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MAGTREAT®

MAGNESIUM HYDROXIDE FOR EGCS

(Exhaust Gas Cleaning Systems)

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CONTENT

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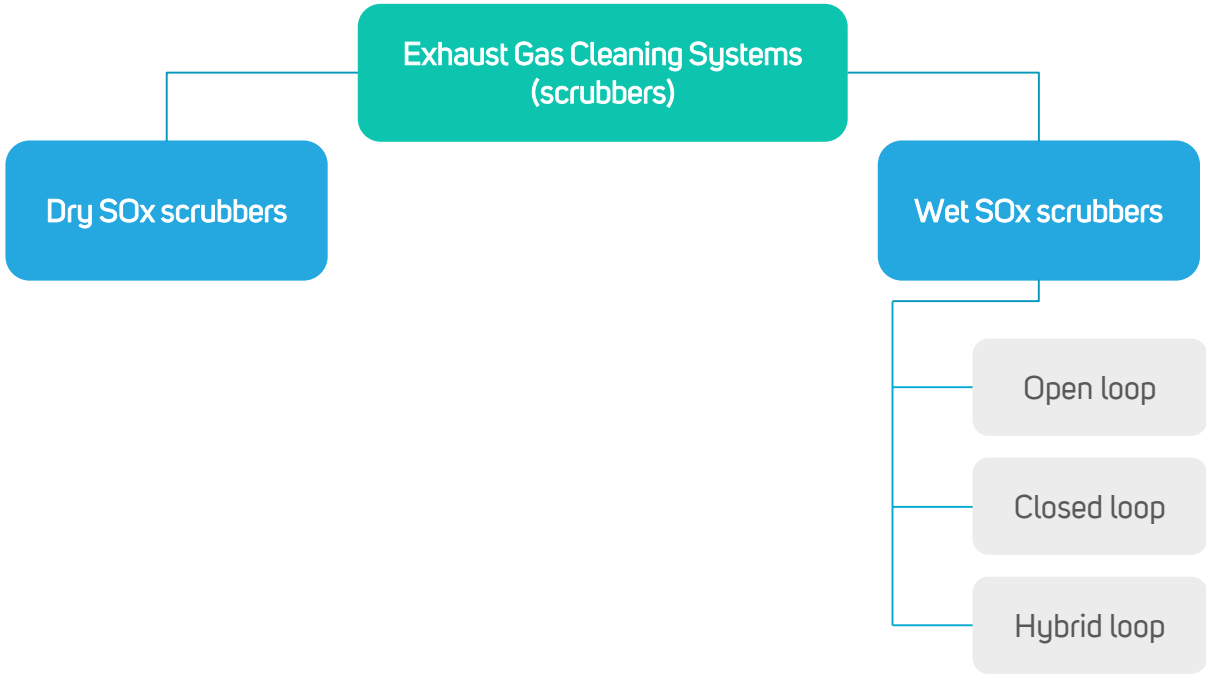
EXHAUST GAS CLEANING SYSTEMS OPTIONS



EXHAUST GAS CLEANING SYSTEMS OPTIONS

Open-loop system

Easy and proven construction
Simple operation

Is banned or tend to be banned in many countries
Performance of the EGSC depend on sea water alkalinity
High fees for using in restricted areas

Closed-loop system

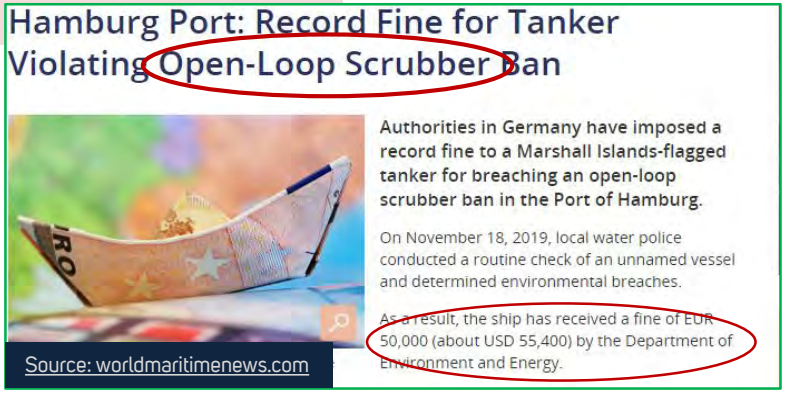
Independence from sea water alkalinity

Alkali reagents is needed

Hybrid system

Flexibility in operation

High installation costs
Alkali reagents is needed



Hamburg Port: Record Fine for Tanker Violating Open-Loop Scrubber Ban

Authorities in Germany have imposed a record fine to a Marshall Islands-flagged tanker for breaching an open-loop scrubber ban in the Port of Hamburg.

