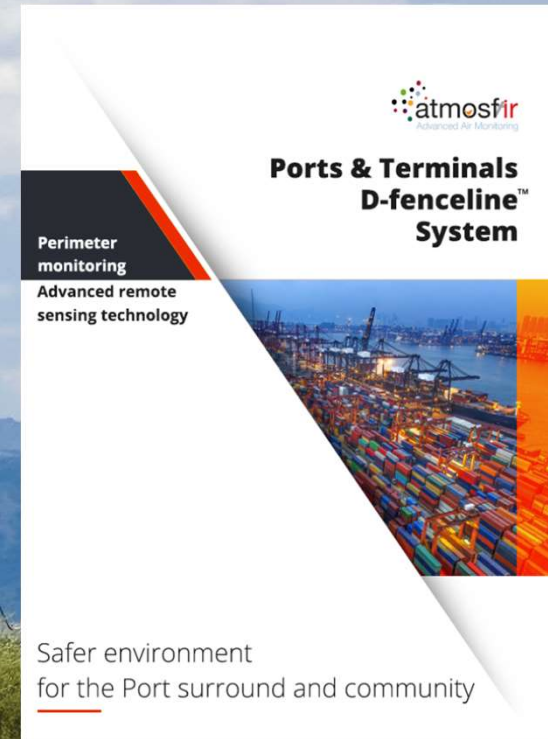




## Advanced Remote Sensing Solutions Accommodating Monitoring Needs to Improve Safety and Environment Surrounding Ports

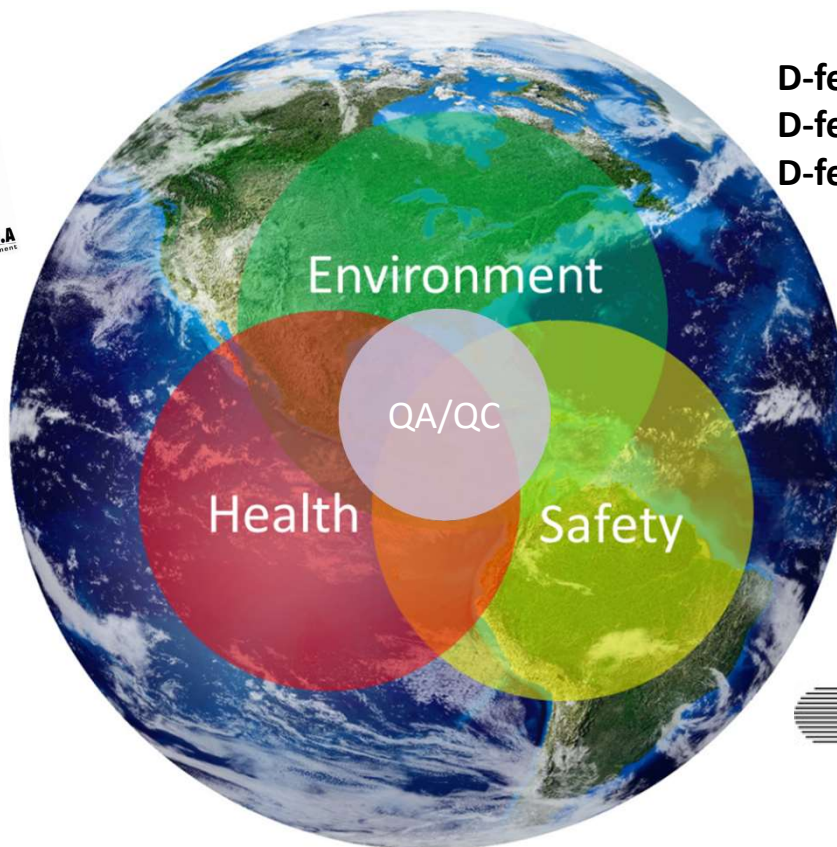
Gilad Shpitzer, Steven LaZar  
Atmosfir Optics Ltd. **2019**

[www.atmosfir.net](http://www.atmosfir.net)



# Atmosfir Optics

System integrator for remote sensing, wide-area, real-time air monitoring.



D-fenceline System™ U UV DOAS  
D-fenceline System™ F OP FTIR  
D-fenceline System™ T TDL



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# Why is a new monitoring approach needed?

**PORTS – Imagine! There is a proven, cost effective way to improve Port perimeter monitoring:**



# The importance of ports to the economy/society



**2018 National Economic Impact of the U.S. Coastal Port System: Executive Summary**

Conducted by Martin Associates  
[www.martinassoc.net](http://www.martinassoc.net)  
 March 2019

**AAPA** American Association of Port Authorities  
 Alliance of the Ports of Canada, the Caribbean, Latin America and the United States

**MARTIN ASSOCIATES**

All photos courtesy of [www.aapa-ports.org](http://www.aapa-ports.org)

Navigation menu: ABOUT INDUSTRY, ABC About The Industry, HOW LINER WORKS, LINER SHIPS, CONTAINERS, GLOBAL TRADE, TRADE STATISTICS, TRADE ROUTES, PORTS, LANDSIDE CONNECTIONS, HISTORY OF

## Cost of losing even one hour of operation!

search

ABOUT THE COUNCIL

Website

English Chinese

English

Chinese

- 30,770,769 jobs generated by port activity**
  - Direct Jobs: 652,078
  - Induced Jobs: 1,056,942
  - Indirect Jobs: 501,555
  - Importers/Exports direct, induced and indirect: 28,560,195
- \$5.4 trillion of total economic value - accounts for 25.7% of U.S. GDP in 2018**
  - \$184.1 billion direct revenue received by firms providing direct services to cargo and vessels
  - \$139.2 billion of re-spending of personal income and consumption expenditures
  - \$5,049.8 billion of economic output by importers and exporters
- \$1.4 trillion total personal income and local consumption**
  - **\$62,800:** Average salary for direct employees
- \$378.1 billion of federal, state, and local taxes**
  - \$47.1 billion generated by port sector revenue
  - \$331.0 billion generated by importer and exporter revenue

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# Chemicals in containers – problems and risks

- The problem of hazardous chemicals in shipping containers has become a topic of major concern over the last 10 years. The combination of sealed containers and long journey times means that hazardous chemicals can build to a level that would never normally be encountered in domestic or industrial settings. The problem is exacerbated by the massive

**15% of containers contain dangerous levels of chemicals**

countries with less strict health and safety controls, and the often poor documentation accompanying the containers.

- It has been estimated that about 15 percent of containers contain dangerous levels of chemicals, with about 0.5 percent presenting an immediate risk to health for workers at the receiving port. In the past, workers unaware of the risks have been exposed to these chemicals over long periods of time, and suffered health problems as a result, such as headaches, nausea, dizziness, and shortness of breath.

