



# STAMICARBON SAFUREX® EQUIPMENT

Full Life Cycle Support  
Philosophy

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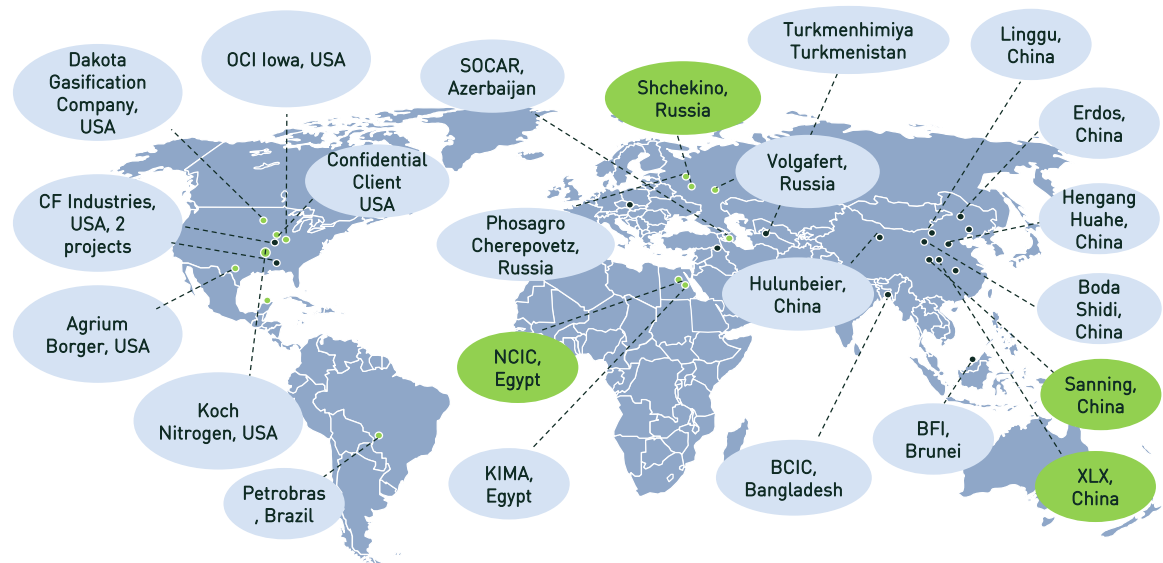
# ABOUT US: INTRODUCTION

- Market leader in the **licensing and design of urea plants** and related **full life-cycle services**, including the supply of **proprietary equipment**.
- Active in **various fertilizer technologies** in collaboration with **reputable partners and EPC contractors**.
- A **pioneering company** with a vision to help enable the world to feed itself and improve quality of life.



# WORLD FERTILIZER TECHNOLOGY LEADER

## Awarded Capacities Stamicarbon (2010-2019 YTD)

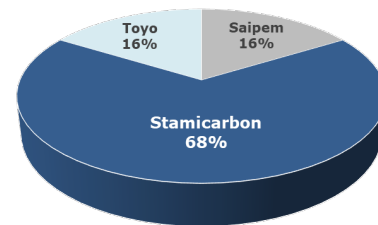


(based on project contract awards as of 2010)

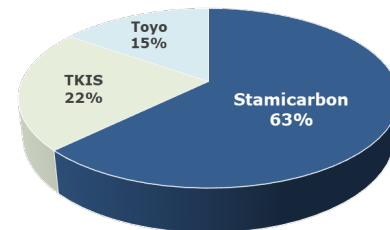
**Stamicarbon maintained its global leading technology position including 4 grassroots project awards last 24 months.**