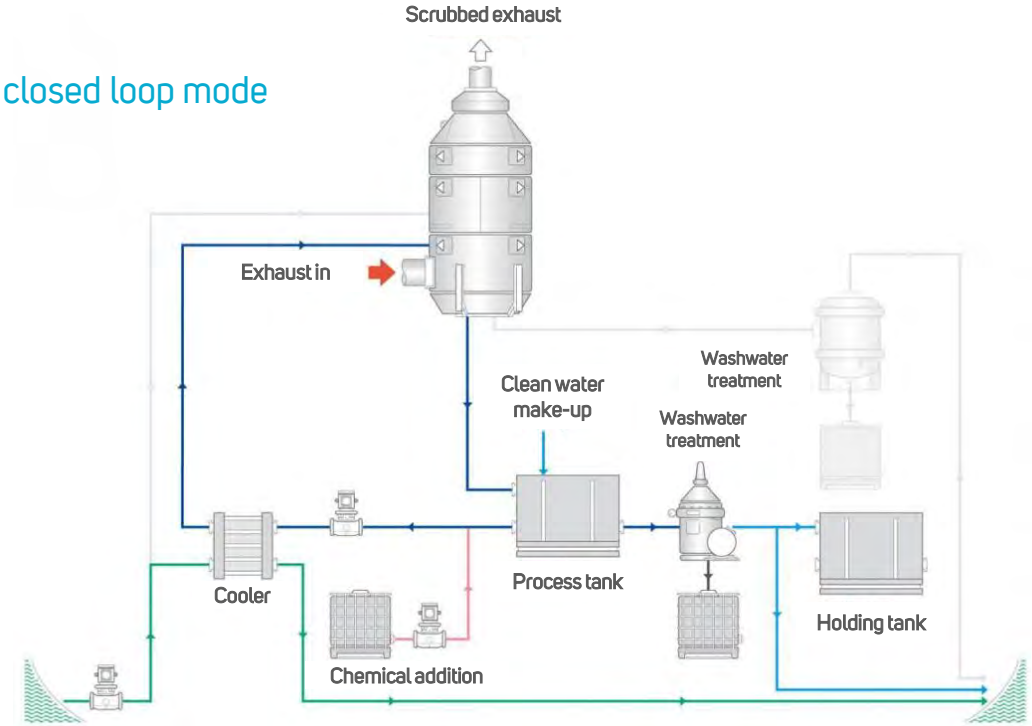
On November 18, 2019, local water police conducted a routine check of an unnamed vessel and determined environmental breaches.

As a result, the ship has received a fine of EUR 50,000 (about USD 55,400) by the Department of Environment and Energy.

Source: worldmaritimenews.com

HOW DOES EGCS WORK ?

Hybrid system in closed loop mode



CHOOSING THE BEST ALKALI. CHEMICAL BENEFITS

Desulphurization reactions:

$$2NaOH + SO_2 + ½\ O_2 \Leftrightarrow Na_2SO_4 + H_2O$$

$2x40_{g/mol}$ $64_{g/mol}$ $142_{g/mol}$

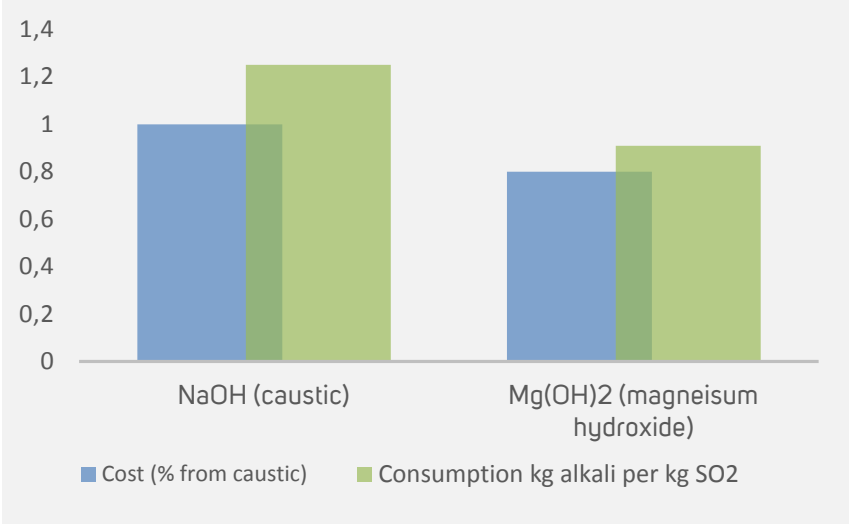
$$Mg(OH)_2 + SO_2 + ½\ O_2 \Leftrightarrow MgSO_4 + H_2O$$

