

Expandable vs Steel Abrasives :

A technical, economical & ecological benchmark



W Abrasives®
your key success factor

THE USE OF EXPENDABLE ABRASIVES AE IN A DECLINE!!

Silica Sand

- Silicon dioxide
- **Highly dangerous** for health;
The use of silica is forbidden in most countries

Coal Slag

- Aluminum silicate = by-product of coal fired power plants
- **Limited supply** due to closure of low efficiency coal-fired power plants

Copper Slag

- Iron silicate = by-product of copper refining operations
- **Heavy metal contamination**
- **Limited supply**

Garnet

- Complex silicate, a natural mineral extracted in Australia & India
- **Regionally limited availability**
- **Decreasing quality**



High levels of dust generation, limiting visibility, lowering efficiency

Significant waste generation creating environmental problems



Converting Expendable Abrasives

Steel abrasives can replace expendable abrasives in stripping of protective coatings/surface preparation with higher efficiency and lower amount of waste generated

- on metallic and dry surfaces
- with specific equipment enabling recovery and recycling of the abrasives



Recycled Steel Abrasives vs. Expendable Abrasives

Onsite Jobs: Superior productivity and surface roughness at a competitive price

Segments	Garnets	Slags	Steel abrasives
Average Stripping rate	8 m ² /h	7 m ² /h	12 m ² /h
Surface profile (roughness & cleanliness)	✓ ✓	✓ ✓	✓ ✓ ✓
Average abrasive cost per ton	250 €/ton	100 €/ton	700 €/ton
Average consumption	30 kg/m ²	50 kg/m ²	1 kg/m ²
Average abrasive cost per m²	7.5 Euro/m ²	5.0 Euro/m ²	0.7 Euro/m ²
Average waste generation	30 kg/m ²	50 kg/m ²	1 kg/m ²
Specific constraints	Decreasing quality Regionally limited availability	Generates a lot of dust and waste	Containment necessary Dry conditions

Use of Recyclable Grit for Ballast Tank Refurbishment



Sections	Double bottom ballast tanks Duct keel (lower tunnel) Under deck tanks
Total area	21 580 sqm
Customer operations	Washing Blast Cleaning: full + spot (Sa 2 and Sa 2.5) De-dusting Heating and tank Climatization Grit suction and recycling Fine cleaning Stripe coat application Full coat application
Working period	25 days

Surface Preparation Ballast Tank

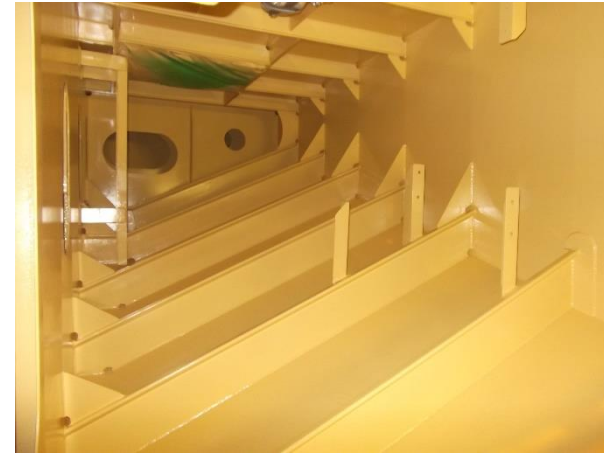


Location	Area (sqm)
DB PS (full+spot)	3 200 (Sa 2.5)
DB SB (full+spot)	3 200 (Sa 2.5)
Liquid dome	60 (Sa 2)
Under deck tank PS	4 700 (Sa 2)
Under deck tank SB	4 700 (Sa 2)
Upper tunnel	120 (Sa 2)
Lower tunnel	5 600 (Sa 2)

Use of Recyclable Grit for Ballast Tank Refurbishment



Use of Recyclable Grit for Aircraft Carrier



Under same circumstances, Steel Abrasives are much more productive and cost effective vs. slags

