

# CompMon

Compliance monitoring pilot for Marpol Annex VI

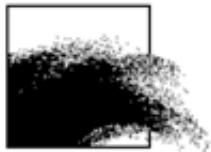


Co-financed by the European Union  
Connecting Europe Facility

## European Sustainable Shipping Forum (ESSF)

24/01/2017

Ward Van Roy



**MUMM**

Management Unit of the North Sea Mathematical Models



## Need for compliance monitoring



- Cost of compliance  $\geq 5$  k€ / day / ship  $\rightarrow$  BN€ for SECA/year
- Monetized value of increased health: **14-47 M€/year**



- Need for level playing field
- MS are obliged to a certain number of port inspections



- Remote monitoring will reduce the obligatory inspections
- More efficient targeting for Compliance
- Ships at sea and sailing out of SECA

## Main objectives of CompMon

- To join forces in voluntary piloting of effective **targeting** for the enforcement of MARPOL Annex VI
- To **pilot the enforcement at sea**
- To share **best practices**
- To **communicate** the experiences to e.g. regional conventions and networks (e.g. BA, NSN)
- To initiate a strategy for the implementation of compliance monitoring **in the future**, with a special focus on the global 2020 cap

## CompMon solution

Port  
Inspections



Land Based  
monitoring



Airborne  
monitoring



## Port Inspections

- Documents (BDN, Oil record book, ...)
- Fuel Calculator Model
- Taking fuel samples
- Handheld or lab analysis



**TOTAL**  
MarineFuels

BUNKER DELIVERY NOTE / Reçu de Bord  
N° 02556

DATE OF DELIVERY / Date de livraison  
25 | 01 | 2016

TOTAL MARINE FUELS Pte Ltd  
250 North Bridge Road, #39-00 Raffles City Tower,  
Singapore 179101  
TEL : +65 6849 4319 - Fax : +65 6337 0489

VESSEL / Navire : Viking Olesca  
FLAG / Pavillon :   
IMO NUMBER / Numéro IMO : 9338075

POINT OF LOADING / Lieu de chargement :   
Identification Barge/Truck / Identification Barge/Camion : MTS Montana

DELIVERY METHOD / Mode de livraison  
BARGE  TRUCK  PIPELINE   
Camion  Oléoduc

LOG DATE TIME / Dates/Horaire  
ALONGSIDE  CONNECTION   
Accosté  Branchement

START PUMPING / Début pompage :   
FINISH PUMPING / Fin pompage :   
DEPARTED / Départ :

PRODUCT / Produit	QUANTITY DELIVERED / Quantité livrée		CHARACTERISTICS / Caractéristiques				
	Liters at 15°C / Litres à 15°C	Metric tons / Tonnes métriques	Temp. (°C)	Density at 15°C	Sulfur %	Viscosity at 50°C	Flash Point (°C) / Point d'éclair (°C)
1 FUEL OIL / Viscosité / viscosité Maximum at 50°C / Sulfur / soufre : 15/15							
2 FUEL OIL / Viscosité / viscosité Maximum at 50°C / Sulfur / Soufre : 15/15	268.330	250.888		0,9350	0,05 %	6,3	68,2
3 MGO/DML/MDO / Sulfur / Soufre :							

Seal numbers N° des scellés

Ships MARPOL Sample / Ech. MARPOL (papier)	Ships retained sample / Ech. Navire	TOTAL retained sample 1 / Ech. Total 1 (transporteur)	TOTAL retained sample 2 / Ech. Total 2 (transporteur)
1			
2	A0743177	A0743175	A0743172
3			

Our General Terms and conditions of sale for marine fuels are applicable to the above deliveries / Nos Conditions Générales pour la vente de combustibles marine s'appliquent aux livraisons ci-dessus

OVERTIME AND OTHERS / Heures supplémentaires et autres :   
REMARKS / Observations :

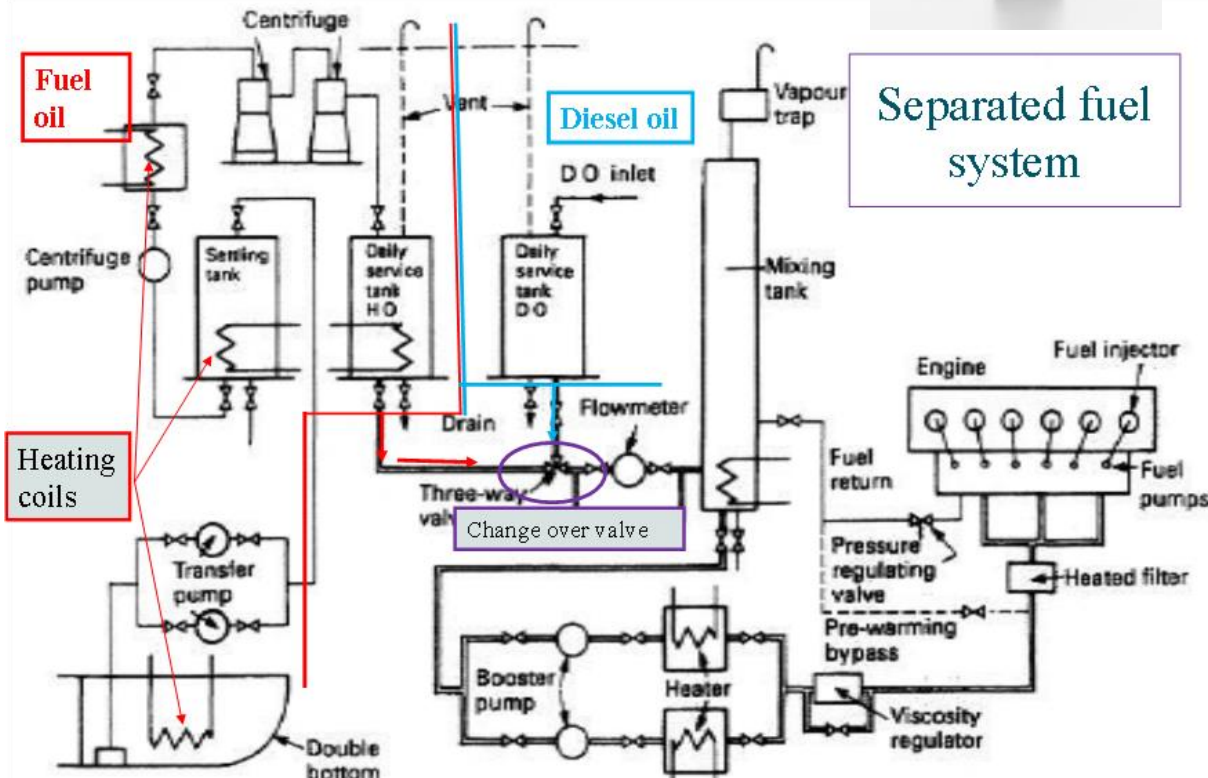
Was a letter of protest issued? / Une lettre de réclamation a-t-elle été émise?  Y  N

