Chemours™

Multimode Gasdetection and Response

Safety Obsession

Charles Mulder
PSM Leader Chemours EMEA

PS Conference May 15, 2019, Dordrecht

What I want to share with you today

- About Chemours
  - One of our core values is safety obsession
- Aside: Chemours on track to minimize GenX emissions
- Multi Mode Gas Detection in Practice
  - For early detection of PSM Events
  - To find and eliminate fugitive emissions
  - To evaluate worker exposure
  - Technology selection
  - Lay-out
  - Response to detection

Chemours™

About Chemours

- Chemours fluoroproducts help give ordinary things extraordinary capabilities, from the cars we drive to the smartphones we carry
- An independently operating spin-off from DuPont
- Works well-within current safety and environmental requirements and standards
- Actively contributes to communities dialogue and the public debate
- Applies core values and practice-oriented focus upon continuous improvement of safety, health and environmental impact

Chemours™

- Fluoropolymers are manufactured in Dordrecht since 1967
- Was spotlighted late 2015, when good relations with the neighborhood were lacking
- In 2016 Chemours launched a so-called Four Points Plan to restore trust among communities' citizens

Core values

Refreshing simplicity

Safety Obsession

Customer centered

Collective entrepreneurship

Unshakable integrity

Safety

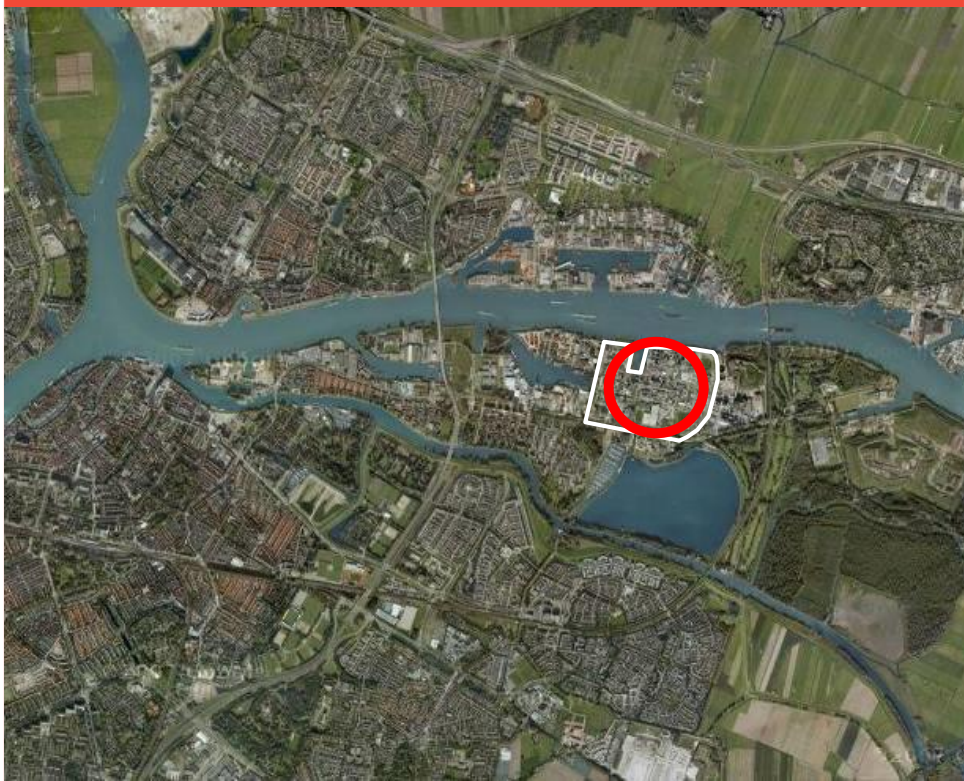
Our number 1 priority

- For many years investments are made in improving site safety
- Investment efforts confirmed in annual scheduled and unscheduled government audits - a.o. because of Seveso guideline (BZRO)
- Independent and reputable DNV GL agency classified a process safety audit carried out in 2018 at Chemours in range "Best in Class" with an 83% score
- Witteveen+Bos assessment says 'Chemours uses a studious and thorough method to ensure the process safety of the production site in Dordrecht'