30% **Productivity**

1st Ballast Tank

2nd Ballast Tank

Surface

4200 m²

4200 m²

Nr of blasters

4

4

Abrasive

Slags

Profilium 45

Abrasive Consumption

40 kg/m²

0,8 kg/m²

Productivity/m²

10 m²/h

14 m²/h

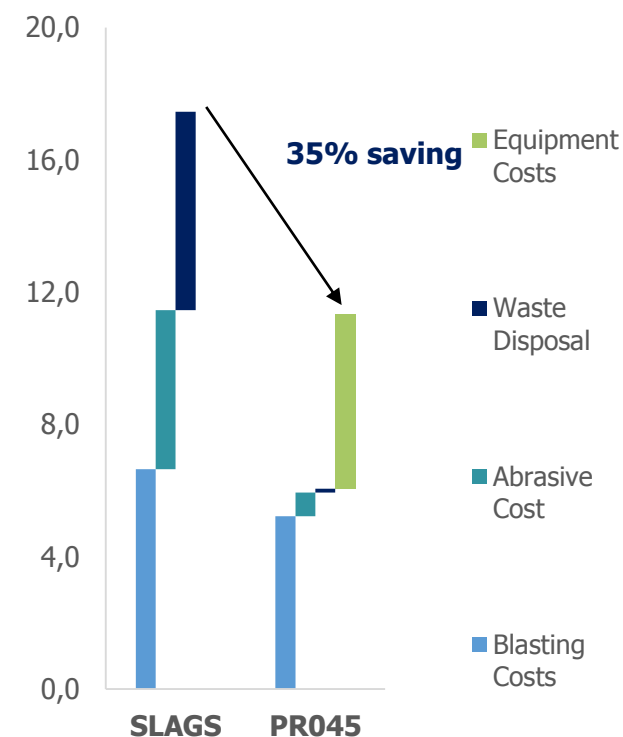
Job Duration

21 days

16 days



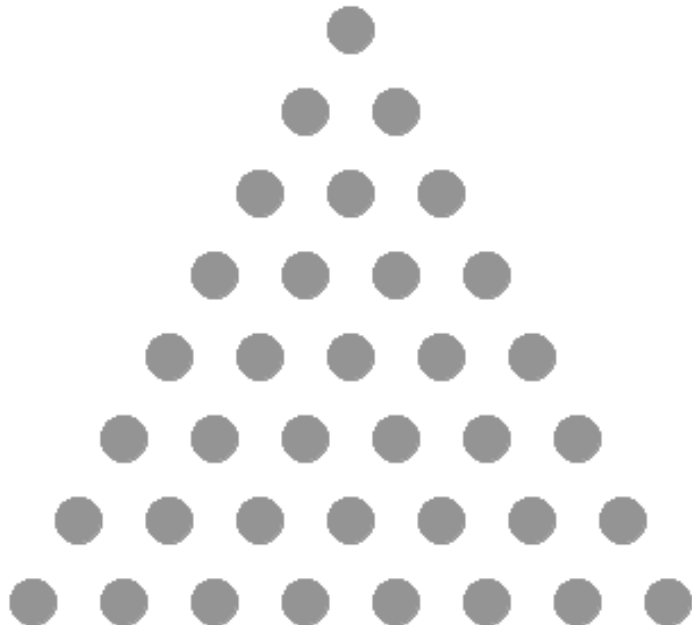
Cost Comparison in €/m²



To abrasive blast 2000 m², you need

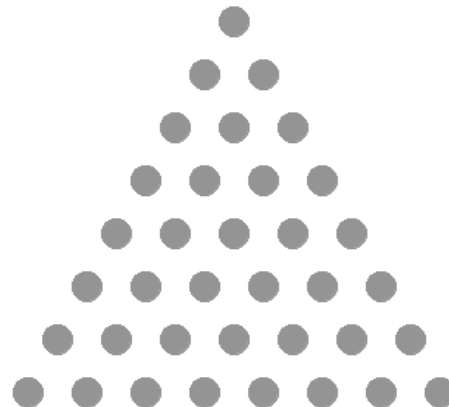
Slags

77 m³
100 tons



Garnet

27 m³
60 tons



Steel Grit

0,5 m³
2 tons



	Slags	Garnet	Glass grit	Corundum	Cast iron	Steel Profilium
Price/ton	70-120 €	350-400 €	800-1000 €	750-900 €	800-900 €	850-1100 €
Consumption /m ²	50 kg	30 kg	15 kg	5 kg	1,5 kg	1 kg
For 2000 m ²	100 t	60 t	30 t	10 t	3 t	2 t
Abrasive Cost	9,5 K€	22,5 K€	27,0 K€	8,3 K€	2,6 K€	1,9 K€
Average waste disposal cost: 150 €/ton (w/o lead, asbestos)						
Waste Disposal Cost	15,0 K€	9,0 K€	4,5 K€	1,5 K€	0,5 K€	0,3 K€
Total Cost	24,5 K€	31,5 K€	31,5 K€	9,8 K€	3,1 K€	2,2 K€