Source: Stamicarbon BI 2019

## MENA: Urea Melt Market Share 2000-2019 YTD



## MENA: Urea Granulation Market Share 2000-2019 YTD

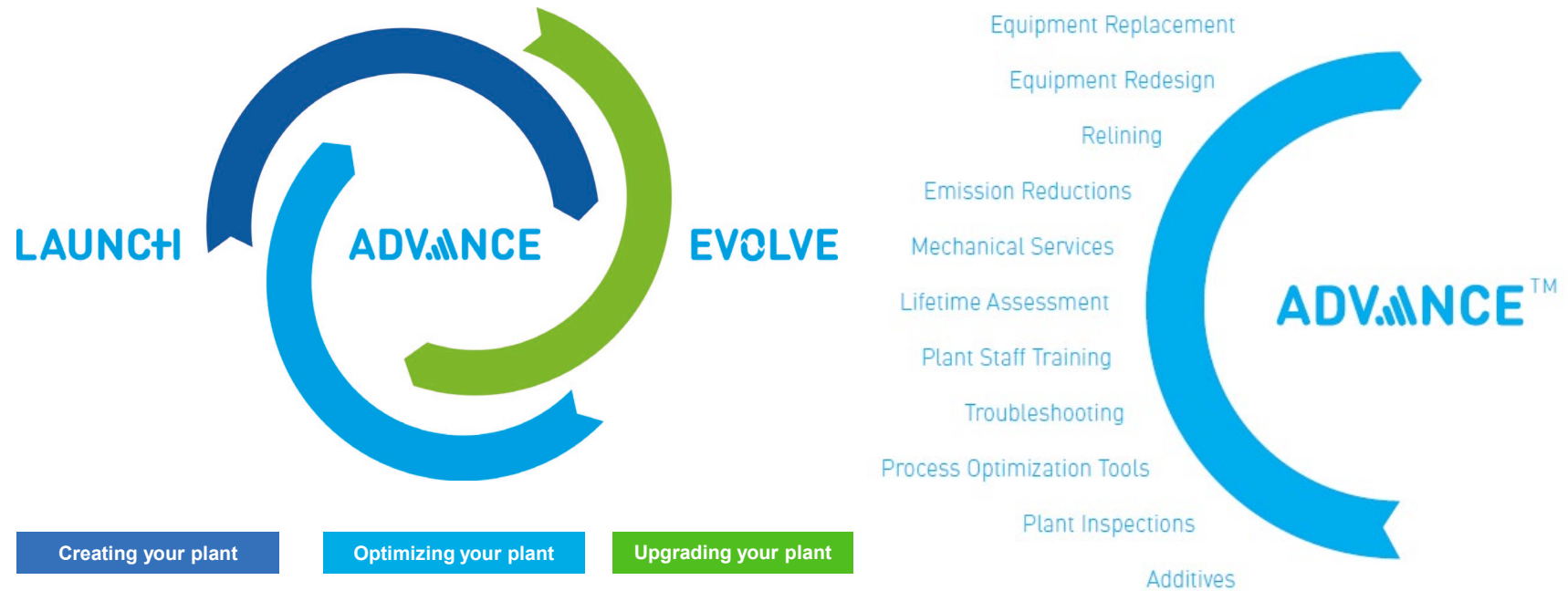


- Based on project contract award
- Excluding Chinese copy technology

The innovation & license company of Maire Tecnimont



# OUR FOCUS: FULL LIFECYCLE SUPPORT



# MATERIAL DEVELOPMENT FOR UREA APPLICATIONS

1920

**First industrial urea  
production plants**

Huge corrosion problems

1956

**DSM | Mr. van Waes**  
**Creating an oxidizing  
environment  
(air dosing)**

Enabling to use austenitic  
stainless steels possible as  
material of construction

1970

**Stamicarbon/Sandvik**  
**25-22-2 (Cr-Ni-Mo)  
material of  
construction**

Optimized fully austenitic  
stainless steel, optimized  
for urea service.