Chemours™

Risk contour of the Baanhoekweg site is 10^{-6}

- What does 'risk contour' 10^{-6} mean?
  - The chance of 1 in 1,000,000 years of a fatality
- Proud about our safety performance:
  - More than 7 years no LWC with employees
  - More than 15 years no LWC employees with contractors



Aside: On track to minimize GenX emissions

- Chemours aspires to be the industry leader in emission reductions
- GenX is a polymer production aid (potentially a substance of high concern)
- Year end 2017: 97% of GenX is either recycled or destructed (within permit)
- Year end 2017: 3% was emitted and has always been within the permit
- Chemours will reduce GenX emission further with another 99% or more by 2020
- So by 2020 99.97% of GenX will be recycled or destructed
- € 75 million is being invested, first results are visible
- Chemours detects GenX at ppt level (nano gram/l)
- Emissions of other fluorinated substances will also be reduced with 99% by 2030.
- Carbon positive by 2050

Chemours™

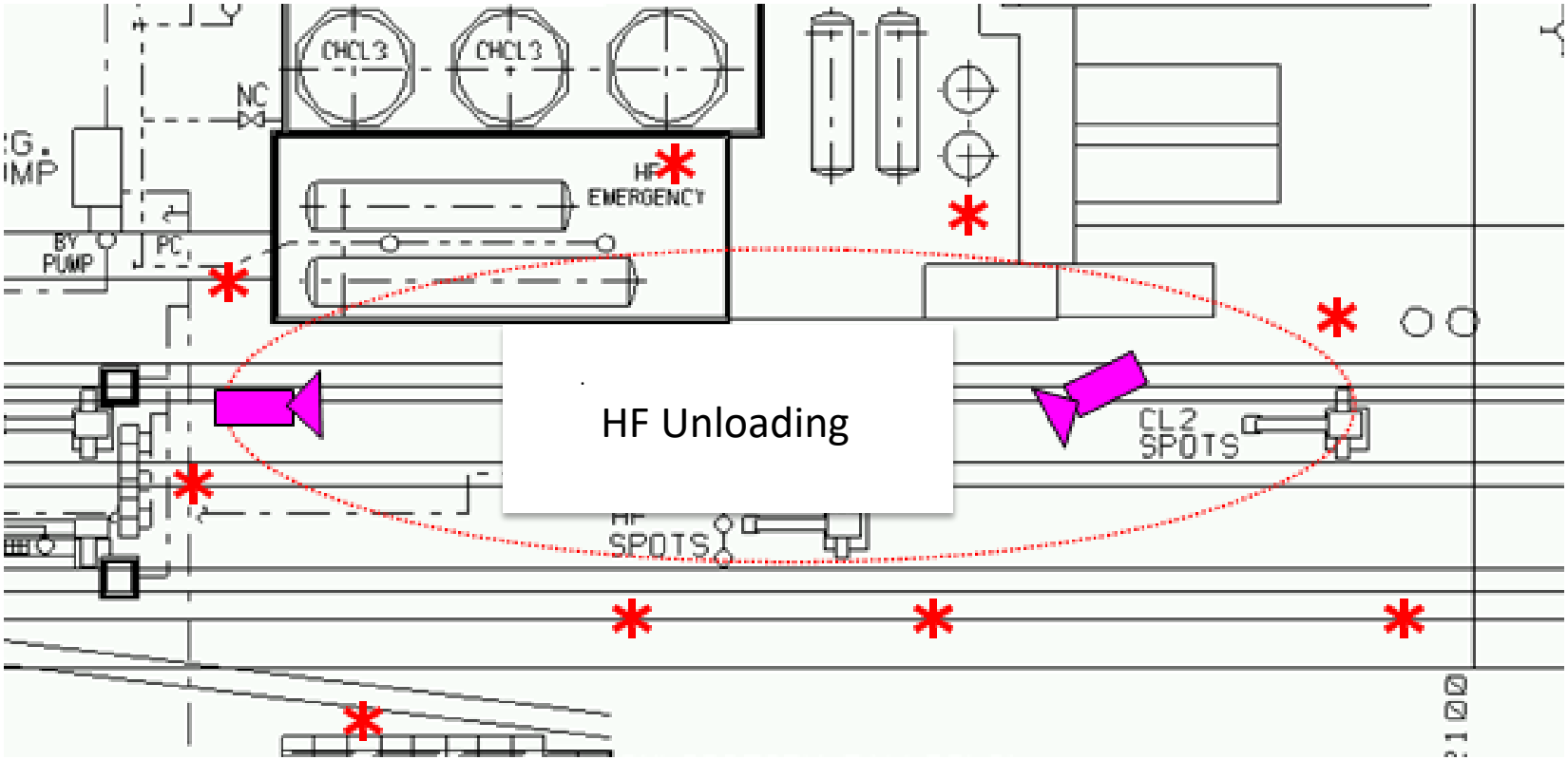
Immediate detection of gasses at very low levels