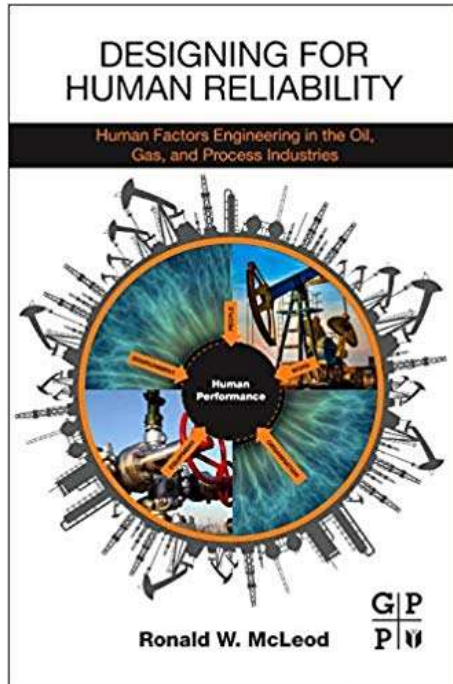
- The chemicals involved are often odorless, and fall into two main categories: fumigants used to fumigate the cargo in transit, and those emitted by the cargo itself. Fumigants initially received the greatest attention, but a couple of high profile cases of poisoning, but further large scale incidents of containers have shown that chemicals from cargo are of equal, if not greater, concern.

**0.5% of containers are an immediate risk to health for workers at the receiving port**



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# What could happen?

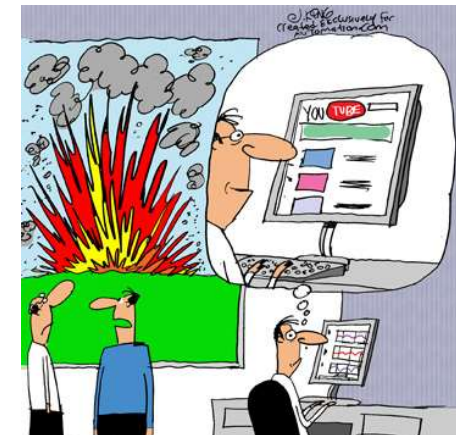


How Much?

What?

Where ?

When ?



*"If only there was a way for us to know what the operator was seeing when the plant exploded."*

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# This could happen!

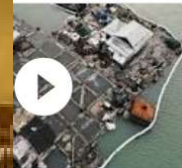


**Thai**  
**score**

Total of  
chemical

17 Jul 2014

rt of Miami



rested after  
tion on  
leak in

YouTube - Nov 9, 2018

YouTube - Jan 15, 2016

YouTube - Nov 26, 2018

The ship leaked chemicals used in industrial production [REUTERS]



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# This could happen!



## Chemical leak forces closure of terminal in Port of Long Beach



### Chemical leak reported at Port Allen facility

Share



Updated: 4:31



File photo of Pier T at the Port of Long Beach. (Photo by Jeff Gritchen/Press-Telegram/SCNG)

## Port worker rescue chemical leak in T

Bay of Plenty Times, Emergency, Thursday,



Paramedics assess a p

Politics & Government

## Substance in Chemical Leak at L.A. Port ID'd

The leak caused 'minimal' disruption to the Port, officials said.

By California News Wire Services, News Partner  
May 13, 2016 9:10 pm ET

Like 0 Share



Reply



# Do we really know what are in the containers?

BANGKOK

## Just how many hazardous chemicals are going through Laem Chabang port?

Published 5 months ago on June 2, 2019  
By The Thaiger

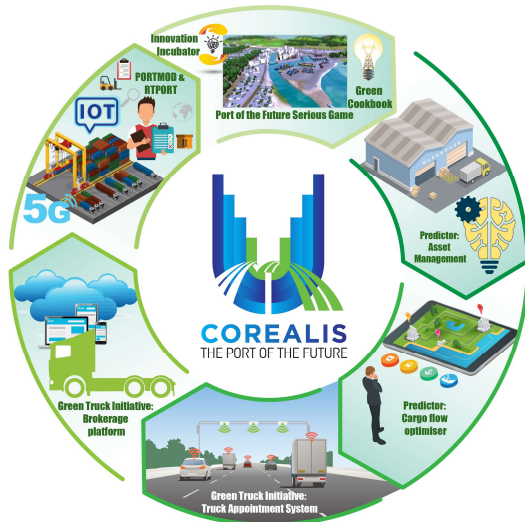


- *The containers were loaded with “dolls and toys” and there are no chemical substances present.”*
- That was the first explanation we heard after the fire that happened last Saturday, May 25, when containers from the KMTC Hongkong burst into flames at Laem Chabang Port, south east of Bangkok. The port area is just to the north of Pattaya on the eastern seaboard.
- Firefighters spent nearly 18 hours battling the confounding blaze as it spread through the containers on the ship billowing toxic fumes and plumes of smoke, causing 228 people, including nearby residents, to be rushed to hospital with burns, eye irritation and breathing difficulties.

# What is a green port?

## Is it just GHGs?

## Are we truly zero emission?



## What is Zero Emission?



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# Where do the emissions come from?



# Where the emissions come from:

- Car and truck traffic, including thousands of diesel trucks servicing each of the major ports every day
- Rail and commercial ship traffic
- Cargo-handling equipment Chemical storage and handling
- Fueling of ships, trucks, trains, and cargo-handling equipment
- Liquid discharges from ships Painting and paint stripping
- Ship breaking (dismantling) Maintenance and repair of roads, rails, grounds, vessels, vehicles, and equipment
- Channel dredging<sup>1</sup>



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# Where should we measure ?



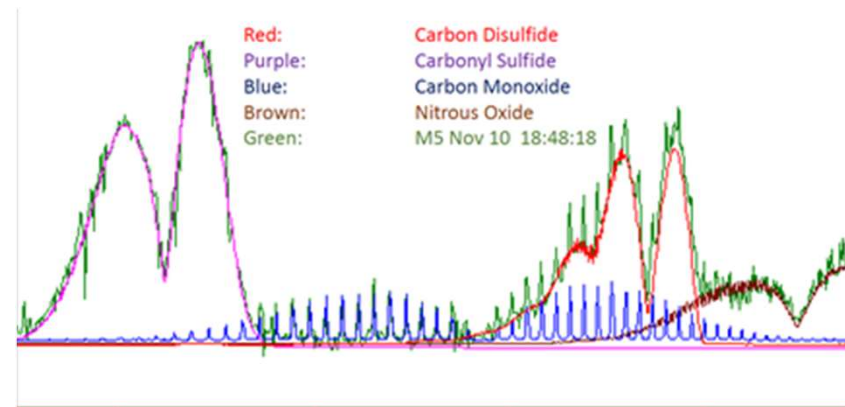
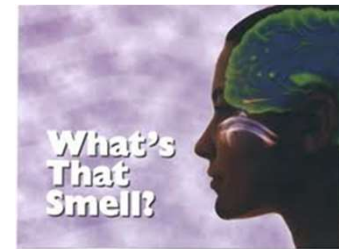
# Can we predict when human errors and equipment failures will happen?