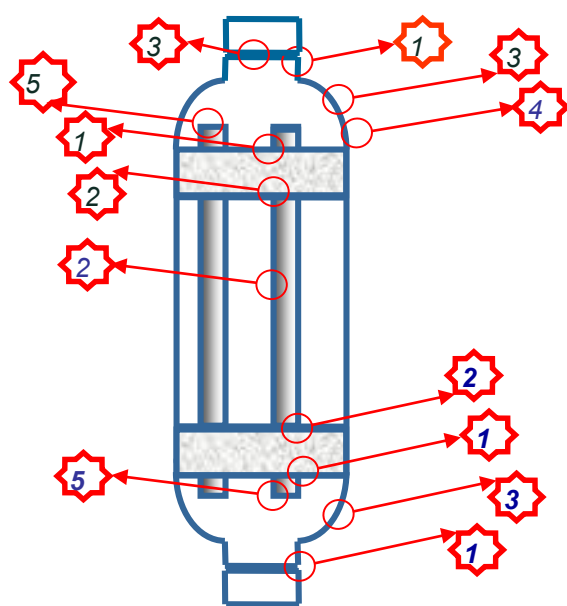
1995

**Stamicarbon/Sandvik**  
**Safurex® a high alloy  
ferritic-austenite  
stainless (“duplex”)  
steel**

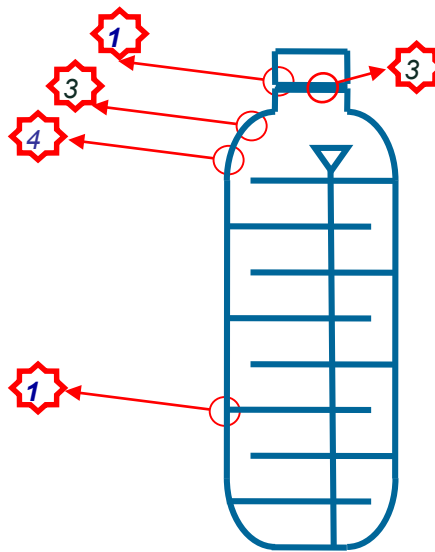
Excellent stress corrosion  
properties, ductility and  
weldability