$58_{g/mol}$ $64_{g/mol}$ $120_{g/mol}$

Alkali	Stoichiometric consumption* kg of alkali per kg SO_2
NaOH (caustic soda)	**1.25**
$Mg(OH)_2$ (magnesium hydroxide)	**0.91**

*-on 100% solid substance basis

Comparison of alkalis for EGCS



CHOOSING THE BEST ALKALI. OPERATIONAL BENEFITS

Sodium hydroxide NaOH

- Commodity, easily available
- Delivered as 50% water solution, easy to dose

- Hazardous
- Corrosive to certain metals
- Reacts exothermically with water, producing heat
- Harmful to eye and skin, requires appropriate personal protective equipment
- Storage temperature over +18°C
- Prices are volatile
- Should be stored in heated tanks

Magnesium hydroxide $Mg(OH)_2$

- Non-hazardous, safe to people & environment
- Non-corrosive
- Can be easily diluted without producing heat
- Storage temperature over +2°C
- Stable prices from producers
- Less dosing amount needed, less storage space, less pumps work
- Delivered as 65% stabilized slurry
- Possibility to supply both slurry and powder by barge
- Easy slurry make down in case of powder deliveries

- Pipes have to be flushed with water after operating the scrubber

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MAGTREAT®

Natural magnesium hydroxide for exhaust gas cleaning systems

MagTreat

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MAGTREAT®: FEATURES

MagTreat® is a highly efficient aqueous suspension based on natural magnesium hydroxide for pH control and treatment of waste water and flue gasses.

MagTreat® properties

	Specification	Typical
Dry Solids, %, min.	63	65
Density, kg/m^3, min.	1550	1650
Viscosity, (Brookfield VT, 100 rpm), cPs, max.	650	200
Product appearance	White, homogeneous, stabilized suspension	
$Mg(OH)_2$ % *, min.	89,9	92,2
CaO, %, max.	3,0	2,6
SiO_2, %, max.	3,0	1,6
Fe_2O_3, %, max.	0,3	0,15
Specific Surface Area, m^2/g	9-11	10
Particle Size Distribution, microns: D_{50}	5,0-6,0	5,5
Laser Diffraction	5,0-6,0	5,5
Sedimentation technique		~2,5