Received above quantities and grades in good order and condition / Reçu des quantités normales les quantités et qualités indiquées ci-dessus

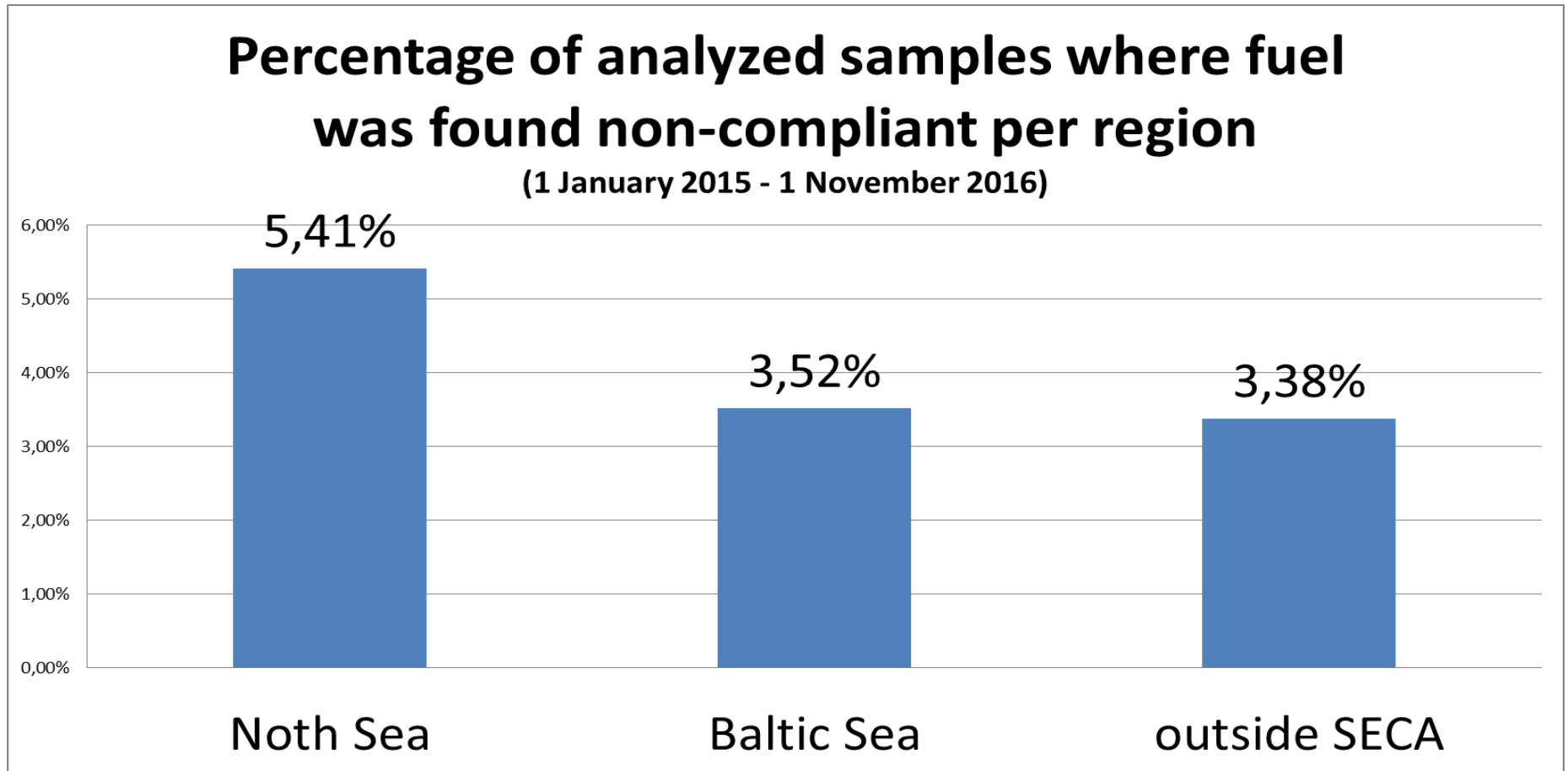
Signature of the FUELS Representative / Cachet navire / Signature of Vessel Officer / Cachet navire / Signature Officier navire

CUSTOMER FEEDBACK / EVALUATION CLIENT  
The following rating is our satisfaction level of the bunkering operation / Indica de satisfaction de l'opération de soufrage