# WHY SAFUREX WAS DEVELOPED?

## TYPICAL CORROSION IN AUSTENITIC STAINLESS STEELS (25.22.2 / 2RE69)



HP stripper, HPCC, HP Scrubber



Reactor

1 = Crevice corrosion

2 = Stress Corrosion

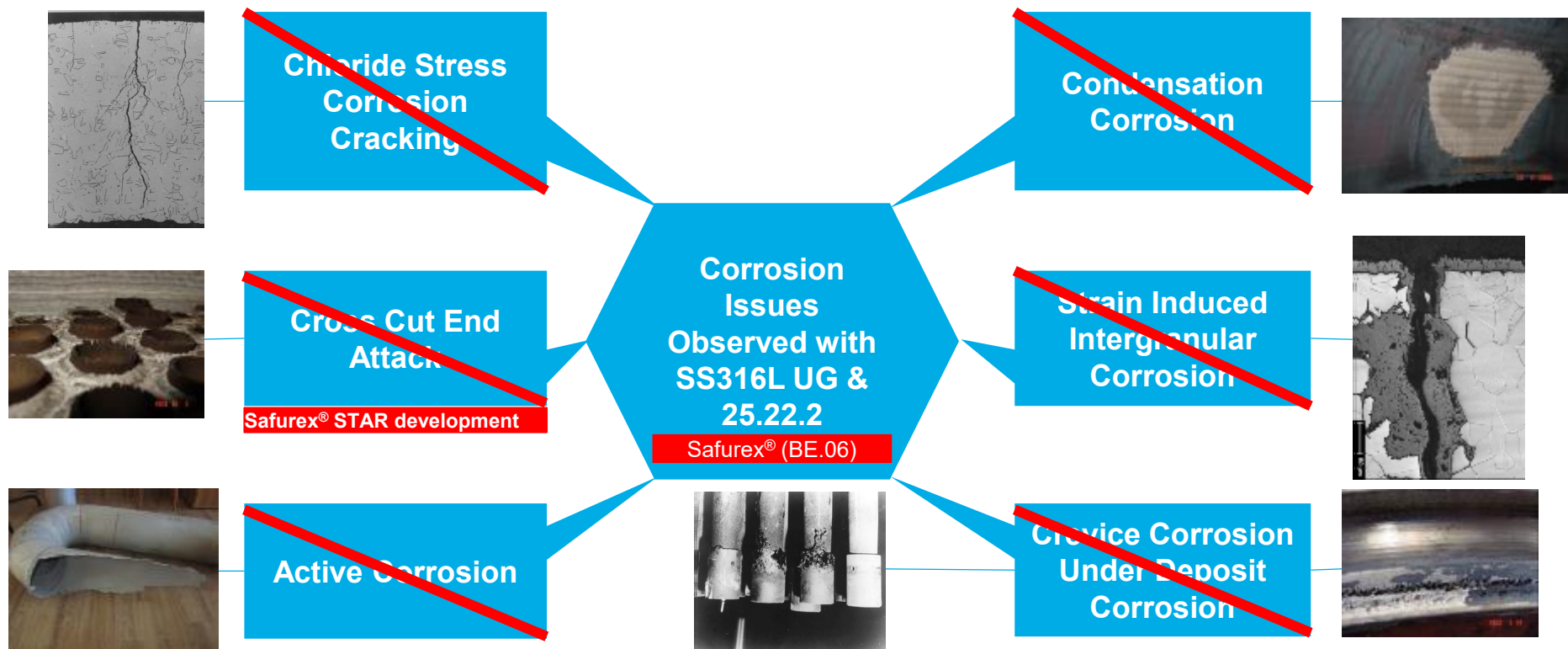
3 = Condensation Corrosion

4 = Strain Induced Cracking

5 = Stern Face Corrosion

*Safurex® was developed to eliminate the above corrosion issues*

# ELIMINATING CORROSION ISSUES USING SAFUREX®





# CORROSION TEST OF BC.01 (316L UG), BC.05 (25.22.2 / 2RE69) AND SAFUREX® INFINITY

BE.06 SAFUREX® INFINITY

BC.05 / 2RE69 (= 25.22.2)

BC.01 (= 316L UG)



Corrosion <0.05mm/yr

Corrosion >30.0mm/yr

gone

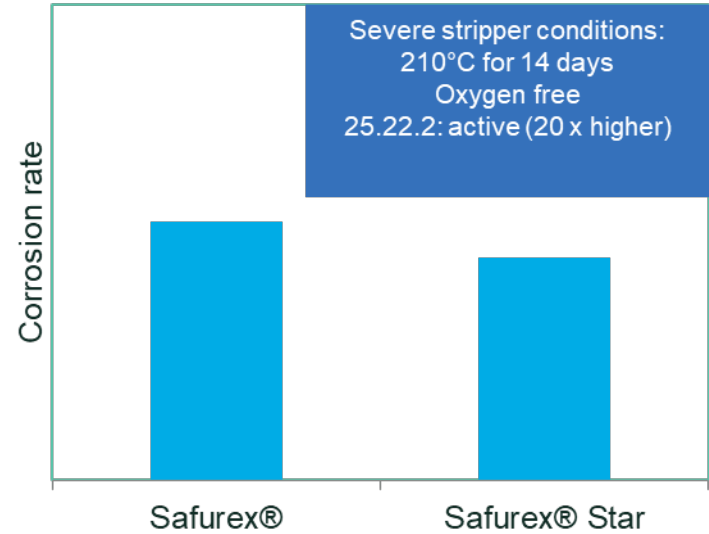
## TEST CONDITIONS:

Temperature	:	183°C
Time	:	75 days
Condition	:	oxygen free (no passivation)