*Dry Solids Basis

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MAGTREAT® FEATURES

1m³ Caustic 50% = 610 kg of treated SO_2 = 305 kg of treated S

1m³ MagTreat-S 65% = 1090 kg of treated SO_2 = 545 kg of treated S

1m³ MagTreat-S 65%
1 IBC

1m³ Caustic 50%
1,7 IBC

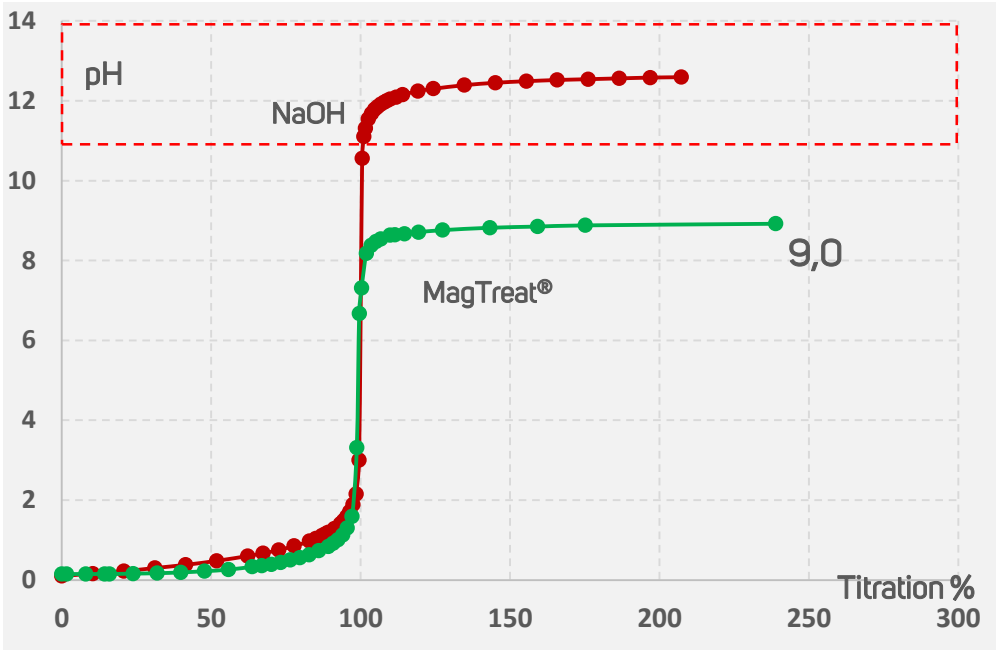
MAGTREAT® FEATURES

MagTreat® buffers at a pH of approx. 9. You can't go higher that value, so no risk of skin/eyes burns.

Where as NaOH can easily reach a pH of 13 (>11.5, that is the deadline for severe skin irritation).

Caustic is hazardous to people and environment. And requires special storage conditions on board.

Chemical burn 11.5 pH



Data of the RnD lab at the processing plant

MAGTREAT® FEATURES

MagTreat® is a natural mineral product. It contains minor impurities, formed million years ago in that mineral.

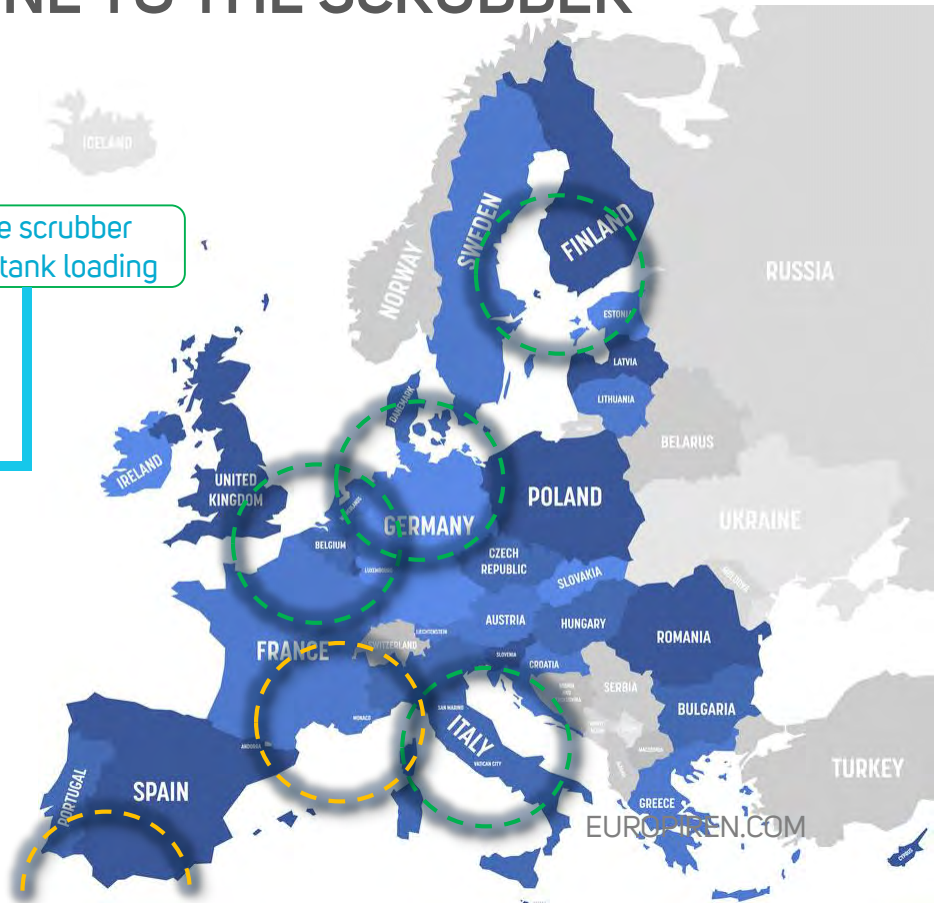
We know about it. That's why, raw material for production of MagTreat® undergoes a strict quality selection by XRF separation equipment.

So we can guarantee the consistency of quality of the final product.