M/V VIKING OLESCA  
CHIEF ENGINEER

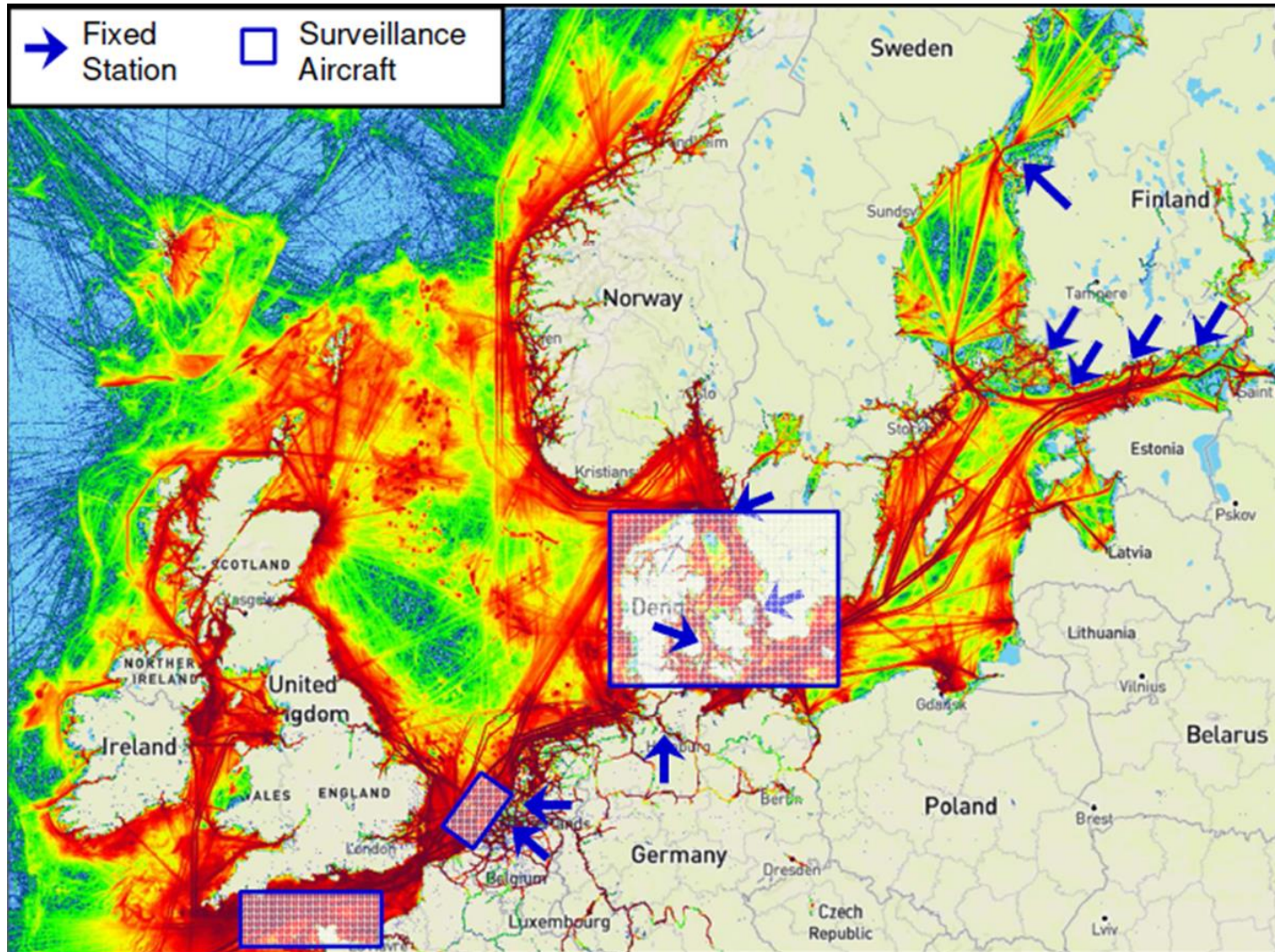


## Result on board inspections (fuel samples)



Source: EMSA (2016)

# Surveillance area land based and airborne monitoring



Source: BSH (2016)

## Land based/fixed platforms

- SE: Inlet channel of Gothenburg
- DK: Öresund bridge and Great Belt bridge
- NL: Hoek van Holland and Rotterdam
- FI: 5 fixed locations, 1 mobile (boat)
- DE: Elbe river



## Airborne platforms

- Belgian coast guard aircraft (MUMM)
  - 153 flight hours (2015-2016)
  - 25 hours funded by NL (ILT)
  - Only Sniffer ( $\text{SO}_2$ ,  $\text{CO}_2$ )
  - Coast Guard Aircraft
- Piper Navajo platform (Chalmers)
  - EASA certified (2014)
  - Sniffer ( $\text{SO}_2$ ,  $\text{CO}_2$ ,  $\text{NO}_x$ ), DOAS & particles
- Skyvan platform (Aalto University)
  - Equiped with sniffer
  - No monitoring conducted

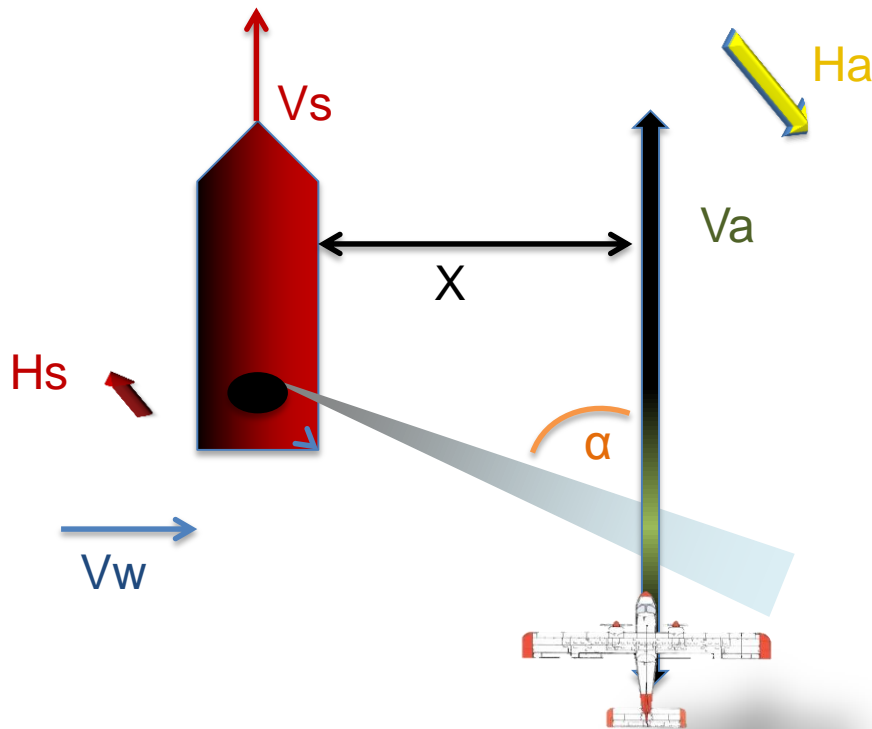








## Sniffer

- FSC based on  $\text{SO}_2/\text{CO}_2$  ratio
- $\text{SO}_2$  concentration: fluorometer
- $\text{CO}_2$  concentration: IR radiometer
- High accuracy
- Active smoke plume sampling
- Low altitude, close to ship
- Tested (NL, BE, FI, RUS, SE, DK, NO)

