

SOLVAir[®]

Marine Solutions

Innovative ship exhaust DeSOx and Particulate
Matter removal system



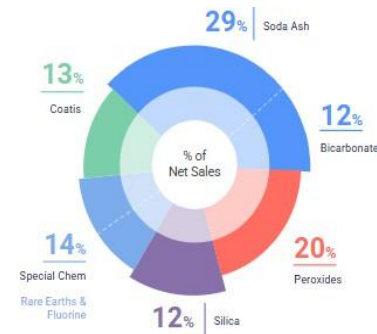
SOLVAY

Introducing Solvay

We are Solvay, a 165-year old, family-owned, pioneering chemical company headquartered in Brussels.

Making progress possible is in our DNA. We master industrial processes to better manufacture technologies that are essential to multiple markets.

Our products are essential to people's daily lives - purifying the air we breathe, conserving food resources, protecting health and well-being, making car tires more sustainable, enabling battery recycling, creating a sustainable impact for generations.



At a glance



~9,000
Employees



€4.7bn
Underlying
net sales



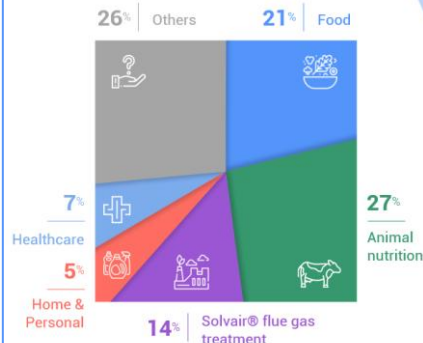
44
Production
sites



41
Countries

>80% regional sales from local production

A market maker in Bicarbonate



We are **ESSENTIAL CHEMISTRY**, making progress possible **FOR GENERATIONS**

SOLVAY

SOLVAir®

On-land and Marine Flue Gas Treatment



SOLVAir®

FOR WHAT? >>>

- > Remove pollutants from exhaust gases
- > Meet current and future international and local air emissions control regulations

FOR WHO? >>>



cement
glass
metallurgy
refinery

Industrial



biomass
fossil fuel

Energy



**Waste
Incinerator**

strict regulation :
acid gases
micropollutants
heavy metals



Marine



**FLUE GAS TREATMENT - CLEAN AIR
SOLUTIONS FOR BETTER PERFORMANCE**

SOLVAY

Air Quality and future environmental regulations driving SOLVAir® growth with clear milestones for maritime transport

ECOSYSTEM AT RISK



Pollution (air, water, and soil) will raise more and more concern triggering the research for new solutions

- Growing demand for air treatment with a special focus on fossil fuel
- Upgrade of large municipal waste management systems in response to lower limits and more pollutants to be treated

01

SECA/ECA

Mediterranean SECA in **May 2025**, with a NECA planned for the future.

U.S./Canada, Baltic & North Seas are already SECA (SO_x) and NECA (NO_x & PM).

Norwegian Sea, Canadian Arctic, and NE Atlantic are expected to become ECAs soon.

All European seas are anticipated to be ECAs in the coming years.

02

Washwater ban

Wash water release banned in Danish, Swedish and Finnish territorial waters (12 nm) from **July 2025**.

03

Port pollution

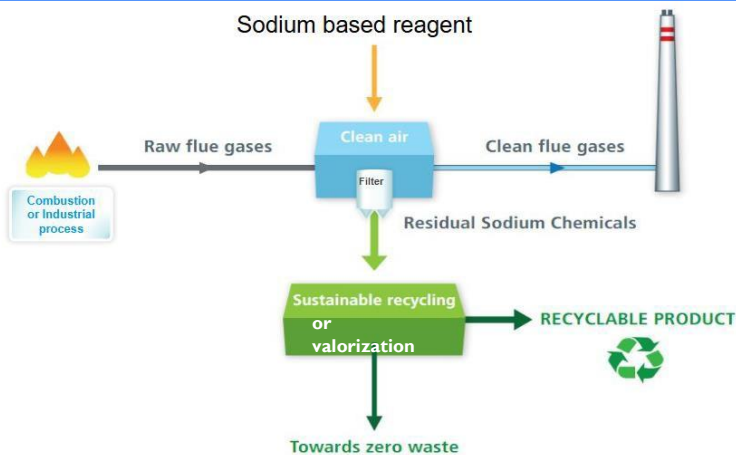
California : Expanded regulations for particulate matter (PM) removal, effective **January 2025**.