PRODUCT WAY – FROM THE MINE TO THE SCRUBBER

Slurry make down facility → Tank truck delivery of the slurry → direct / or → Marine scrubber storage tank loading

Slurry make down facility → Barge loading → Marine scrubber storage tank loading



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Slurry make down facilities

Current facilities Future facilities

MAGTREAT® PRODUCTION

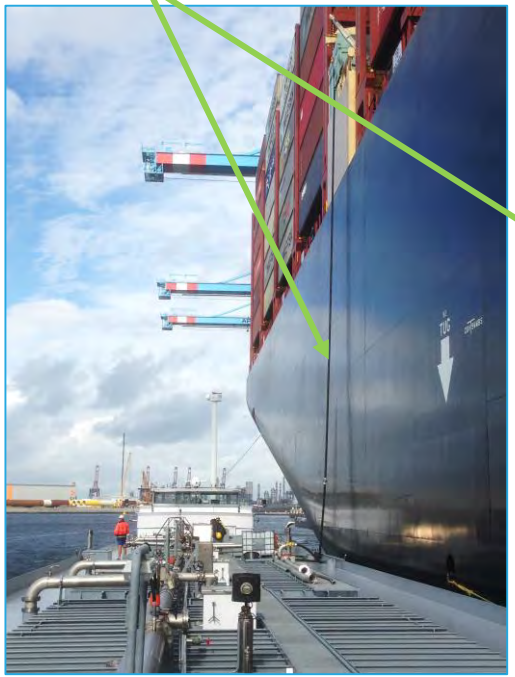
Example of slurry make down facility in Finland

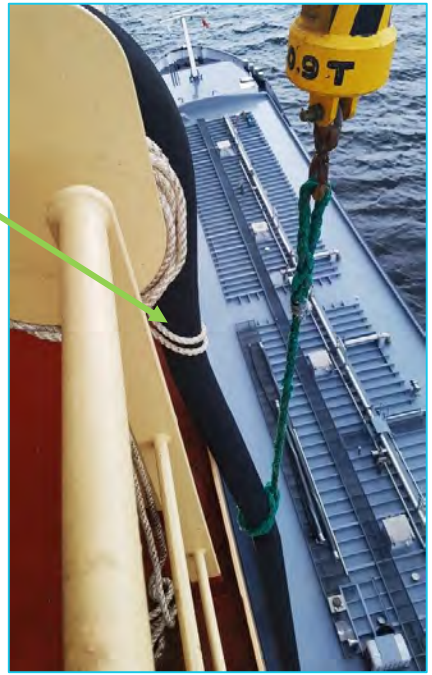
MAGTREAT® PRODUCTION

Example of slurry make down facility in Belgium

MAGTREAT® LOADING FROM BARGE

MagTreat





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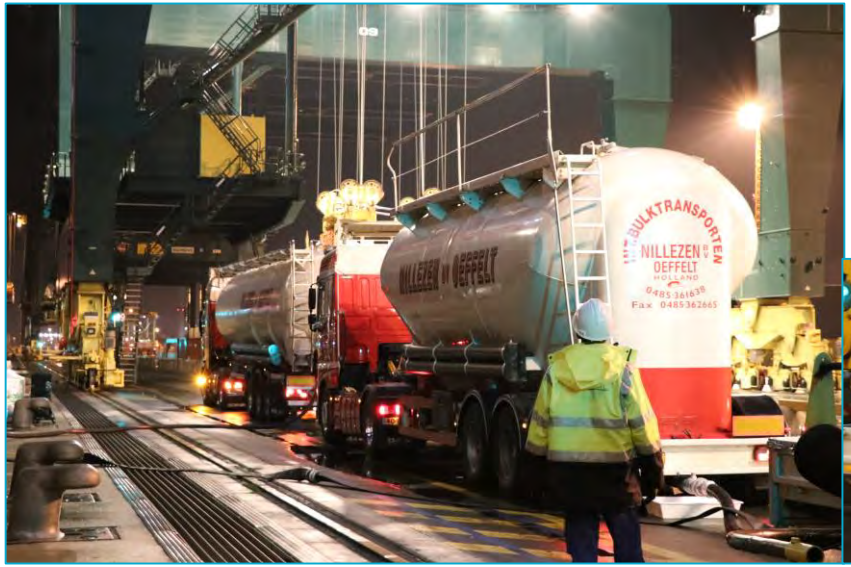
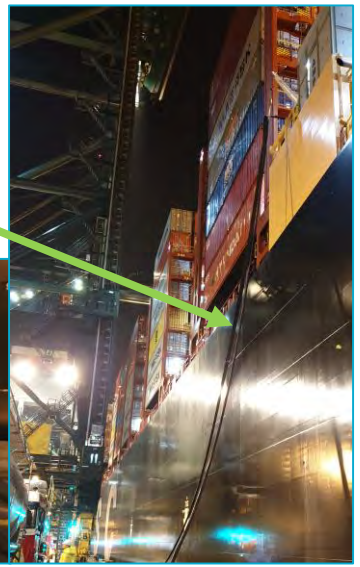
MAGTREAT® LOADING FROM TRUCKS