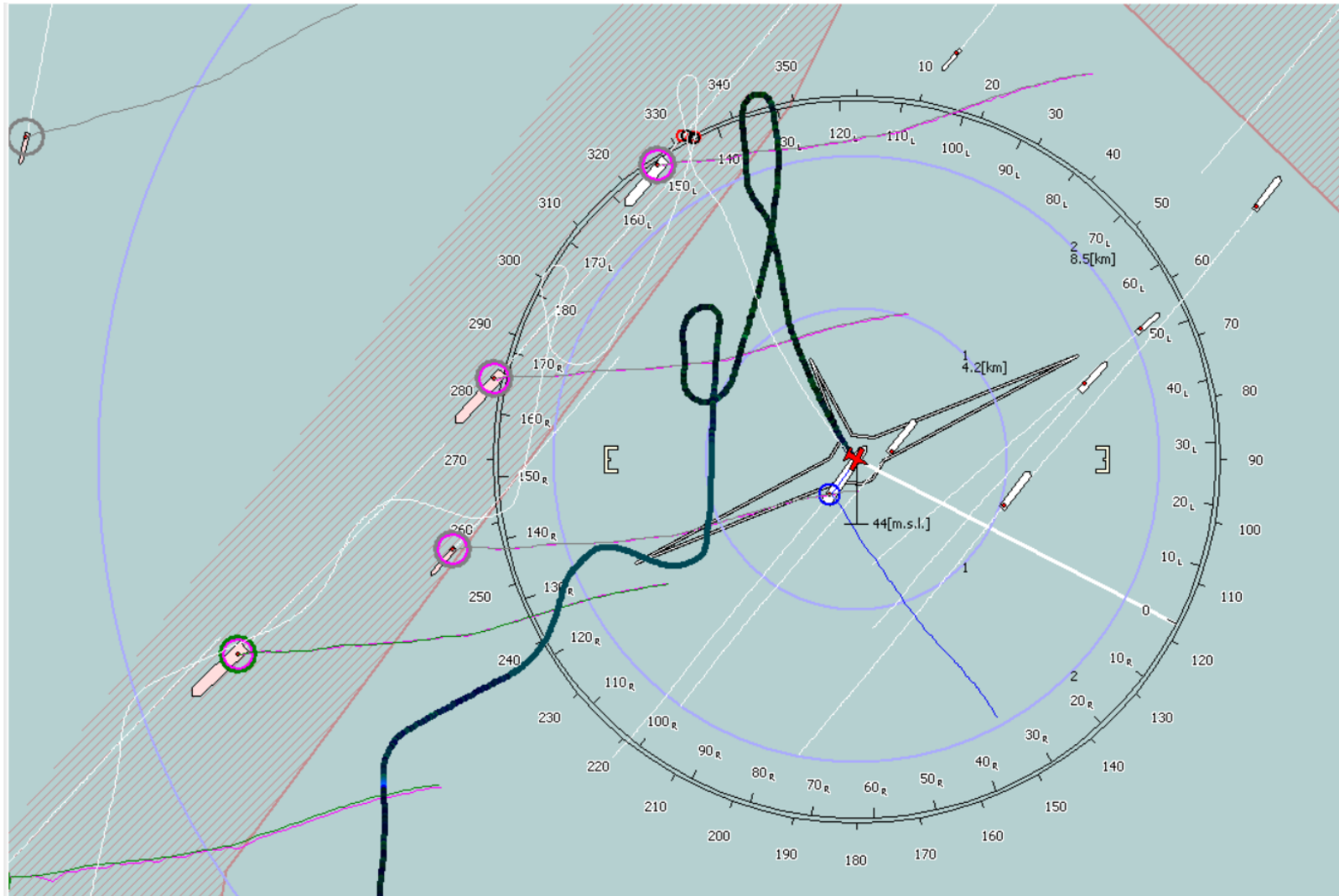


## Flight approach

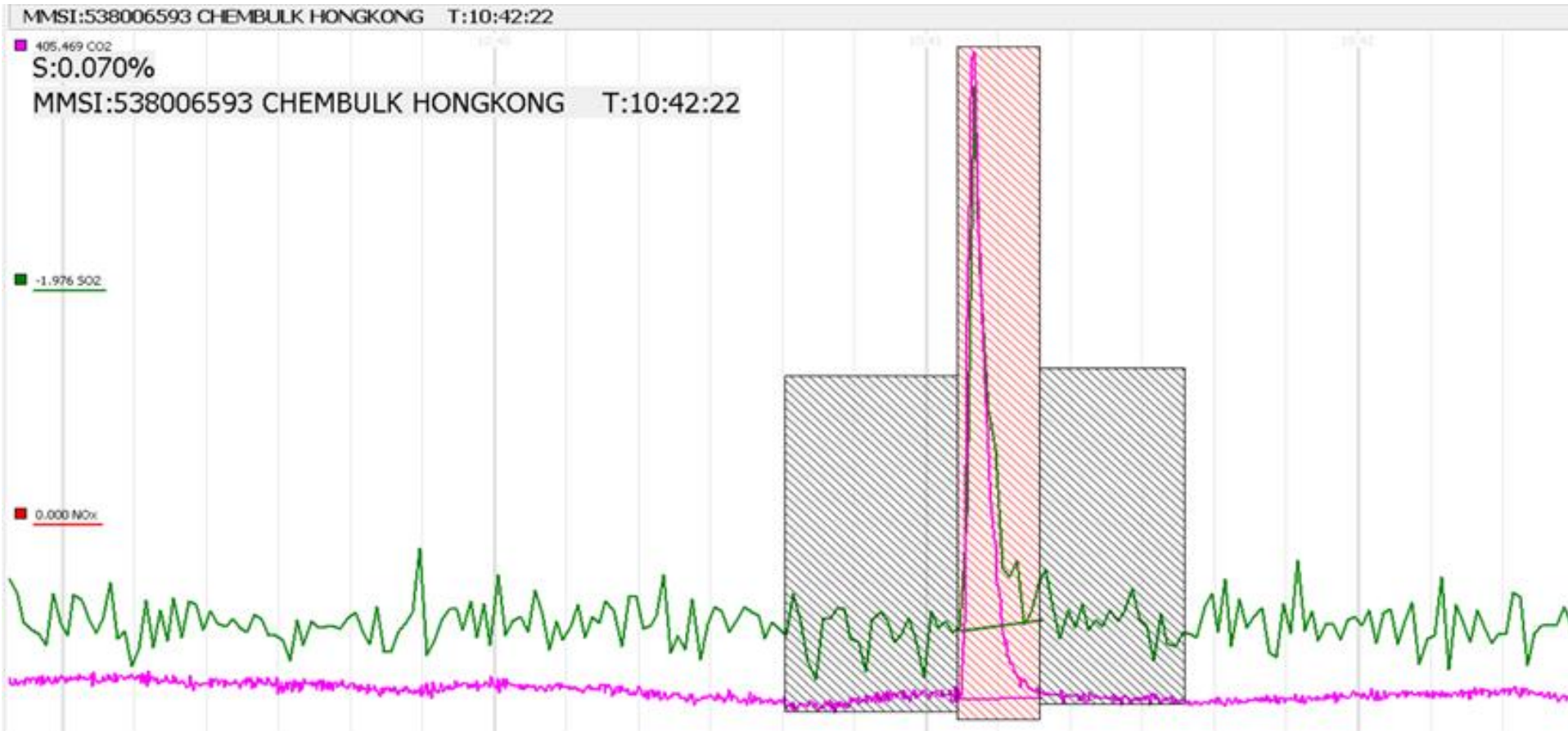


-   $V_w$  Wind speed vector
-   $V_s$  Ship speed vector
-   $H_s$  Height of funnel = e.g. **60m**
-   $H_a$  Altitude Aircraft =  $H_s$  (>150 ft)
-   $V_a$  Aircraft speed = **110 kts**
- Plume crossing at 90°**
- $X$   distance to ship > **200 m**

## Software enhances flight operations

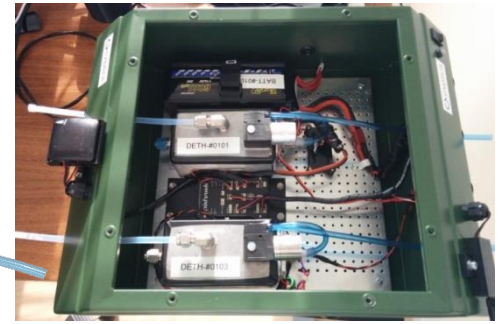