- Hydrofluoric Acid - 0.05 ppm
- HydroChloric acid - 1 ppm, 10 ppm/m
- Hexafluoropropylene – 0.5 ppm, no odor, not visible
- PerFluoroIsoButylene – 0.5 ppb, no odor, not visible
- TFE – 0.5 ppm
- Others

HF Gas detection – Fixed point

- Electrochemical Cell
- Also detects HCl and Cl2
- Low investment €2300
- High maintenance
  - Regular Calibration
  - Regular Cell replacement
- Automatic activation of:
  - Unloading ESD
  - Water curtain

HF Fixed point detectors Lay-out



Portable leak detector HF

- Laser wave length absorption inside
- Reading in seconds
- Very practical
- Very sensitive: 0.05 ppm
- Cost €13,000

Chemours™

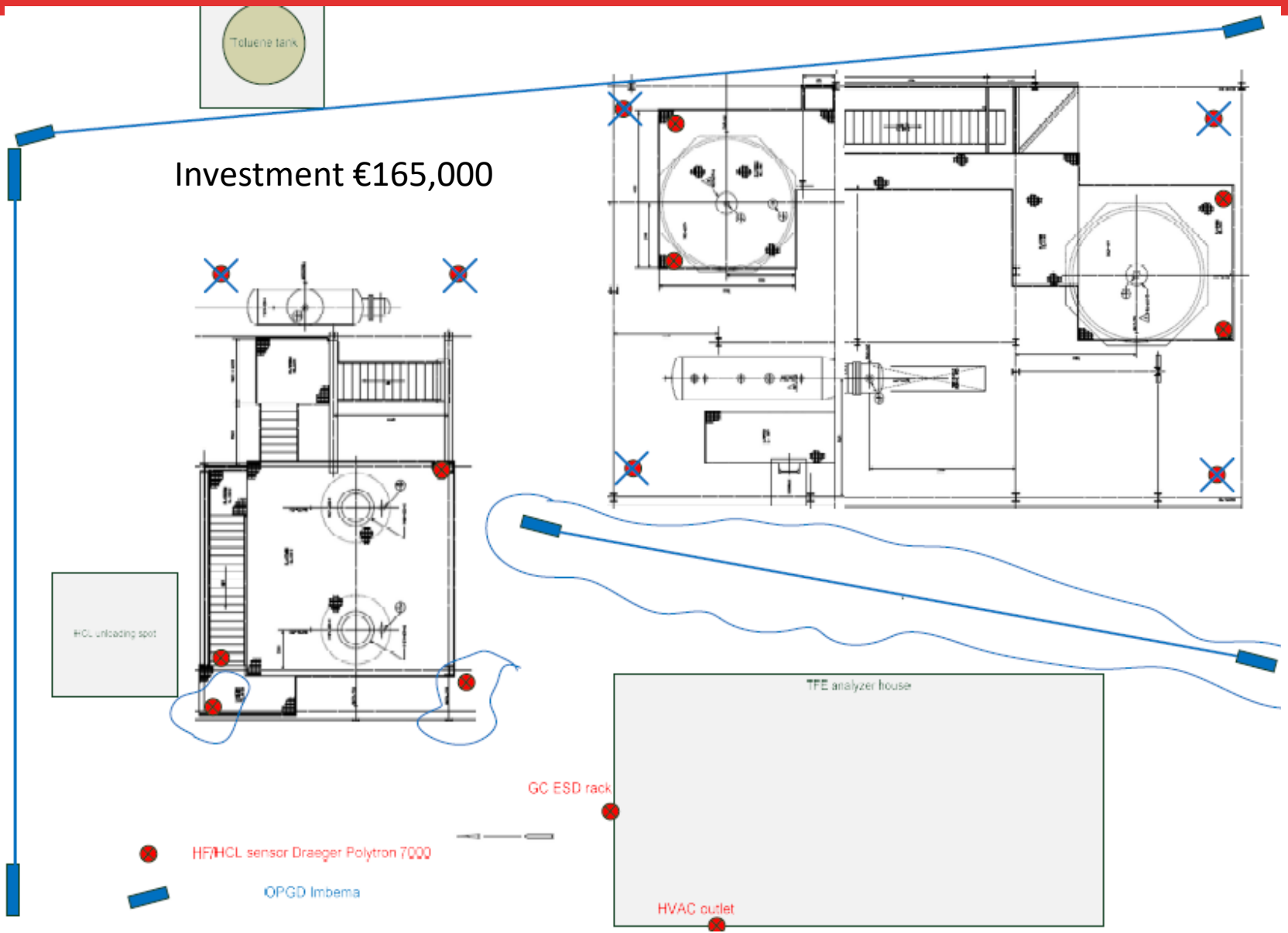
HCl Storage: Open Path gasdetection

- Laser wave length absorption open path
- Very specific for substance
- Low Detection limit 10ppm.m
- Perimeter guarding
- High investment
- Maintenance very low
- Lowest total life cycle cost
- More detections
- Automatic ESD on AHCL unloading