# What are the emissions? Is it just CAPs ?

- **Odor** – amines, mercaptans, alcohols, Carbon Disulfide, Carbonyl Sulfide...
- **Hazardous material**- phosgene, BETX, Carbon tetrachloride, Carbon monoxide, Total alkanes, methylene chloride Ethylene oxide ....
- **Acids** – HCl, HBr, HF, SiF<sub>4</sub>, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub>, H<sub>2</sub>O<sub>2</sub>, H<sub>2</sub>S, H<sub>2</sub>CO<sub>3</sub>
- **Aldehydes** – formaldehyde, acetaldehyde, benzaldehyde ...
- **GHGs** – Methane, N<sub>2</sub>O, HFCs


Is it just CO<sub>2</sub> NO<sub>x</sub> SO<sub>x</sub> PM ?



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# Recent changes in US legislation




  
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FEDERAL REGISTER
   
 Vol. 80
   
 No. 23
   
 Part I
   
 Environmental Protection Agency

AB 1647 Petroleum refineries: air monitoring systems. (2017-2018)
   
 Date Published: 10/08/2017
   
**Assembly Bill No. 1647**
  
**CHAPTER 589**
  
 An act to add Section 42705.6 to the Health and Safety Code, relating to petroleum refineries.
   
 [ Approved by Governor October 08, 2017. Filed with Sec. of State October 08, 2017. ]
   
**LEGISLATIVE COUNSEL'S DIGEST**
  
 AB 1647, Muratsuchi. Petroleum refineries: air monitoring systems.
   
 Existing law generally designates air pollution control and air quality management district responsibility for the control of air pollution from all sources other than vehicular sources. The State Air Resources Board or the air district to require the owner or operator of a petroleum refinery to take any action that the state board or the air district determines necessary for the determination of the amount of air pollution emissions from that source.
   
 This bill would require a refinery-related community air monitoring system to be installed on or before January 1, 2020, as specified, and would require an air district to maintain a fence-line monitoring system or to contract with a third party to maintain a fence-line monitoring system, as defined, on or before January 1, 2020. The bill would require the air district and the owner or operator of a petroleum refinery to install, operate, and maintain a fence-line monitoring system, as defined, on or before January 1, 2020. The bill would require the air district and the owner or operator of a petroleum refinery to install, operate, and maintain a fence-line monitoring system, as defined, on or before January 1, 2020. The bill would require the air district and the owner or operator of a petroleum refinery to install, operate, and maintain a fence-line monitoring system, as defined, on or before January 1, 2020.

Table 1- Refinery-Related Air Pollutants to be Addressed by Fence-Line Air Monitoring Plans
   
 Air Pollutants

Requirements are coming

Criteria Air Pollutants
Sulfur Dioxide
Acetaldehyde
Acrolein
1,3-Butadiene
Styrene
BTEX Compounds (Benzene, Toluene, Ethylbenzene, Xylenes)
Other Compounds
Hydrogen Sulfide
Carbonyl Sulfide
Ammonia
Black Carbon
Hydrogen Cyanide
Hydrogen Fluoride

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The real-time and near-real-time disseminated measurement data shall be available to the public in an acceptable quality. Also, it is important that the preliminary real-time measurement data be disseminated to the public as quickly as possible, with automated screening where feasible, to prevent the dissemination of erroneous data.

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# Atmosfir Optics D-fenceline™ solution



**The D-fenceline™ system accommodates these four key elements of fenceline monitoring:**

## **When**

Continuous monitoring 24/7/365 detection and alert in real time  
due to effective plume capture and short time resolution

## **What**

Simultaneous detection and identification of dozens of emitted compounds by FT-IR technology with Atmosfir's spectral analysis algorithm, reported with a spectral validation and QA measures.

## **Where**

Continuous open path monitoring data + meteorological data allows for rapid determination of where the emissions are originating. The spatial feature of D-fenceline™ delivers critical information to estimate the source location

## **How much**

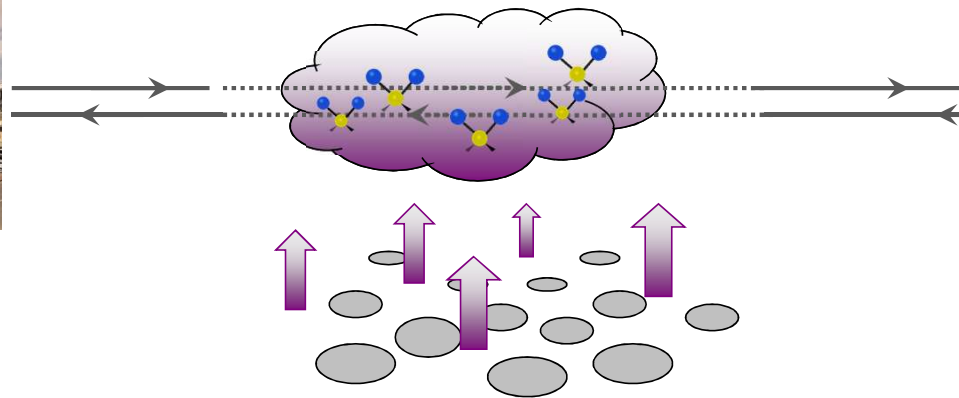
ORS data combined with meteorological data is processed by patented algorithms to calculate the emission rate at the fence line → estimation of emission flux rate due to a momentary event → an annual emission rate.

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# D-fenceline™ System – Technology Principles