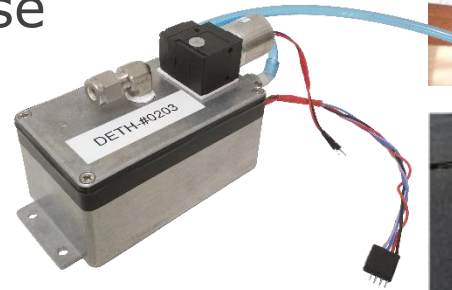


## Software automatization with manual control

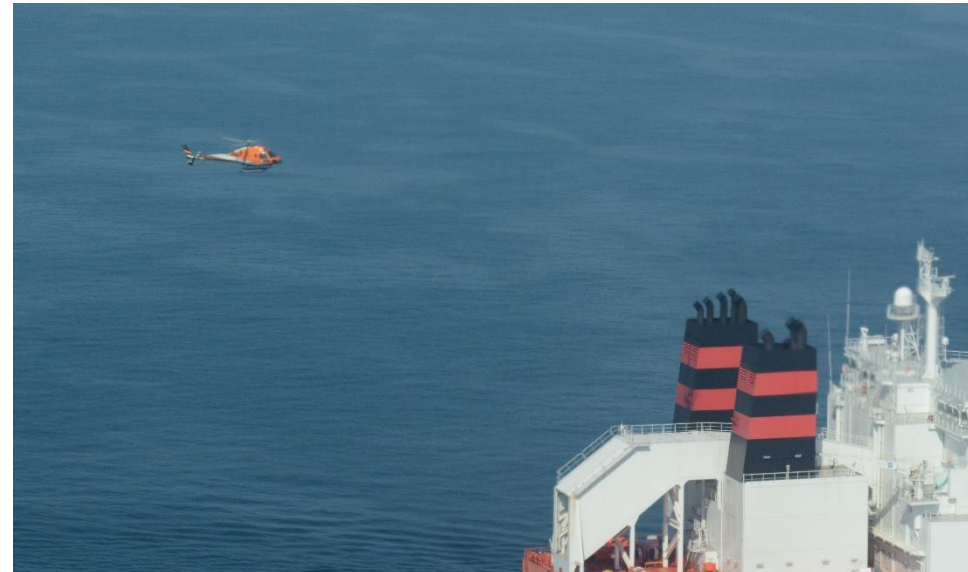
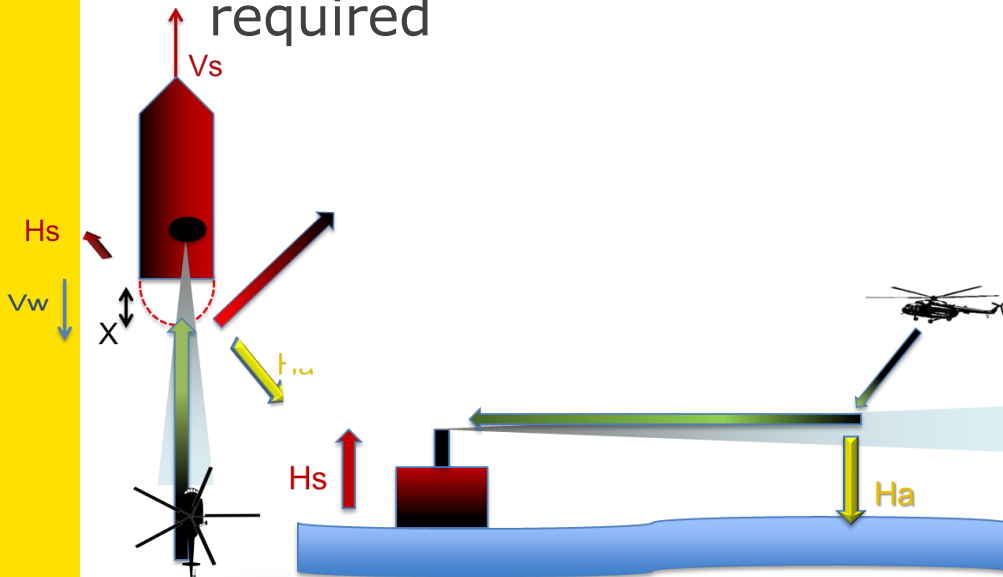


## Mini-sniffer

- Similar but slower time response
- Small and low cost sensors
- More time in the smoke plume
- Helicopter and RPAS/UAV
- More validation and accuracy testing required