Shipyard with Expendable abrasives



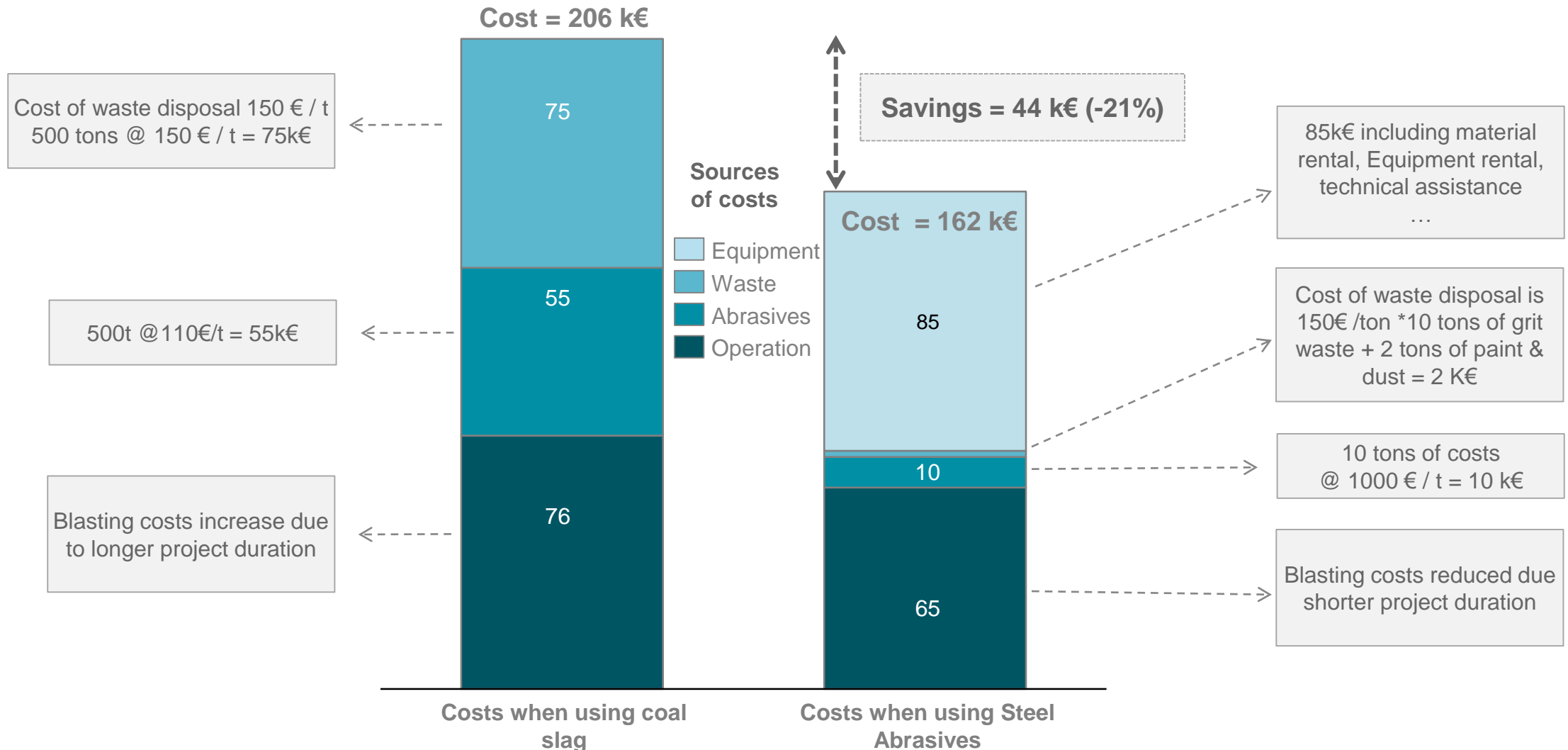
Shipyard with Steel Abrasives

98% **Waste reduction**

 **Site organization**



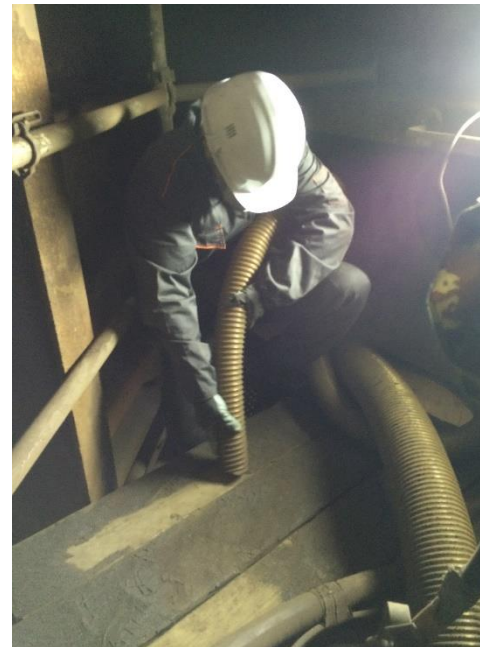
Case Story: 10 000 m² bridge treated by a contractor