***Safurex® shows excellent conditions compared to the severe affected 25.22.2 (2RE69) and SS316L UG***

# CORROSION EXPERIENCES SAFUREX®

- Passive corrosion: (excluding stripper hex tubes)
  - $0.10 \text{ mm/y} < \text{SS316L UG} < 0.20 \text{ mm/y}$
  - $0.05 \text{ mm/y} < 25.22.2 < 0.09 \text{ mm/y}$
  - Safurex® Infinity  $< 0.01 \text{ mm/y}$
- Heat exchanger HP strippers:
  - Passive corrosion Safurex® Infinity comparable to 25.22.2
  - However: never experienced active corrosion also not in flooding conditions
  - Passive corrosion Safurex® Star up to 20% improved corrosion rate compared to Safurex® Infinity



***Safurex® STAR has proven superior results***

# RECENT INNOVATIONS: WITHIN SHORT TIME PERIOD, SOLID TRACK RECORD OF NEW INTRODUCED (HIGH POTENTIAL)- SAFUREX MATERIALS

1998

## INTRODUCTION SAFUREX ∞ INFINITY

- Standard super duplex steel
- Proven track record: >20 years in synthesis section
- Value: Reliability, safety

- Reactor
- Pool Condenser
- Stripper
- Scrubber
- Piping
- Valves
- Ejector
- Liquid Div.



### HP EQUIPMENT

- OPR: 90 Plants
- UCT: 9 Plants

2016

## INTRODUCTION SAFUREX ° DEGREE

- New production process for super duplex material via the Hot Isostatic Pressing method
- Value: Handle min design metal temp of -35c improving corrosion resistance

- Upgrade Liquid Dividers
- Valves
- Optional Ejector



### Liquid Dividers

- OPR: > 10 Plants
- UCT: 2 Plants

2017

## INTRODUCTION SAFUREX \* STAR

- Special super duplex steel
- Application in the most demanding equipment such as the HP stripper in the CO2 and thermal stripping
- Process suitable for competitive strippers
- Value: Extreme corrosion resistance

- Upgrade: Stripper / heat exchanger tubes



### HP EQUIPMENT

- OPR: 2 Plants
- UCT: 4 Plants

2019

## Under Development: SAFUREX® Next Generation

# SAFUREX® MATERIAL PROPERTIES

MATERIAL	YIELD $R_{p0,2}$ Mpa 20°C/225°C	TENSILE $R_m$ Mpa 20°C/225°C
C-steel	248/202	482/482
BC.01 (316L UG)	190/135	490/412
BC.05 (25.22.2)	270/195	580/495
<b>SAFUREX® INFINITY</b>	<b>650/465</b>	<b>800/717</b>
<b>SAFUREX® STAR</b>	<b>680/510 (250°C)</b>	<b>830</b>

*Excellent properties of Safurex®*

# HP EQUIPMENT (RE)DESIGN AND SUPPLY

## Our Safurex® products

- HP equipment
- HP Valves
- HP Piping
- Internals of HP equipment

## Our Customers

- New urea plant
- Existing urea plant



*Large variety of Safurex® applications*

# APPLICATION OF SAFUREX FAMILY

## SAFUREX

### Safurex ∞ INFINITY

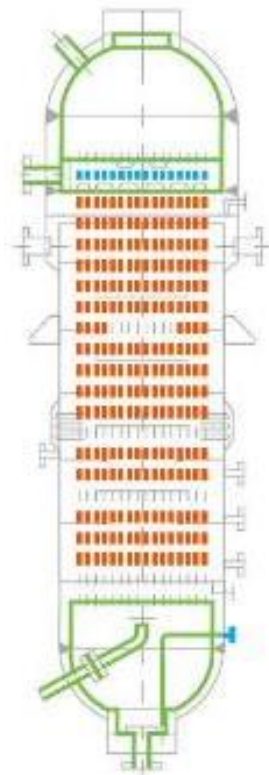
- can be used everywhere

### Safurex \* STAR

- for Hex tubes in the stripper

### Safurex ° DEGREE

- powder metallurgy by Hot Isostatic Pressing (HIP process)
- liquid dividers, radar cones, replace large forgings