MagTreat



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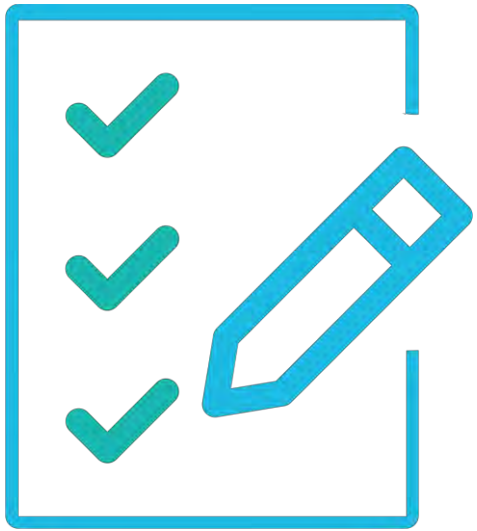
MAGTREAT® ADVANTAGES

- Non-hazardous to people and environment, exempted from REACH registration
- Proven applications of natural magnesium hydroxide product in different fields (wastewater treatment, pulp bleaching)
- Ecological product with low carbon footprint
- Most cost effective alkali compared to others
- Occupies less storage space than caustic soda
- Available as ready-to-apply slurry with the highest solids content - 65%
- Stable prices guaranteed by the manufacturer
- Own resource base with confirmed reserves
- Quick delivery within Europe from 4 slurry-make-down plants



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MAGTREAT® SUPPLY

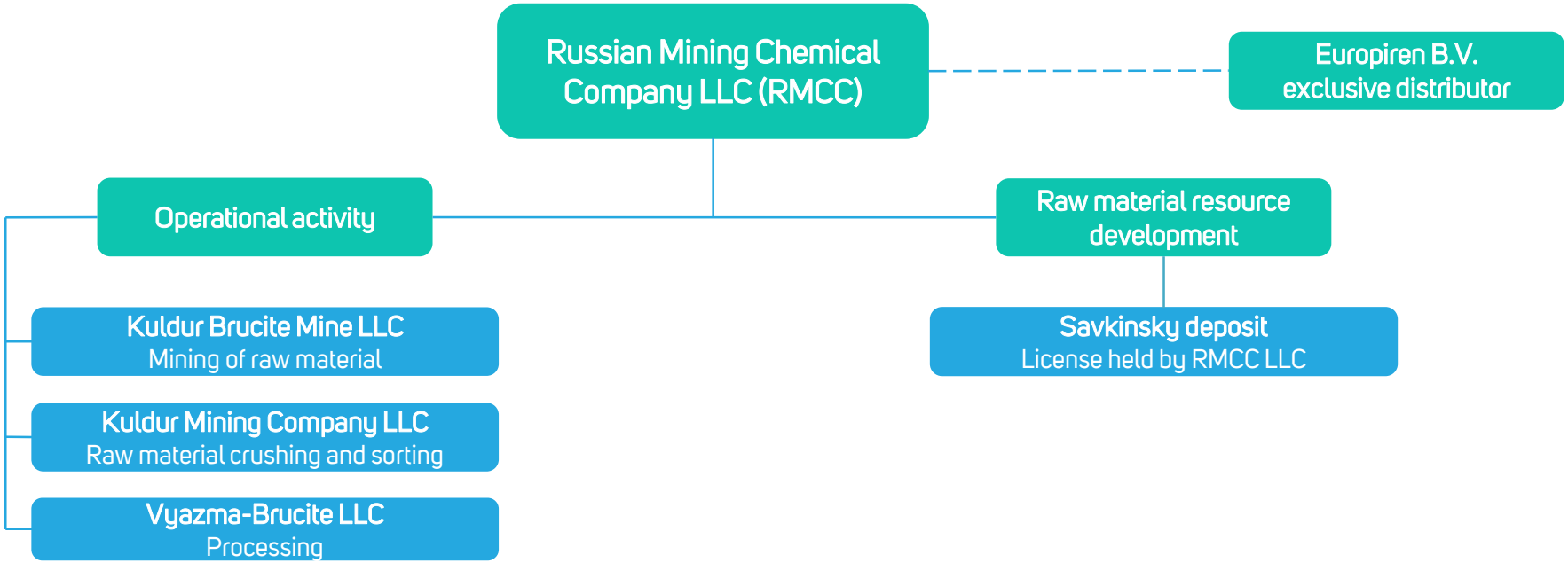
Ports where the suspension is loaded from:

- Antwerp
- Rotterdam
- Bremerhaven
- Hamburg
- Gioia Tauro

Tons of MagTreat® were successfully supplied:

- **> 4 000 tons** 2019
- **15 000-20 000 tons** Plan for 2020

COMPANY STRUCTURE



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OWN RESOURCE BASE

MagTreat® is produced from natural magnesium hydroxide, brucite mineral.

- The world's largest brucite deposits
- Confirmed reserves of more than 8 million tons
- Current output approx. 350.000mt/y of all grades
- A new deposit with reserve of 22 million tons is being developed and will be operational in 2025

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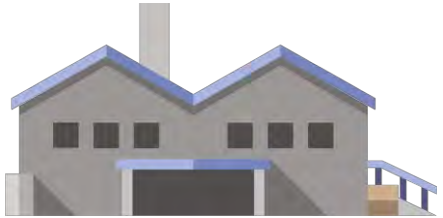
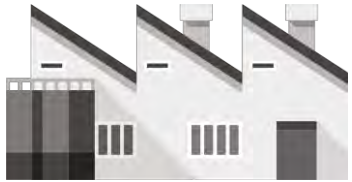
PROCESSING PLANTS

- Manufactures end-products from natural magnesium hydroxide ore
- In 2009-2011 the new production facilities were built up. it allowed us to increase the quantity of the end-products
- In our production process we use equipment of world leading companies. We install the up-to-date technology equipment to provide manufacture of high-quality products
- Production is done in accordance with the certificate of compliance of quality management system ISO 9001:2015
- In January 2020, the 4th production line started

PRODUCTION CAPACITIES

CAPACITY, TONS PER YEAR	PLANT 1	PLANT 2	PLANT 3
			
	60 000	40 000	45 000

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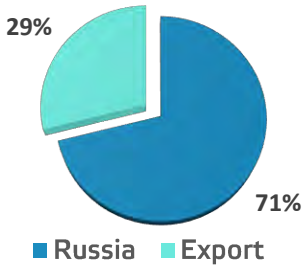
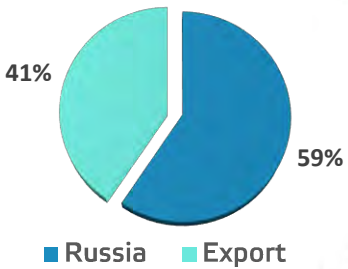
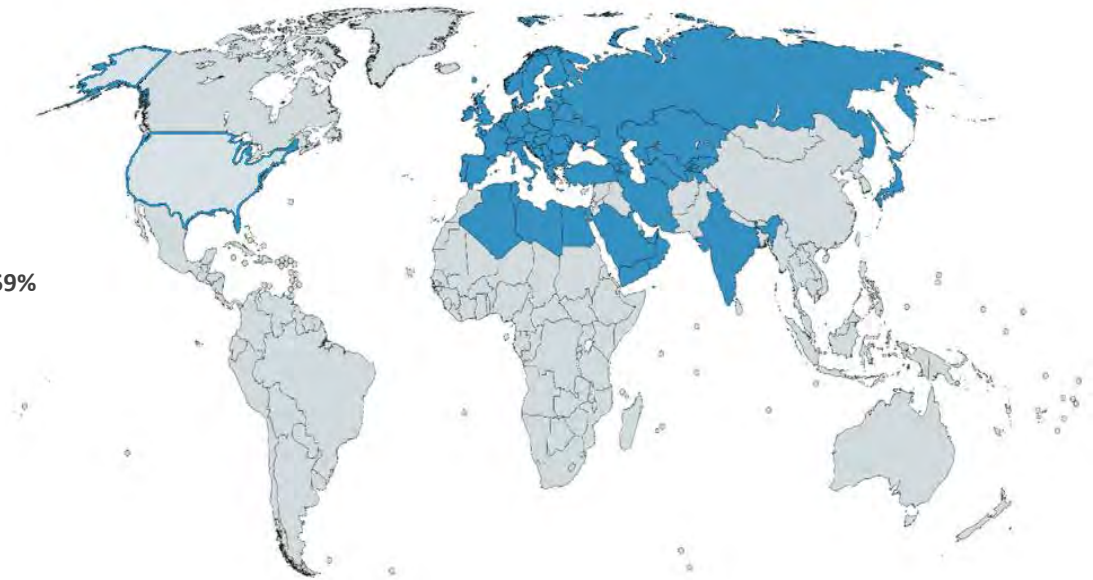
PERFORMANCE HIGHLIGHTS. SALES GEOGRAPHY