Other regions and countries are expected to follow suit soon.

SOLVAY

SOLVAir® 30 years of experience in delivering solutions for the most stringent air quality regulations

Injection of a dry sodium-based sorbent (DSI) to neutralize acidic flue gas (SO_x, HCl, HF...)



BENEFIT

- Economical and operational efficiency
- Easy to install, adapt and handle
- Residues recycling offer available
- No effluents released



- ~500 kT of DSI grade bicarbonate per year
- Growing demand (4%/y) driven by air quality regulation
- Mainly EU (DE, FR, IT) and new incinerator projects



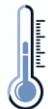
Marine

Started in 2018

DeSO_x and PM removal for HSFO vessels

The Science behind Solvair®

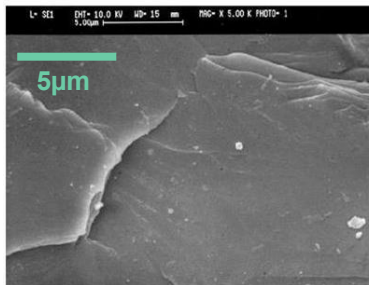
Dry Sodium Sorbent Injection (DSI) of bicarbonate to neutralize acidic Sox flue gas



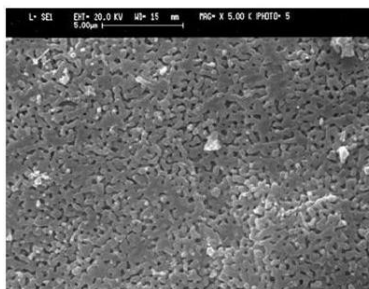
STEP 1 thermal activation to porous carbonate structure

First reaction at 80°C (during injection):

- $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$
- (2* Sodium bicarbonate -> Sodium carbonate + CO₂ + H₂O)



BEFORE ACTIVATION
(SEM X 5000)



ACTIVATED STATUS
(SEM X 5000)



STEP 2 neutralization and oxidation to inert sulfate salt particles

Second reaction:

- $\text{Na}_2\text{CO}_3 + \text{SO}_2 \rightarrow \text{Na}_2\text{SO}_3 + \text{CO}_2$
- (Sodium carbonate + sulfur dioxide -> Sodium sulfite + CO₂)
- $2\text{Na}_2\text{SO}_3 + \text{O}_2 \rightarrow 2\text{Na}_2\text{SO}_4$
- (Sodium sulfite + oxygen -> Sodium sulfate)