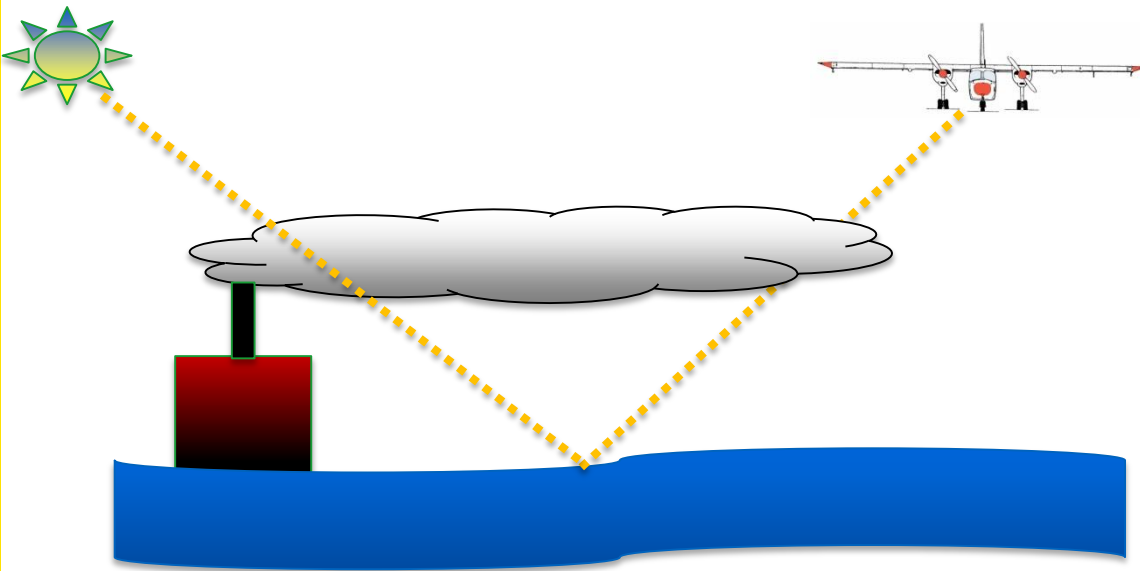


Source: Explicit (2016)



## Optical system - DOAS (Differential Optical Absorption Spectroscopy)

- Uses the light absorption characteristics of SO<sub>2</sub> in the exhaust plume
- Can be used in fixed installations or on airborne platforms
- Less accurate → differentiation between 1.0% and 0.1% fuel
- Max distance 1km
- Restricted by light conditions



## Non-Compliance levels (Baltic Sea+Hamburg)

Station/Area	Period	# of measurements (quality OK)	Cut-off level	Ratio of non-compliance
<b>Finland Northern Baltic</b>	2016	<b>2570</b> (Fixed) <b>430</b> (Boat)	<b>0,15</b>	<b>0,6 %</b>
<b>Sweden Gothenburg</b>	2016	<b>3389</b> (Fixed)	<b>0,15</b>	<b>1%</b>
<b>Denmark Great Belt Bridge</b>	June-Nov 2016	<b>2011</b> (Fixed)	<b>0,15</b>	<b>4 %</b>
<b>Denmark Waters Aircraft</b>	June 2015 – Oct. 2016	<b>1052</b> (Fixed)	<b>0,20</b>	<b>6 %</b>
<b>Germany Hamburg Harbor (Wedel)</b>	Nov. 2014 – Nov. 2016	<b>6523 (Fixed)</b>	<b>0,15</b>	<b>1.66%</b>

## Ratio Non-Compliance (North Sea)

Station/Area	Period	# of measurements (quality OK)	Cut-off level	Ratio of non-compliance
Netherlands (Fixed, Rotterdam)	2016	1229	Varies	7 %
Netherlands Southern North Sea (Helicopter)	Sept. 2016	327	0,13	18 %
Belgium Aircraft Southern North Sea	2015-2016	1308	0,15 0,20	12% 8%
CompMon SECA Border (Aircraft)	Sept. 2016	74	0,20	16 %

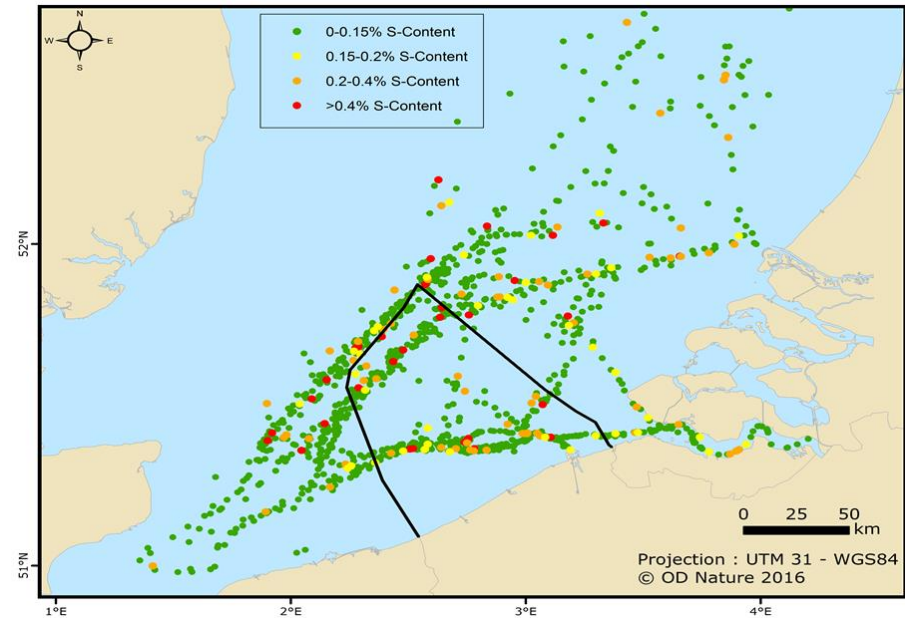
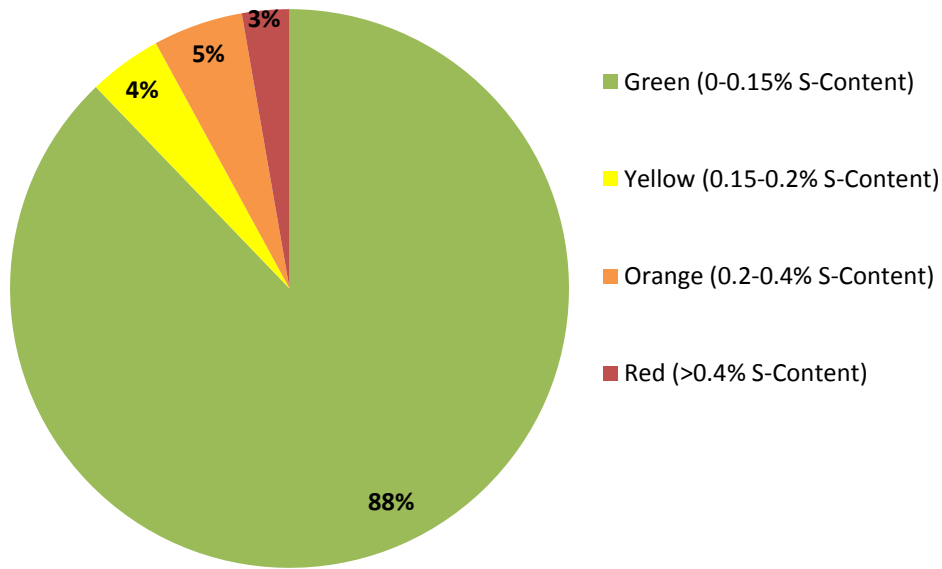
Source: DEA (2016)