2015 - 2018



2019 - 2023



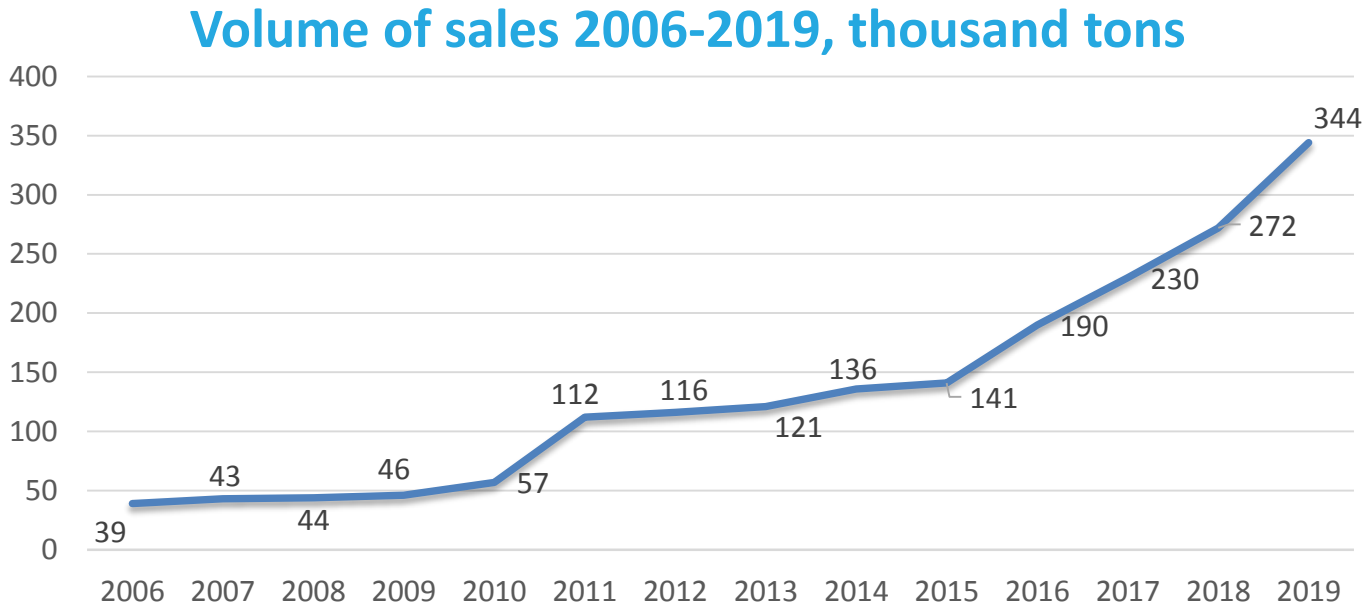


PERFORMANCE HIGHLIGHTS. SALES STATISTICS

Volume of products sold in 2018:
260 000 tons

Volume of products sold in 2019:
344 000 tons

Plan for 2020:
375 000 tons



PRODUCTS AND APPLICATIONS

Flame retardants for polymer

Product line developed specially to meet the needs of wire & cable, ACP-panels, TPO membranes and other fire resistant building materials producers all over the world.

Environmental

Products line designed directly to help industry overcome ecological challenges connected with water & gas treatment.

Pulp & Paper industry

Special products designed for pulp & paper industry.

Technical Rubber and Plastics

Cutting-edge product which acts as an effective scorch polymers. It is also a thickening agent in BMC and SMC.

Mineral fertilizers

Special product acting as anticaking agent & conditioning additive during mineral fertilizers production.

Glass production

Product developed for industrial production of glass for construction, technical and domestic purposes.

Metallurgy

Special product for steel making in oxygen converter, EAF and blast furnace.

Magnesium based chemicals

Raw material product for the production of a wide range of magnesium compounds and products

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