Retroreflector



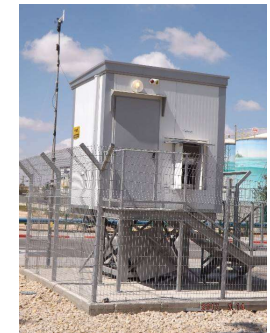
Nonlocalized Emission Source



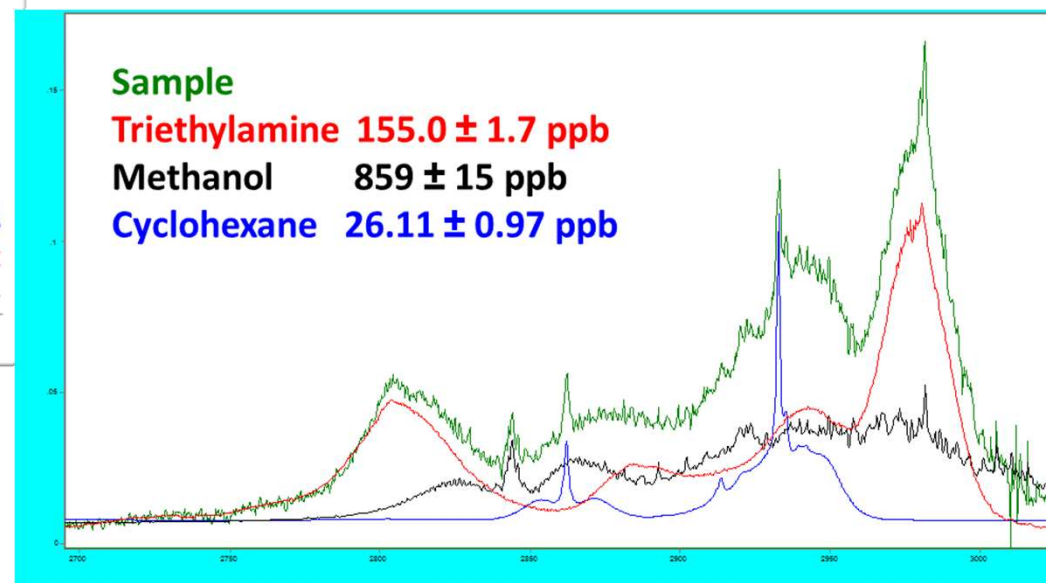
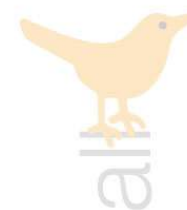
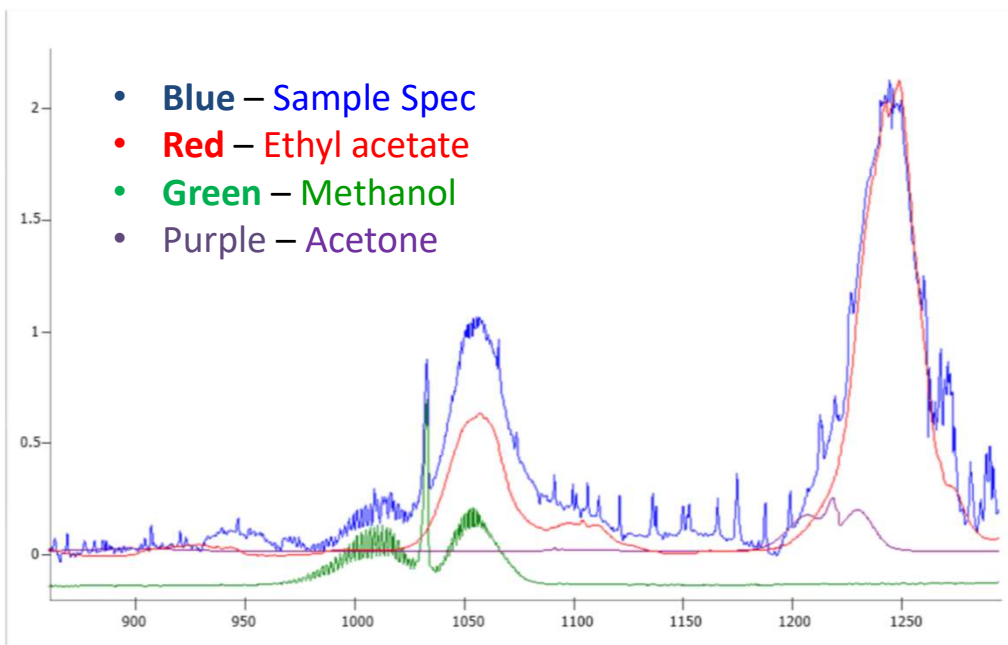
ORS Source/Detector  
(monostatic)

$$A_{(v)} = K_{(v)} CL = -\ln[I/I_0]$$

Open-path instruments provide path-averaged concentration data



# Spectral Fingerprint



# The D-fenceline™ is Based on Reference Methods: US EPA TO-16/OTM10



**Technology Transfer Network  
Emission Measurement Center**

Recent Additions | Contact Us | Print Version Search:  **GO**

[EPA Home](#) > [Air & Radiation](#) > [TTMWeb - Technology Transfer Network](#) > [Emission Measurements](#)

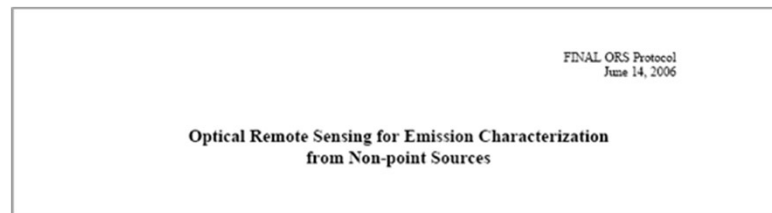
### Test Methods

Test methods can be divided into several categories:

- [Category A: Methods Proposed or Promulgated in the FR](#)
- [Category B: Source Category Approved Alternative Methods](#)
- [Category C: Other Methods](#)
- [Category D: Historic Conditional Methods](#)

