	180
Ammonia	13.5
Benzene	125
Butadiene	125
Butane	250
Carbon Dioxide	1079
Ethane	250
Ethanol	15
Ethylene	250
Iso-Butylene	125
Iso-Pentane	40
Methane	250
Methanol	10
N-Pentane	20
Propane	500
Propylene	125
Sulfur Dioxide	20
Toluene	150
Vinyl Chloride	2.5
p- or m-Xylene	20

*Please consult with Sales Representative for a complete gas list. We will also work with you to develop custom gas analytics.

A release of hydrocarbon gas and its concentration is clearly shown with a GCI camera.

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Questions?

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Thank you.

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