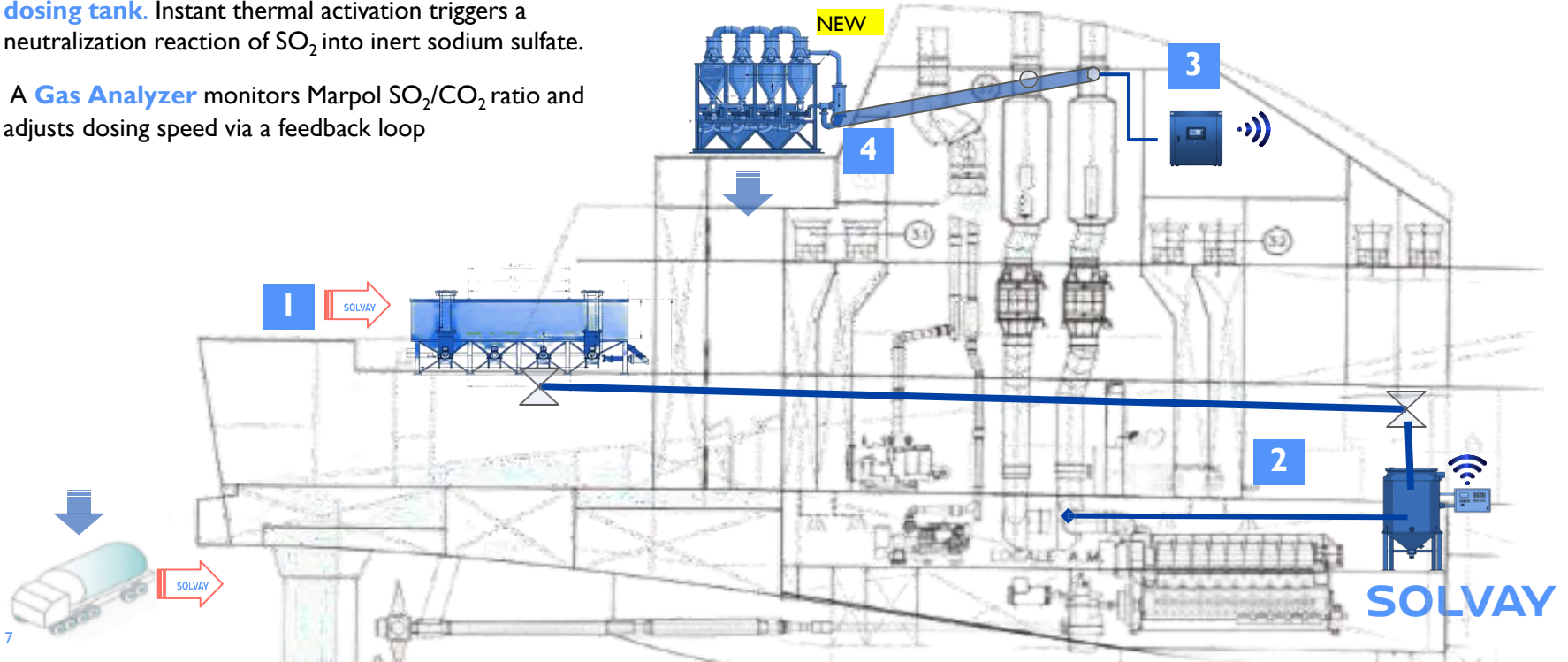
Solvair® Marine Dry Cyclone DeSOx/PM System

Solvay S350 marine-grade bicarbonate is stored in a **dry silo installed on deck**

S350 powder is injected after the turbocharger via a **dosing tank**. Instant thermal activation triggers a neutralization reaction of SO_2 into inert sodium sulfate.

A **Gas Analyzer** monitors Marpol SO₂/CO₂ ratio and adjusts dosing speed via a feedback loop

Sodium sulfate crystals can adsorb black soot and fines. 90+% of particle emission can be filtered out via a **cyclone system** and disposed on-land