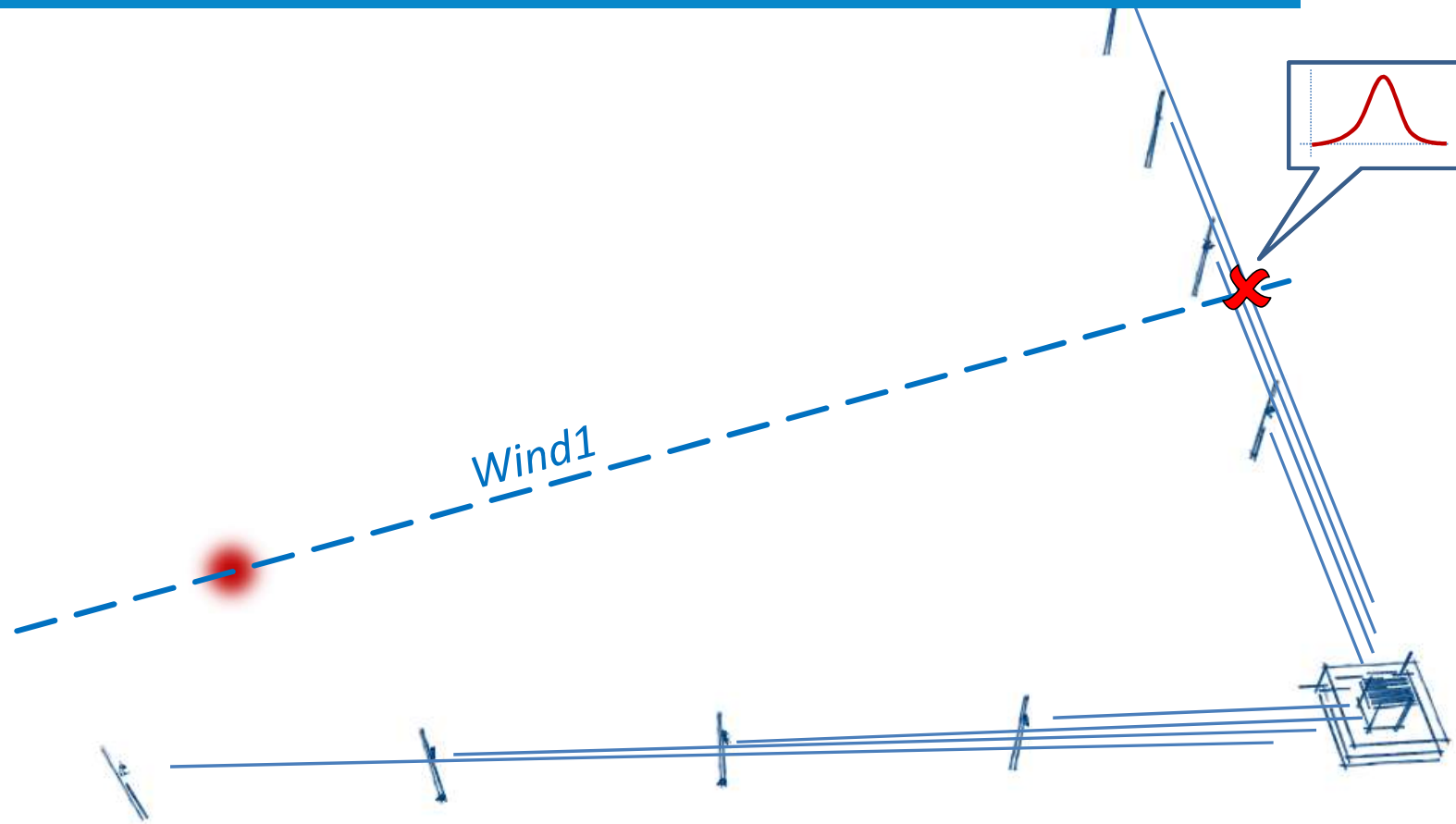
**Inte**

A fundamental component of the EMC web site is to provide information regard methods into four different categories. The categories are based on the legal s