Fixed: about 38000 measurements

Mobile: about 4000 measurements

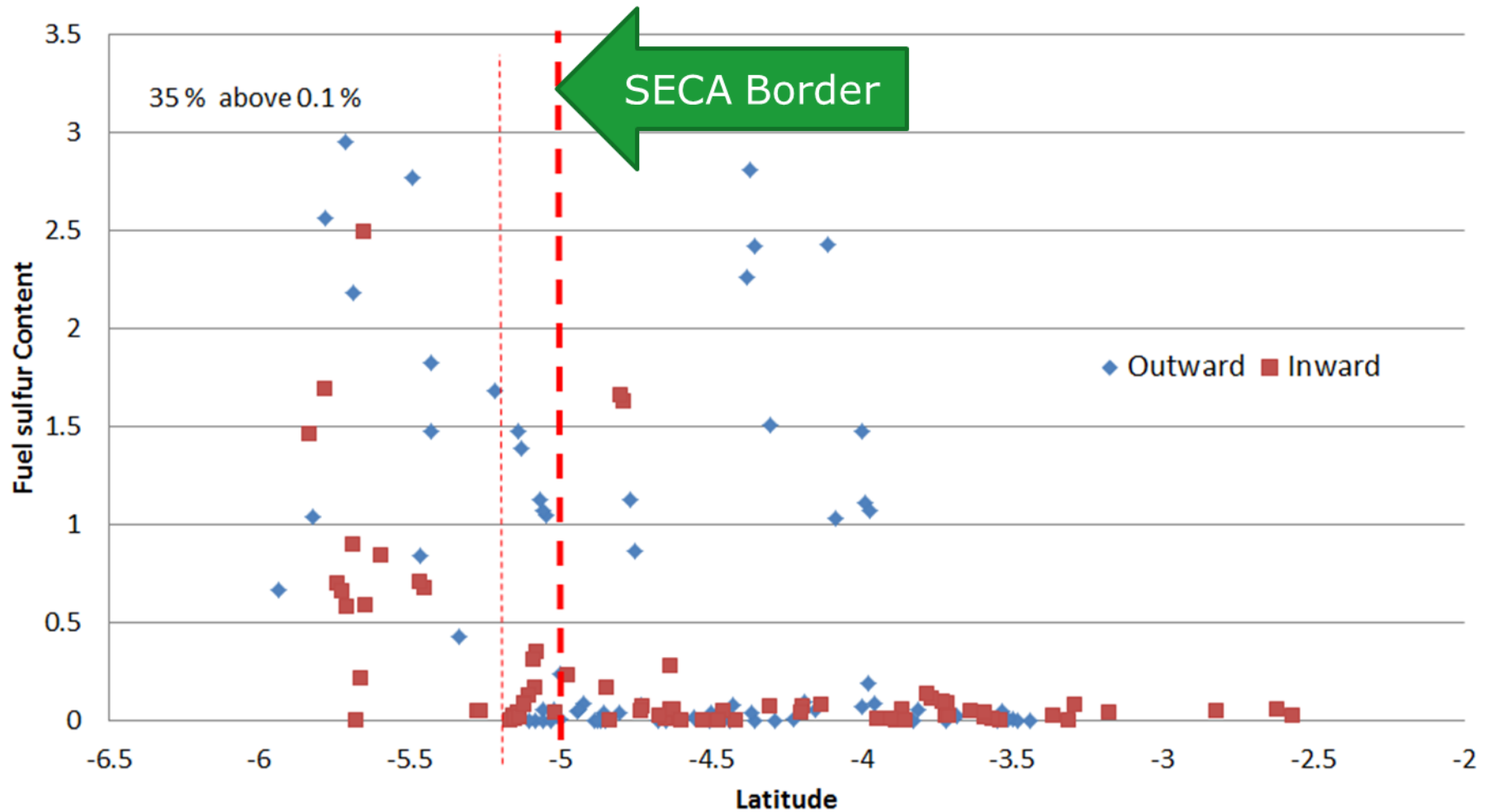
## Compliance analysis

BE Sniffer Campaign 2015-2016



- No correlation with destination (inside or outside SECA), flagstate nor size
- Spatial distribution shows more non-compliance off-shore