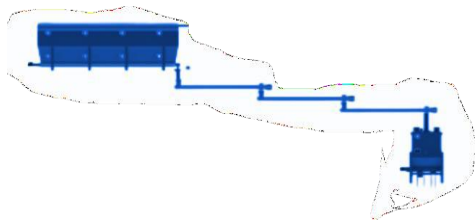


Components of Solvair® Marine process

Combination of “on-land” and marine-design industrial technologies

Dry Powder Injection

Marine environment
Solvay technology and plant
support experts



Gas sampling & analysis

Same technology and providers for
wet scrubber systems

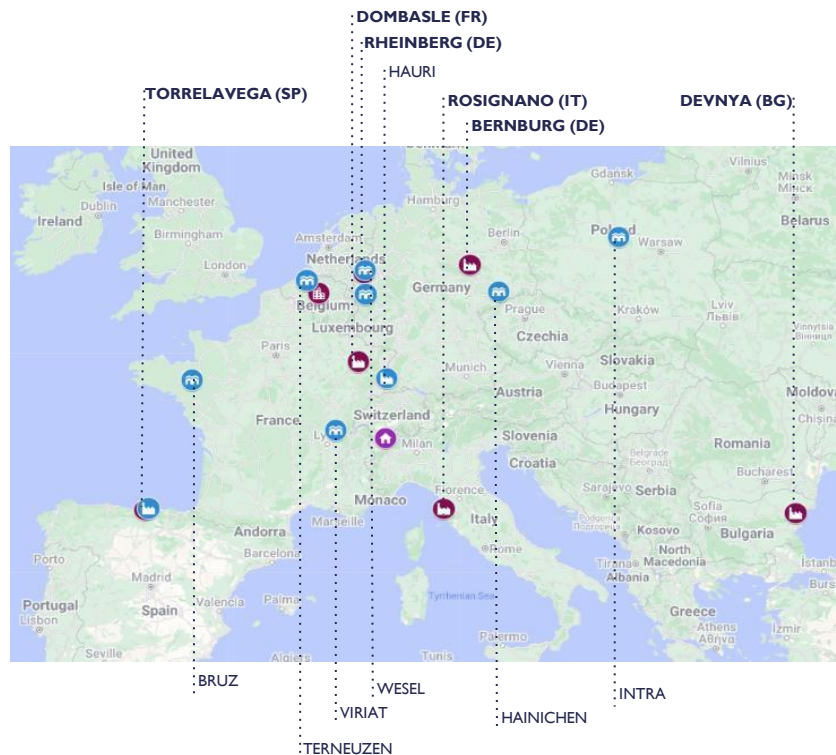


Cyclone filter

PM removal
Re-application to Marine of
Industrial Filtering System



Optimized logistics to serve European ports



SOLVAIR®
Marine Solutions

- ✓ Solvair produces more than **1 Mio. T** of bicarbonate from **6 plants** in Europe
- ✓ Solvair supplies more than **300 Solvair on-land customer sites**
- ✓ A unique logistic network to serve the **North Sea, Baltic and Mediterranean SECA ports**
- ✓ Adapted to **RoPax, container feeder and local bulk cargo** vessels with regular port calls



PRODUCTION



WAREHOUSE

SOLVAY

Benefits of Solvair[®] Marine : cost savings and sustainability

01

Economical & Efficiency

Investment **payback < 12 months** for a 20,000 GT RoPax sailing in SECA area on HFO vs. ULSFO/MGO

Proven, reliable technology for flue gas treatment on land

02

Easy to Install, Adapt, and Handle

No dry dock necessary

Minimal additional on-board **power/electricity** needed

Non-hazardous powder and residues

03

No Air or Waste Water Release

Possible to retrofit **wet scrubber** to a “Solvair-hybrid” system

Anticipation of **future regulation on particle emissions**

04

Residues handling offering

Solvair on-land valorization business model



SOLVAY

Solvair® Marine references

Yeoman Bridge (Basic Dry)



Bontrup Amsterdam (Basic Dry)



Piana (PM removal bag filter)



Stena Flavia - Cyclone filter add-on
under discussion (2026)



Solvair® Marine: Class approvals - DSI

Dry Systems Injection with Sodium Bicarbonate



SOLVAY

Solvay develops sustainable solutions for the **marine industry** to help comply with new environmental regulations



SOLVAir®
Marine Solutions

- ✓ **Dry exhaust gas treatment system** for SOx and PM removal
- ✓ **90+% Of Particles** Are Captured
- ✓ **NO WASH WATER** release
- ✓ **300 satisfied customers** on land benefit from 30 years SOLVAir® experience
- ✓ **SOLVAY** is teaming up with leading marine engineering companies to speed up deployment of a dry DeSOx and PM Removal system for vessels running on HFO diesel engines

Thank you

SOLVAY
ESSENTIAL FOR GENERATIONS