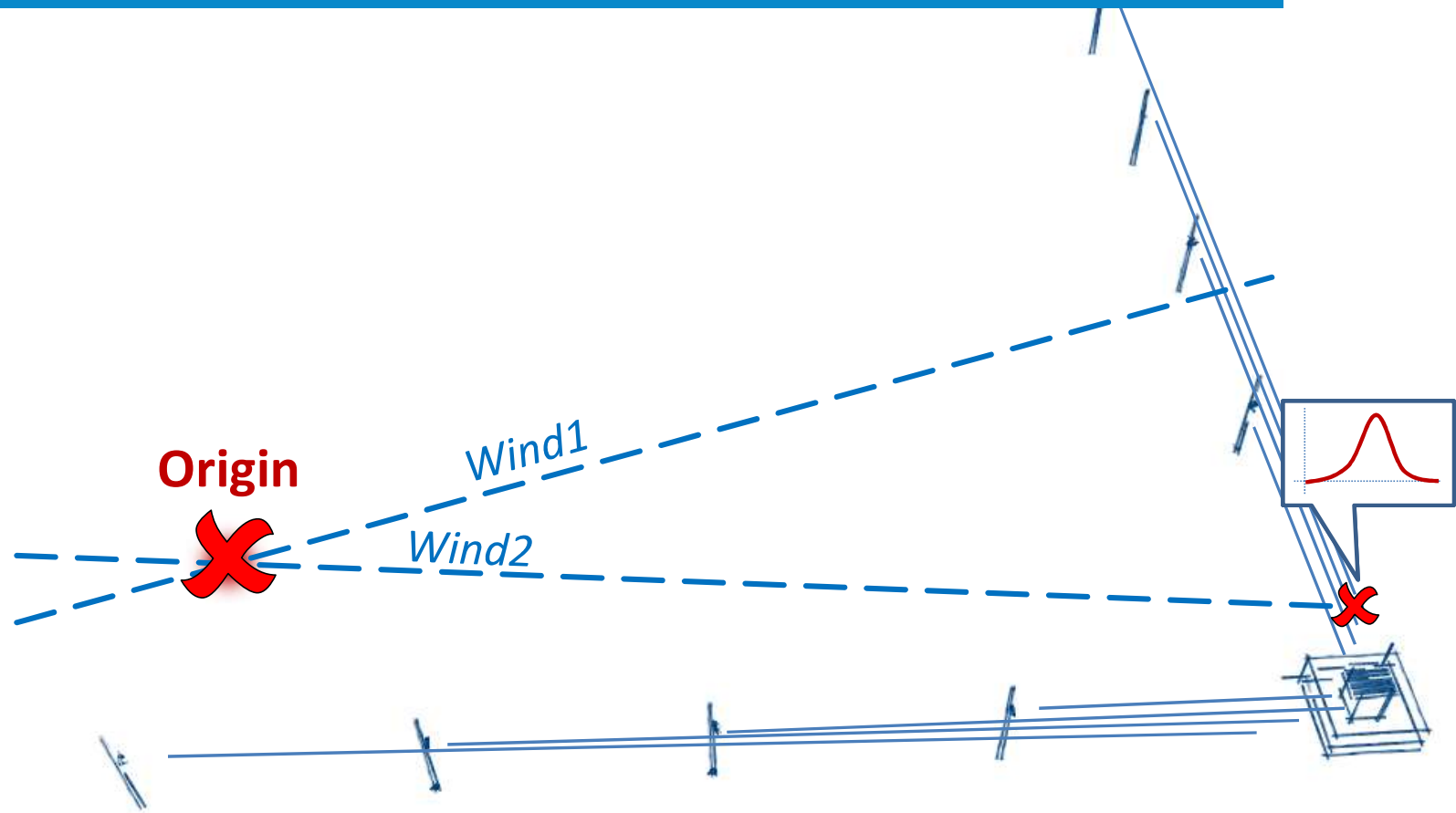


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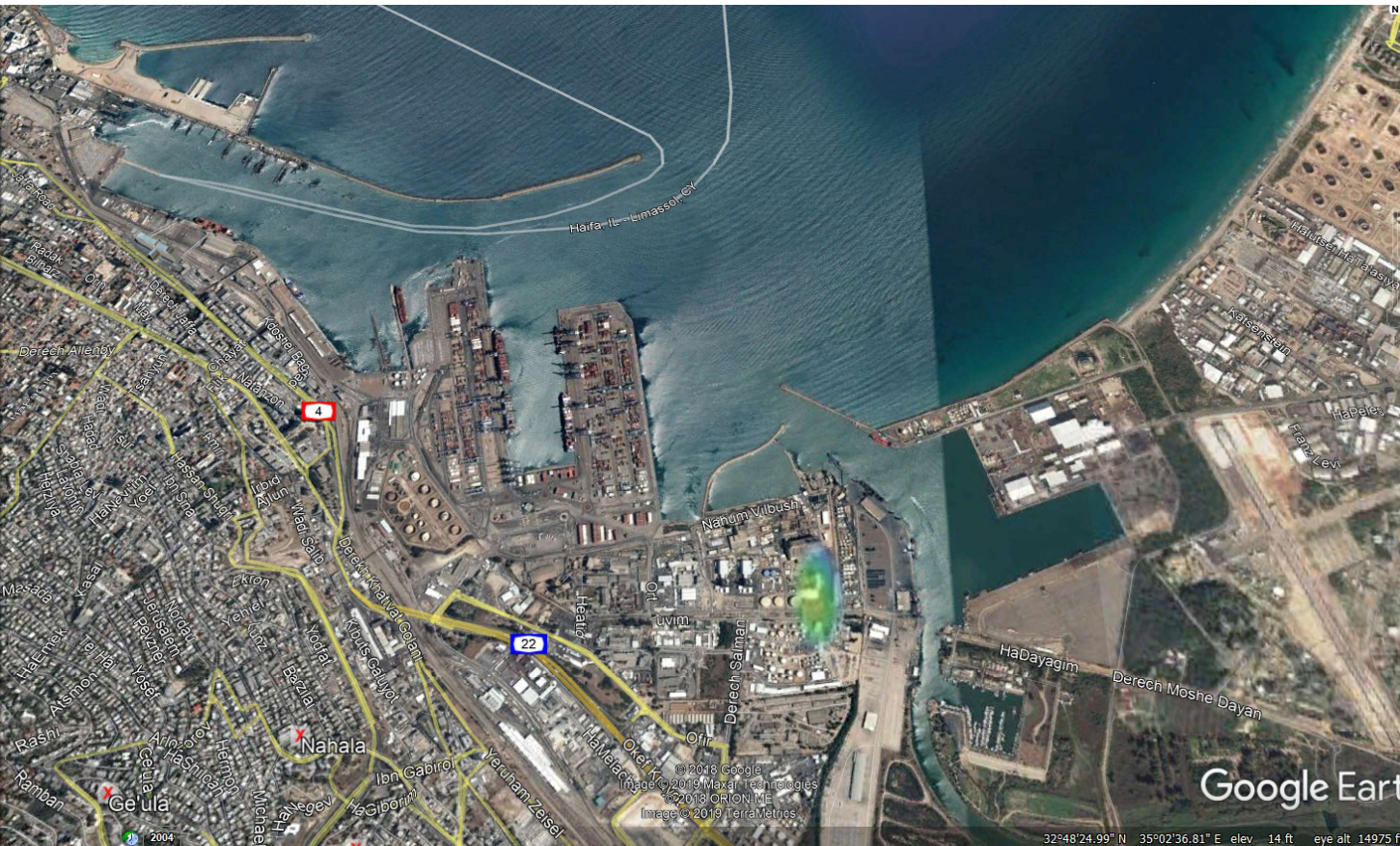
# Where – locate leakage source accurately



# Where – locate leakage source accurately



# Automatic source location

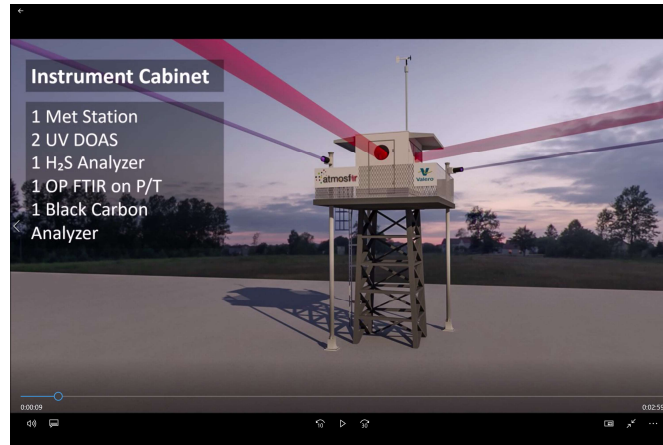