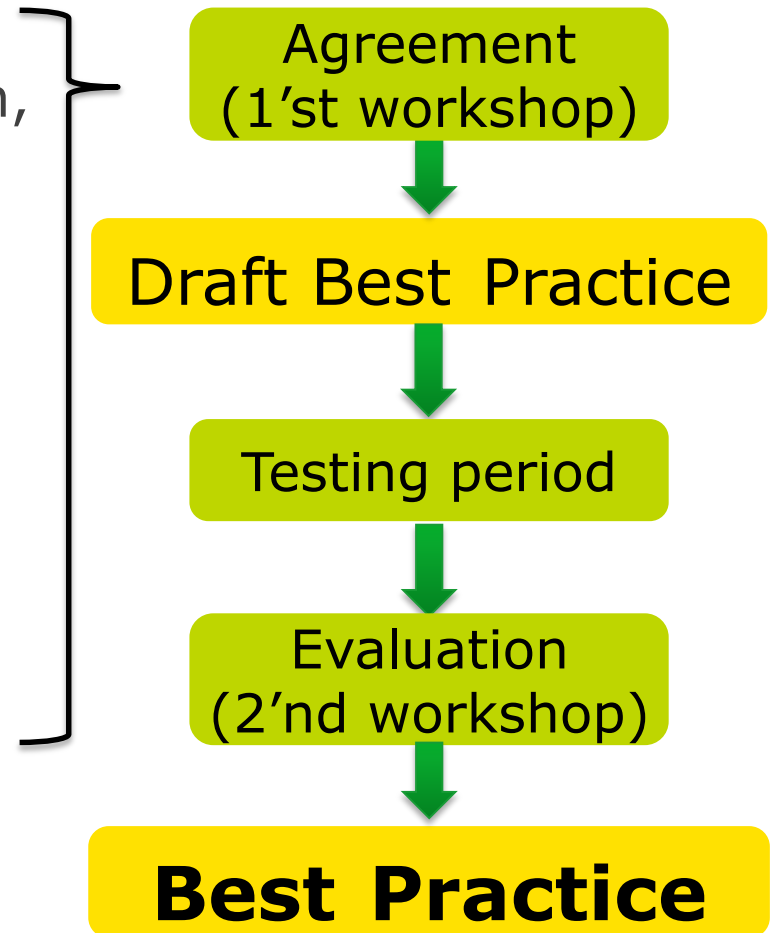
## Monitoring at SEACA border



Source: Chalmers University (2016)

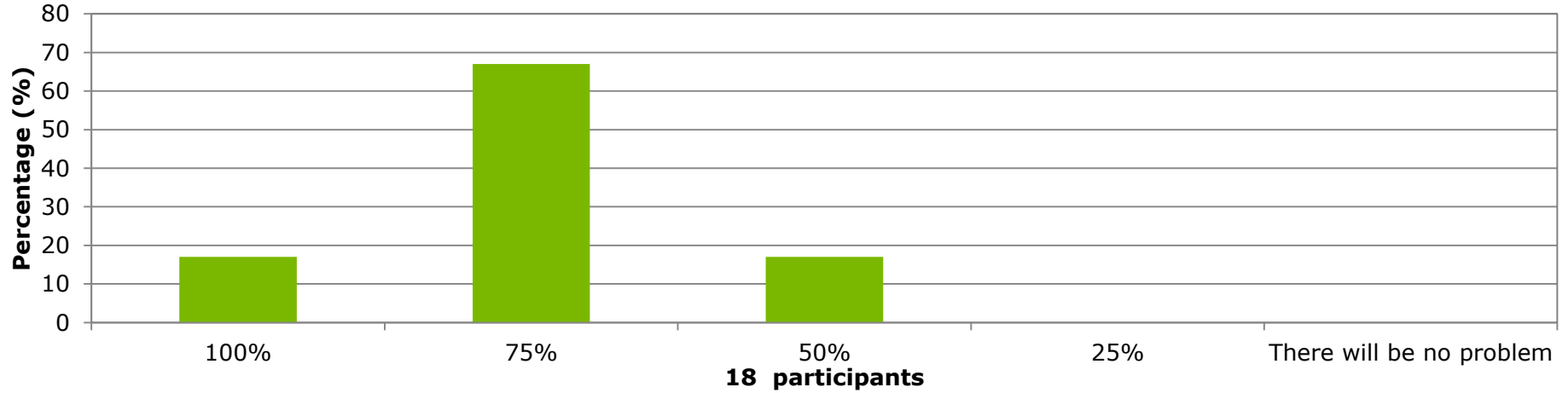
## Best Practice in Airborne Marpol Annex VI Monitoring Report based on expert input

- Participants: pilots, operators, engineers, PSC, legal experts,...
- Flight procedures (flight approach, speed & altitude, plume localisation, sampling attempts,...)
- Weather minima
- Health & Safety issues
  - ✓ Principle: to avoid unnecessary low-passes
- PSC reporting & feedback
- Data sharing

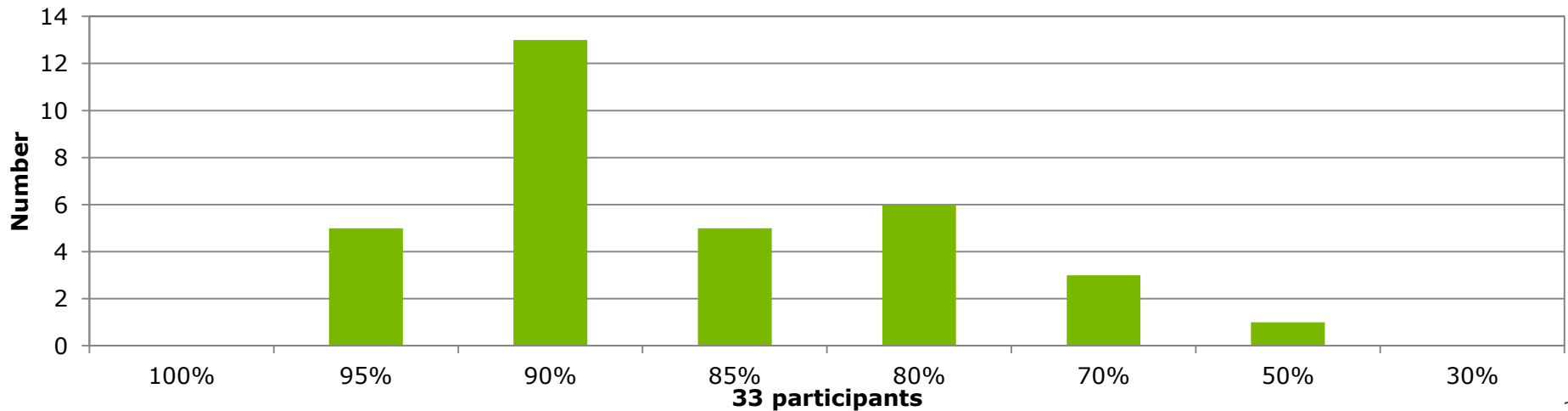


## Question at CompMon stakeholder conference

How likely is a compliance problem when the global 0.5% limit is implemented



What in your mind is the present off-shore compliance rate in the North Sea?



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[www.compmon.eu](http://www.compmon.eu)



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## Partners



## CHALMERS