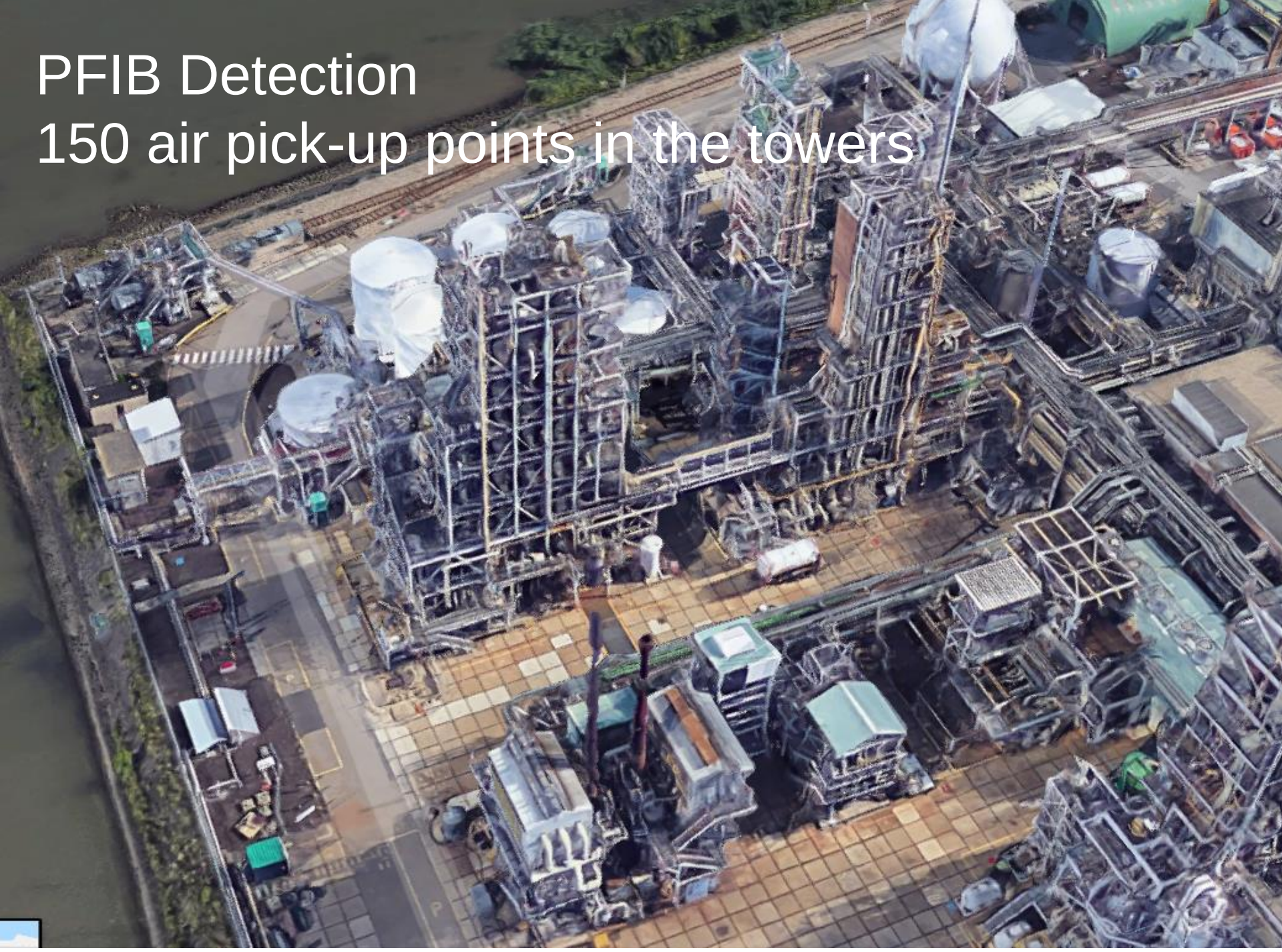
Chemours™

Open Path gas Detection Lay-out

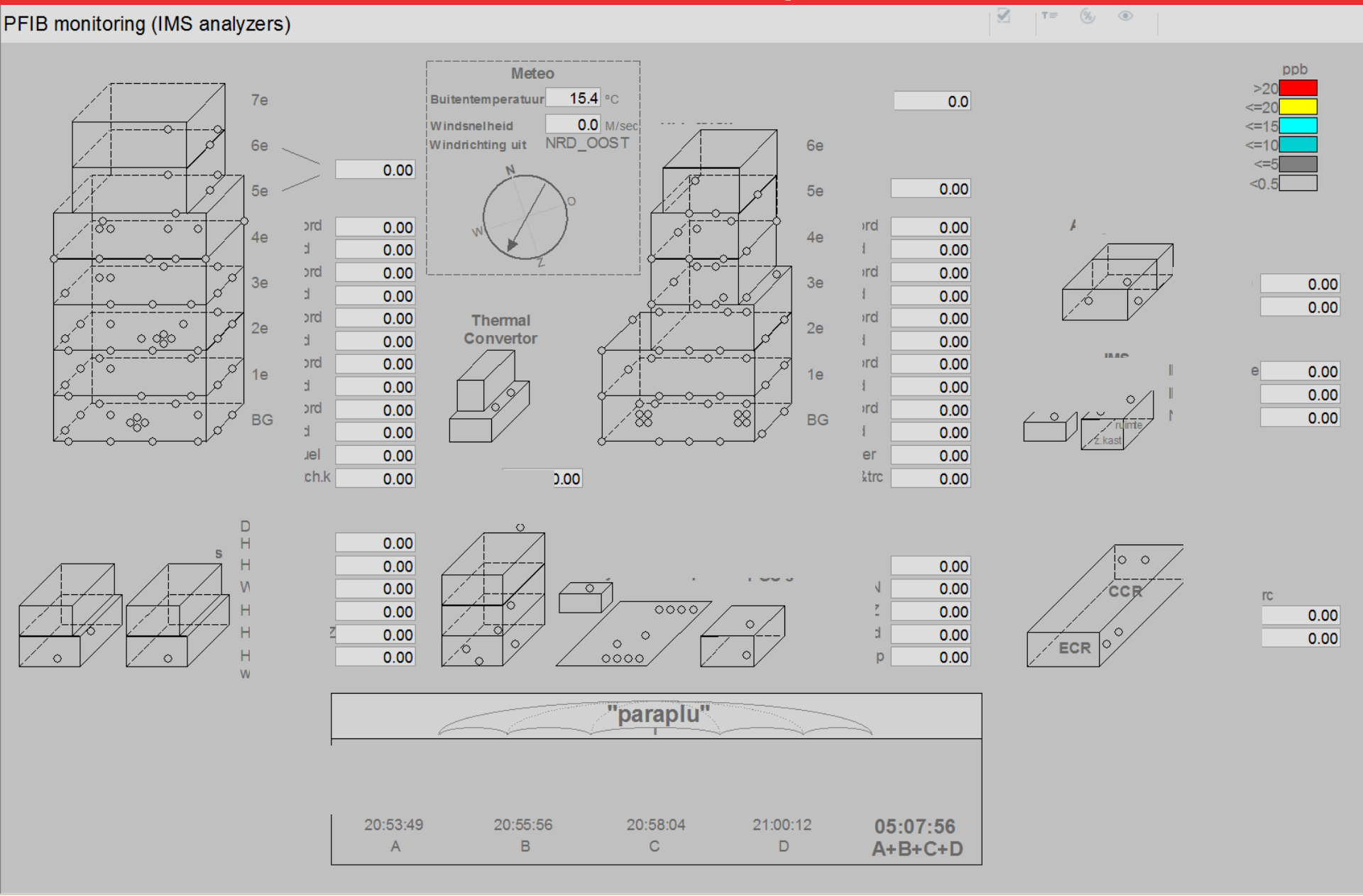
Investment €165,000



PFIB Detection
150 air pick-up points in the towers



Alarm communication to operator



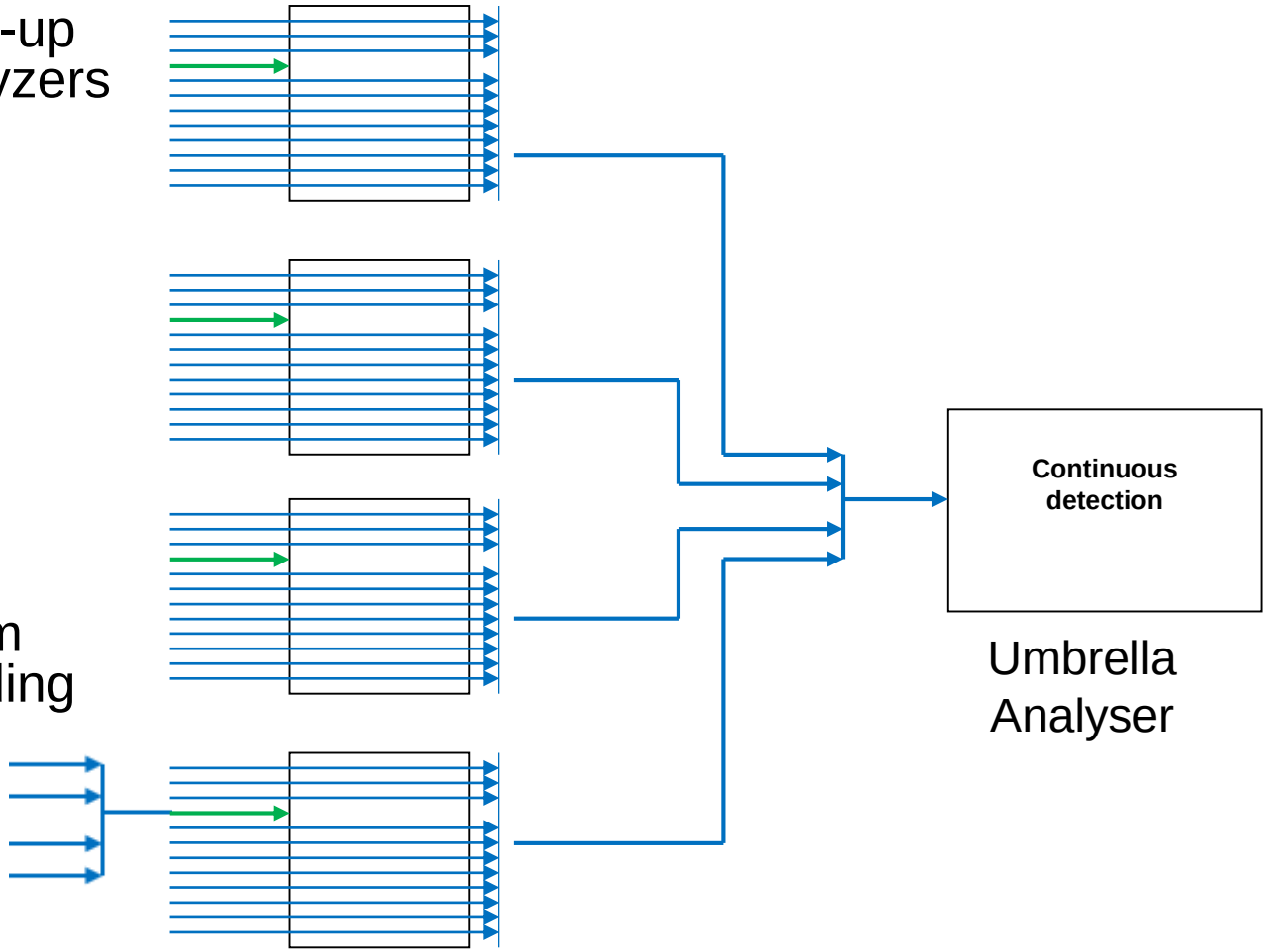
PFIB Detection set up

More than 150 air pick-up points flow into 4 analyzers

Umbrella analyzes all streams continuously

This combines early warning and a low detection limit

Response: Automatic tower evacuation alarm and shut down of building ventilation



Chemours™

PFIB rack mounted analyzer

- Ion Mobility
- Very selective
- High investment €70,000
- Detection limit 0.5 ppb

Chemours™

PFIB Portable Detector

- Ion Mobility
- Detection limit: 0.5 ppb
- Investment €50,000
- In use: 2

Chemours™

HFP/TFE Air monitor

- FTIR-Technology
- Range 0-10/50 ppm
- Detection limit 0.5 ppmv
- Investment €57,000
- 32 streams
- Respons 90 s
- In use: 2
- HFP/TFE/Dimer

Chemours™

For HFP leak detection

- InfraRed absorption
- Very practicable
- Reading in seconds
- Long battery life
- Cost: €1600