# Fixed installation at the Valero Refinery



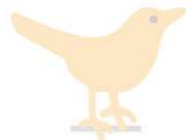
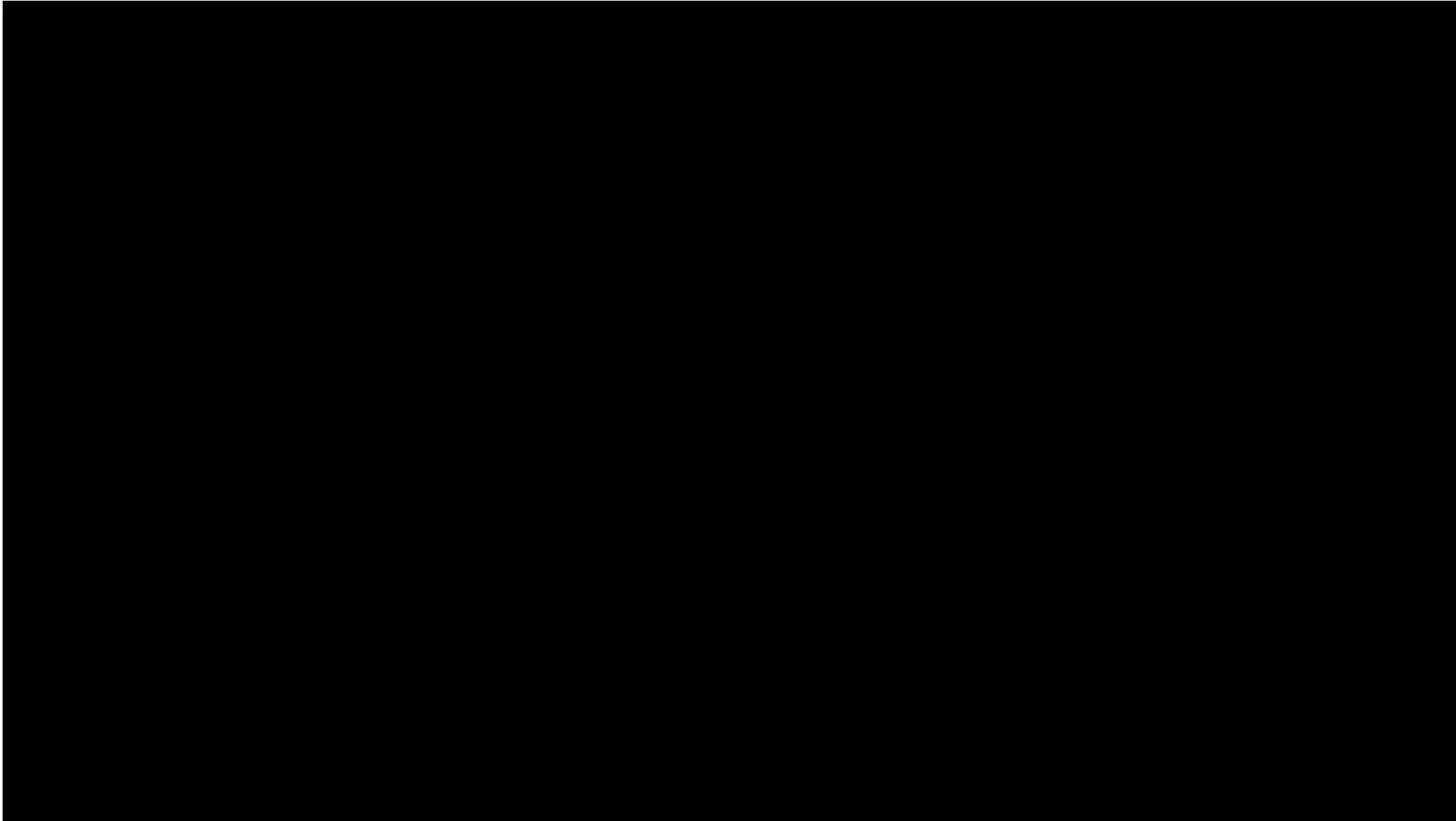
Valero Wilmington  
Fenceline Monitoring Plan, Rule 1180  
Atmosfir Optics Presents :  
D-fenceline System™