Duration: 3 months, recycled grit used

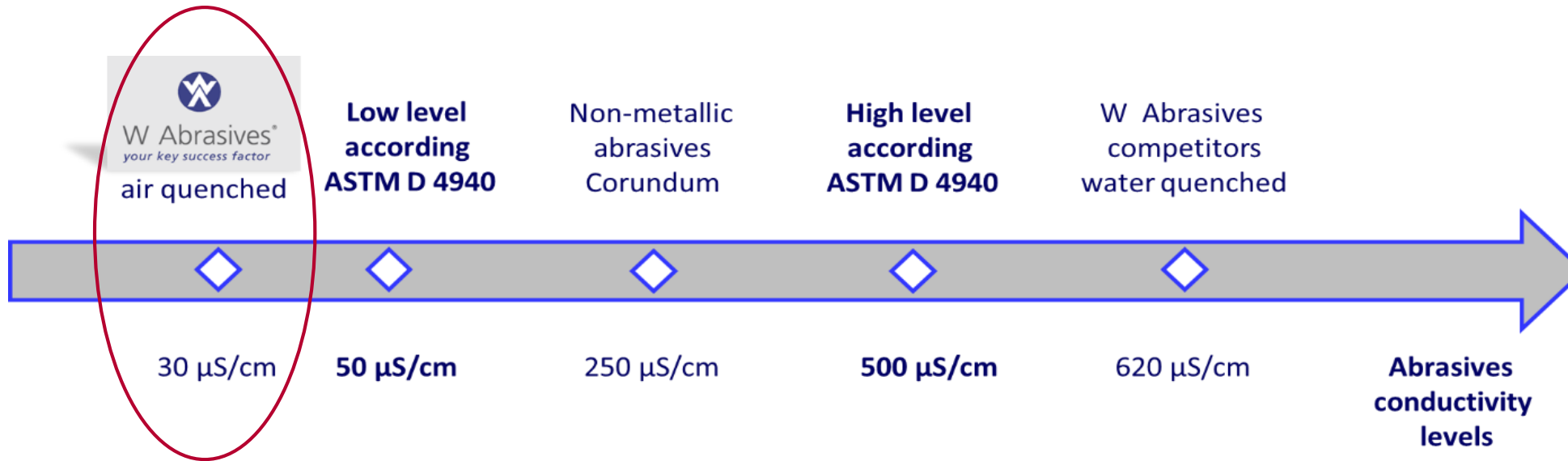


- Customer preferred to use Profilium 45
- Rented 3 Recovery & Recycling Machines
- Recycled steel abrasives and stored in bigbags on-site



Parameter	Value
Micro Structure	Fine, homogenous martensite
Shape	Angular
Hardness	> 64 HRC
Specific Density	> 7.6 g/cm ³
Loose Bulk Density	> 3.6 g/cm ³
Average Grain Size	0,6 mm

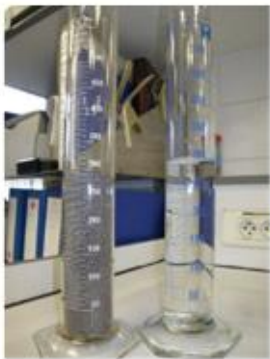




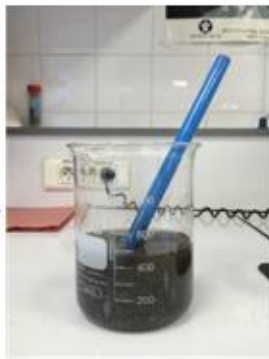
- Abrasives conductivity is related to the concentration of soluble ionic species (mainly chlorides and sulfates) contaminating abrasive surface
- Quenching media plays a major role on the final conductivity level of abrasives
- Air quenching minimizes the presence of soluble ionic species compared to the water quenching process used by our competitors.

- Our customer and end-customer checked regularly conductivity levels
- Customer's Frosio Inspector controlled both surface and quality of recycled grit
- Profilium 45 tested when delivered, during the job and at the end of the job both on site and at lab.