# WHY STAMICARBON SAFUREX®

## MECHANICAL BENEFITS

- ✓ Physically strong material
- ✓ Reduced weight
- ✓ Same thermal expansion as CS
- ✓ Most proven welding procedures
- ✓ **No active corrosion seen so far**

## OPERATIONAL FLEXIBILITY

- ✓ O<sub>2</sub> content not critical
- ✓ Plant turndown not critical
- ✓ Chloride content not critical
- ✓ Change in N/C ratio not critical
- ✓ Block-in period not critical

## ECONOMICAL BENEFIT

- ✓ **Reduced emissions**
- ✓ **Reduced OPEX**
- ✓ **Increased equipment lifetime**
- ✓ **Maintenance interval 6 year**
- ✓ **Higher reliability**

# SAFUREX

*More than 150 Safurex® HP vessels in operation*

*Over 20 years of Safurex® operational experience*

# STAMICARBON VALUE



The value of Stamicarbon in the HP equipment supply

CLIENT



- PROCESS & MECHANICAL design based on more than 70 years of Stamicarbon Urea experience
- *More than 100 Urea revamp projects successfully completed*
- Full Stamicarbon expediting and inspections during manufacturing to secure high quality and reliability
- *Best (price-quality) corrosion resistant material: Safurex®*
- Most proven welding procedures and experience for Safurex® material
- *More than 20 years of proven records in Safurex® material with recent successful material upgrades*
- Single point responsibility with high skilled communication and project management
- *Cooperation agreement between Stamicarbon & Sandvik materials technology*



# SINGLE POINT OF CONTACT

## Stamicarbon project management



### Design

- Process Evaluation
- Process improvement
- Equipment Design
- Equipment Enhancement



### Manufacture

- QA and QC
- Inspections



### Logistics

- Delivery time
- Importing procedures
- Customer clearance



### On-site service

- Start-up assistant
- Installation service
- Performance evaluation

Stamicarbon

We can take care of everything for you!

# CUSTOMER FEEDBACK: HIGH APPRECIATION OF PREMIUM QUALITY AND FAST DELIVERY



**OPEX**

## **CLIENT CANADA**

Happy with latest test: low oxygen levels



**Safurex Star**

## **CLIENT NETHERLANDS**

Appreciation of core benefits of Safurex: less weight, reduced passivation air in relation to revamp with stripper

## **CLIENT FSU**

stripper proofed that active corrosion will not occur anymore



**Safurex Star**

## **CLIENT MIDDLE EAST**

Extreme fast delivery of stripper and scrubbers



**Safurex Degree**

## **CLIENT GERMANY**

Proven concept in view test results leading to installment of Degree liquid dividers.



**Safurex Spares**

## **CLIENT LATINS**

HP piping and added value appreciated with a premium in SNAM plant.



**Others**

## **CLIENT USA**

Appreciation for 30 days block in period enabling easy restart without drain

# CASE STUDY: SAFUREX HP STRIPPER PROJECT

- Safurex STAR and DEGREE stripper
- Replacement Project in The Netherlands

..\HP equipment\STAMICARBON SHOWCASE - The first HP Stripper with SAFUREX Star and Degree - v6.mp4

# KEY ADVANTAGES OF SAFUREX



1. Operational flexibility
  - Oxygen passivation not critical
  - Turndown ratio not critical
  - Blocking in period not critical



2. Reduced oxygen
  - Reduced steam consumption and emissions (OPEX)
  - Safety



2. Increase corrosion resistance leading to:
  - Extended equipment lifetime
  - Extend equipment inspection intervals
  - Reduction of maintenance & repair cost (OPEX)



4. Stamicarbon value in replacement projects

A close-up photograph of a person's hands, wearing a blue lab coat, holding a large quantity of small, white, granular particles. The background is dark and out of focus.

**THANK YOU FOR YOUR ATTENTION!**  
**FURTHER INFORMATION NEEDED?**

شكرا

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