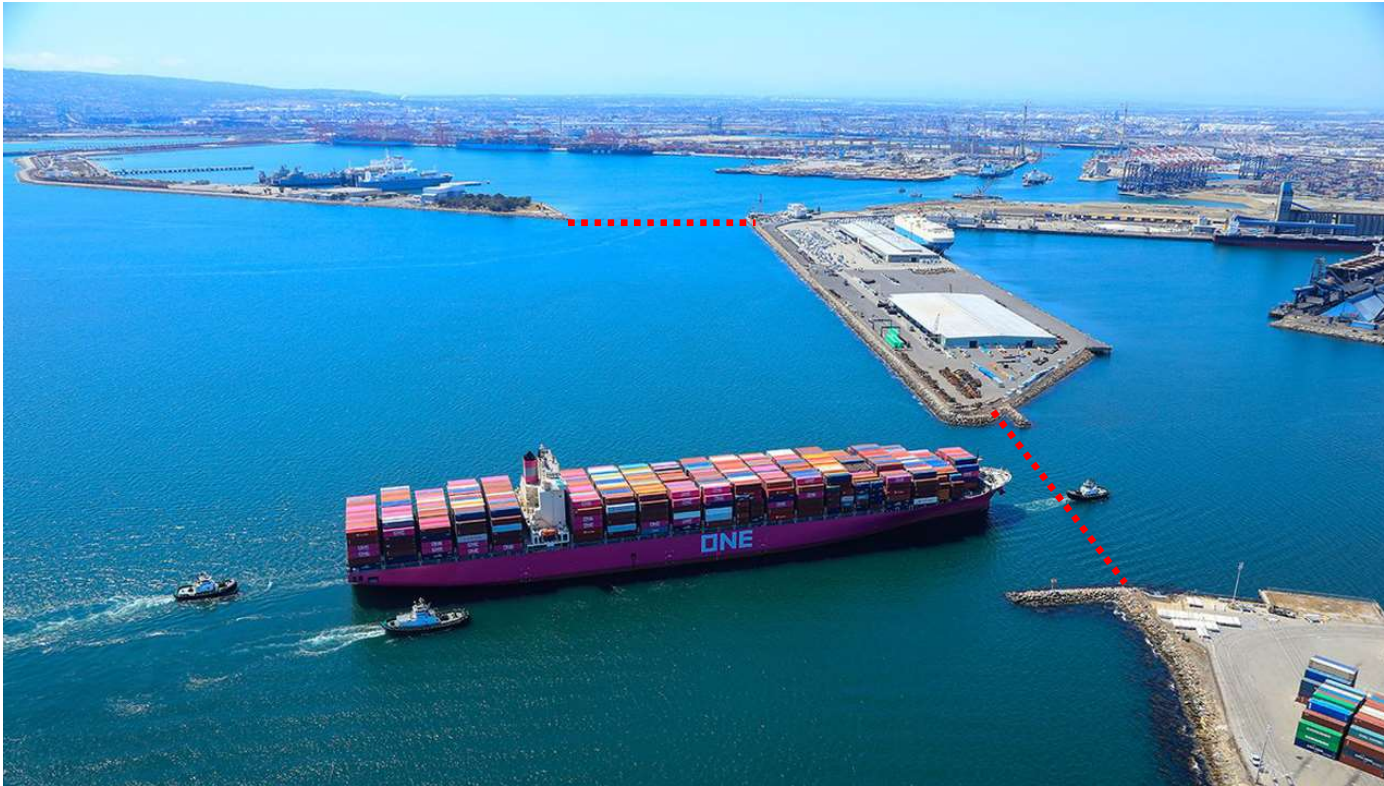


# Fixed installation at the Valero Refinery



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# Monitoring Port Gates



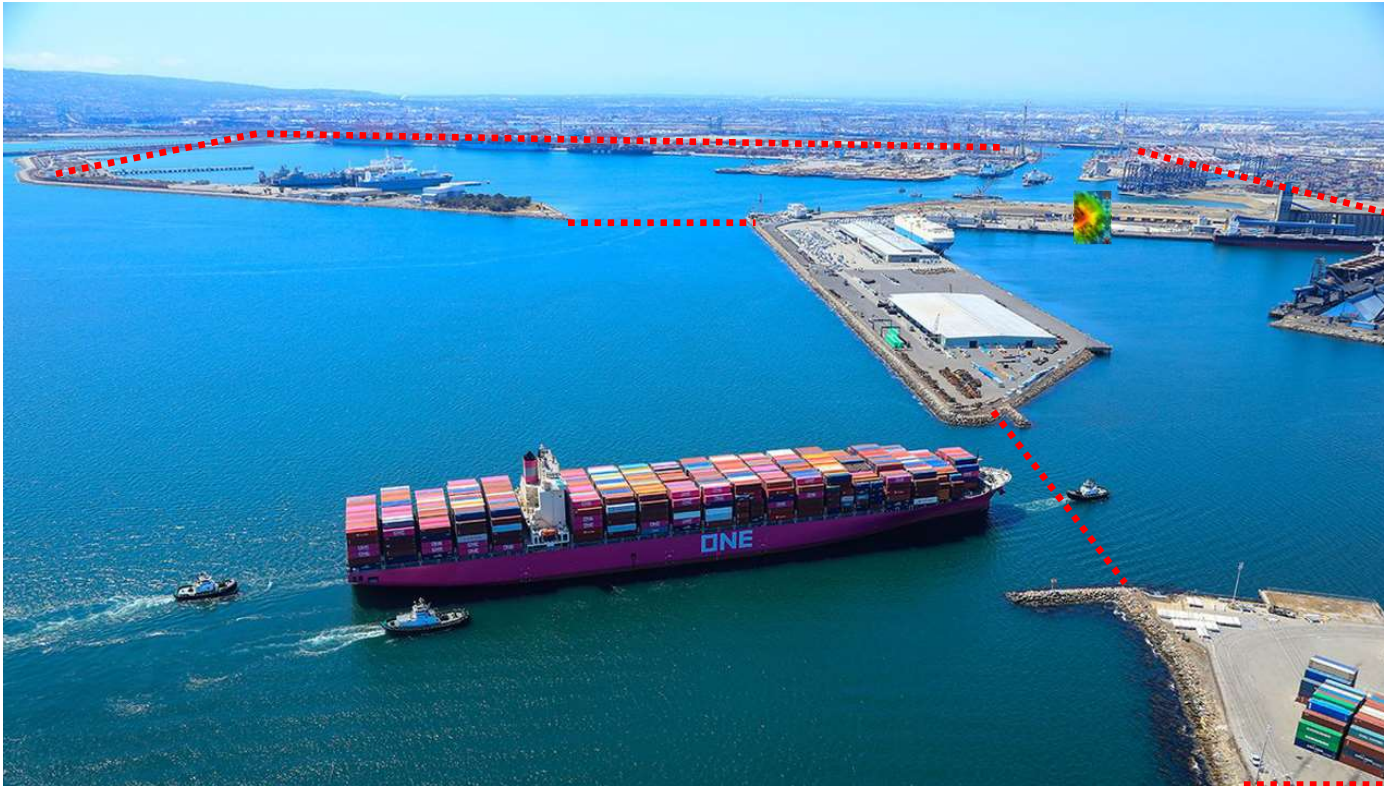
Identify leaking container

Identify polluting vessel



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# Monitoring Port Surround



Identify leaking containers

Improve worker awareness

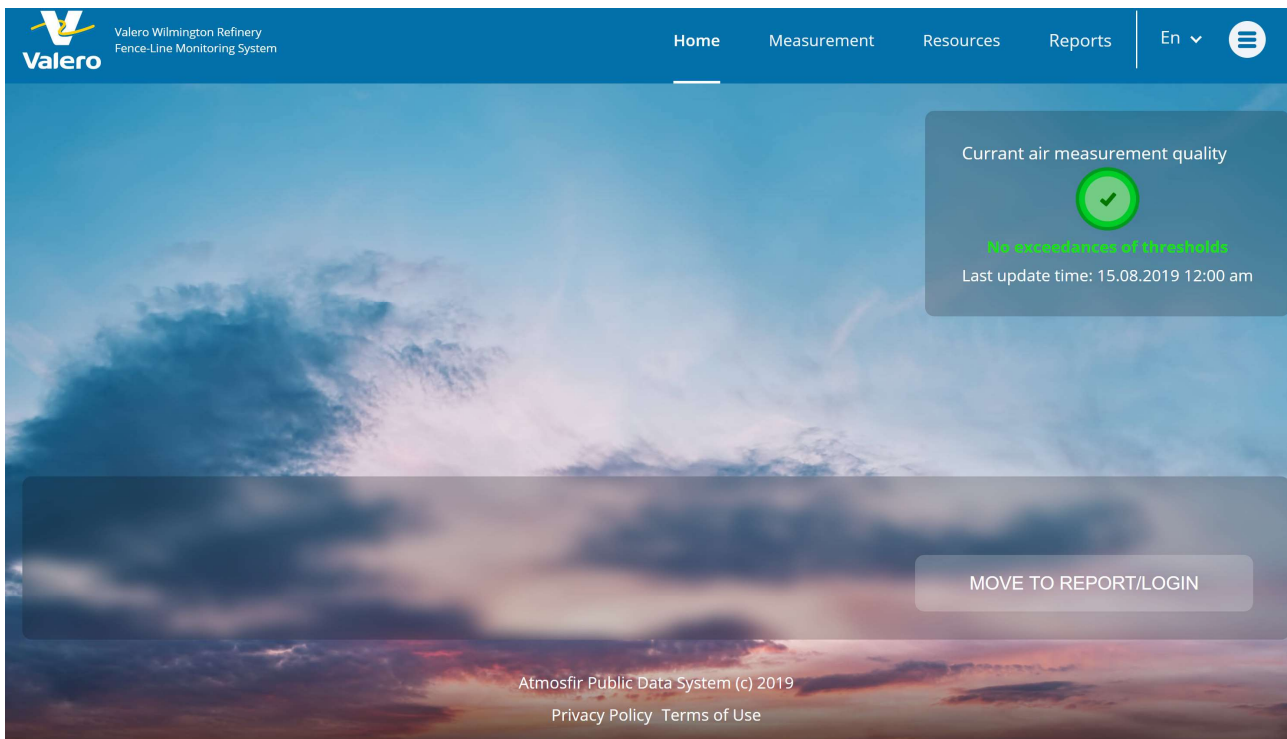


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# Improve Public Relations (PR)



- Public transparency through easy, user friendly, public website



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# Cost Effective, BAT solution

- Reduced down time from HAZ events
- Improved PR
- Providing a healthier work environment
- Unique business model, customized for each Port that can increase in net profit up to 2.5%



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## Ports & Terminals, D-fenceline™ System can give you:



- ✓ Fast detection and response to Hazardous Material events for better safety and security
- ✓ Cleaner environment for the Port surround and community
- ✓ Providing a healthier work environment
- ✓ Better public relations (PR)
- ✓ Increase in net profit up to 2.5%

A vertical logo consisting of a stylized yellow bird icon at the top, perched on the text 'Quality above all'. The text is written vertically in a light grey, sans-serif font.

# Conclusions :

## Ports & Terminals D-fenceline™ System Features:

**Fenceline measurement can be the “nose” for an advanced warning if something goes wrong**

**Real time data, 24/7, wide area, should be implemented**

**One instrument can measure a long list of contaminants**

**Combination of :**  
**Wind data**  
**Spatial analysis**  
**Time resolution**  
**Can locate the source of the problem**

**monitoring = supervision = education**  
**Can improve maintenance and operation reliability**

**Public transparency= PR**



Questions?

[gilad@atmosfir.net](mailto:gilad@atmosfir.net)