HFP Personal Air Sampling

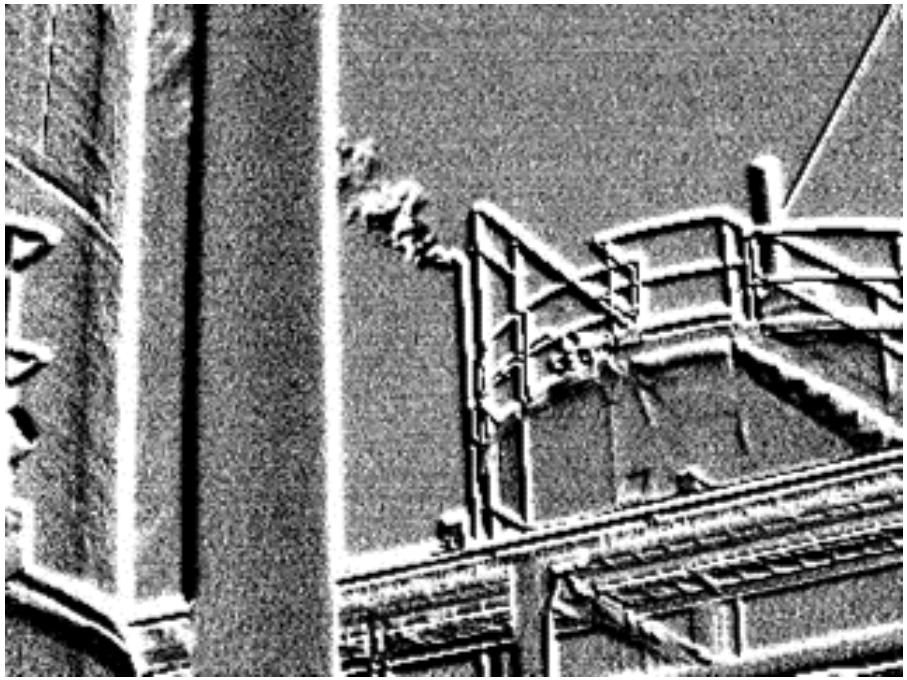
- Novel Technology
- Helium Diffusion Sampling
- By ALS Labs
- 8 hour task or location
- 5-400 ppb range
- €175 per sampler all in (incl analysis and shipping)

Chemours™

HFP/TFE/F22 Portable Gas detector
FLIR Camera

- Infra Red Technology
- Long range “eye”
- Detection limit ~0.1%(lab)
- Investment €50,000
- In use: 2
- For Fugitive emissions
- For group of chemicals
- Vendor has other models for other groups of chemicals
- Not suitable for LDAR

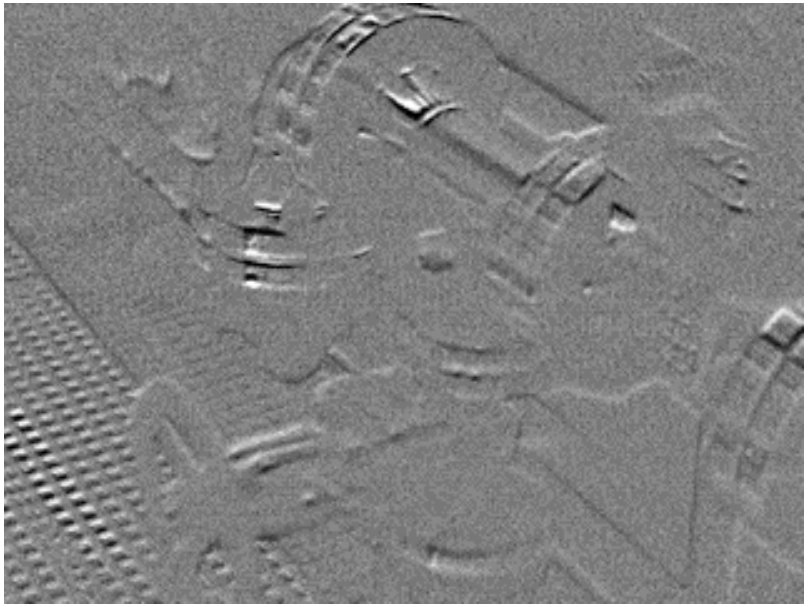
Demo FLIR camera – Long range detection



This known emission has already been eliminated (video’s)

Chemours™

Demo FLIR GF304 camera



1- Very small fugitive leak at blindflange (video)

2- After replacing gasket (video)

Chemours™

Conclusions

- A combination of point, open path and portable and technologies and arrangements must be considered for best early warning and protection
- Detectors readings are indicative not quantitative
- Use detector readings for manual or automatic (preferred) ESD, mitigation activation, automatic evac lights and building ventilation shut down
- The FLIR Camera has a unique property of measuring at distance from detector
- Portables can be used in emergency response to quickly measure at the fence line in case of leaks to advise authorities on evacuation zone size

THANK YOU FOR YOUR ATTENTION! ANY QUESTIONS?

Chemours™