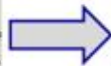
DATE	ORIGIN	PRODUCT	WATER		SAMPLES	
			Cx: $\mu\text{S}/\text{cm}$	Cx: $\mu\text{S}/\text{cm}$	Chlorides mg/l	Sulphates mg/l
05/01/2016	WA	PROFILUM 045	0,62	32	8,1	1



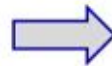
300 mL of abrasive
+
300 mL of deionized water



Stirring + stand



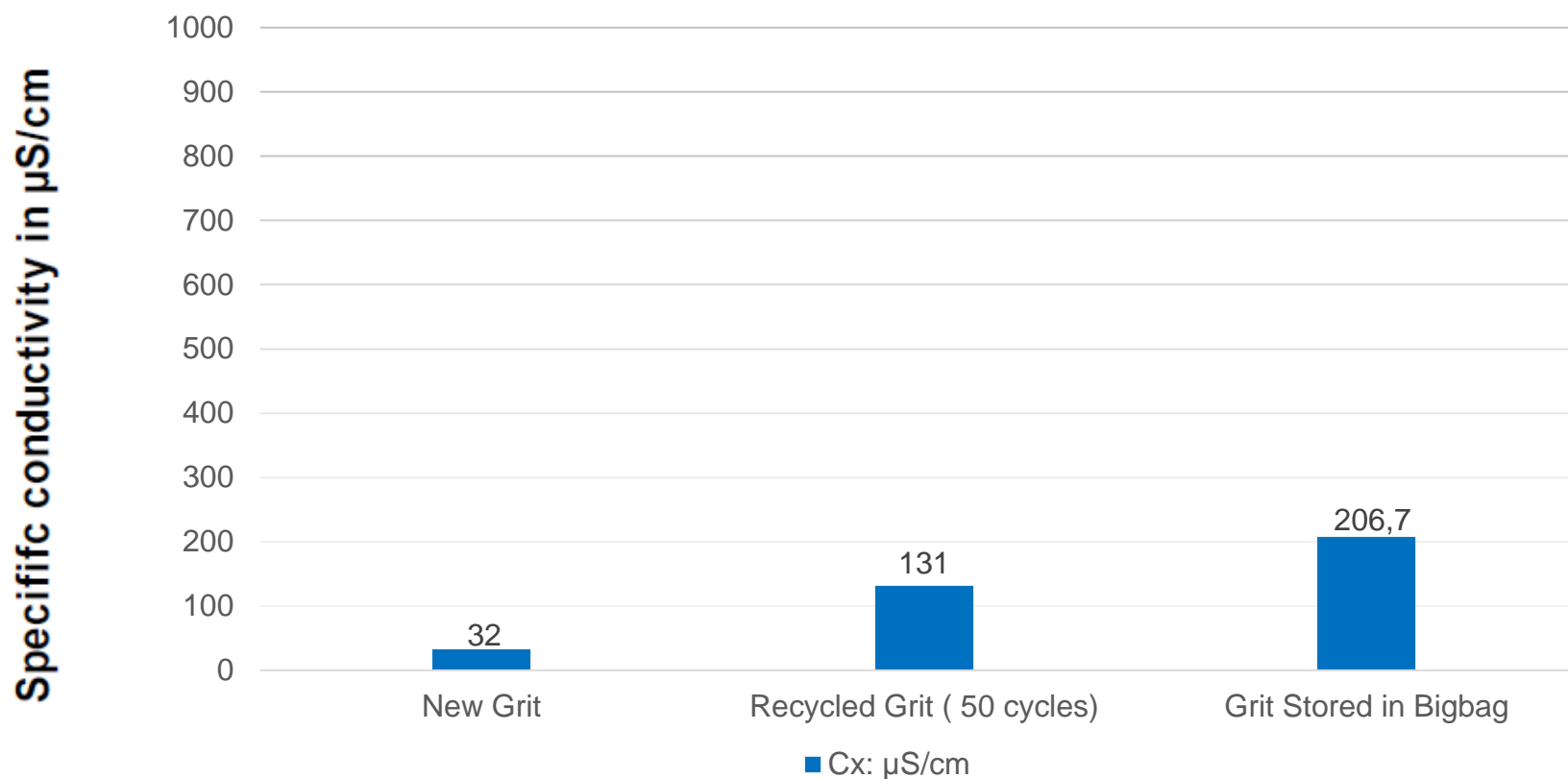
Filtration



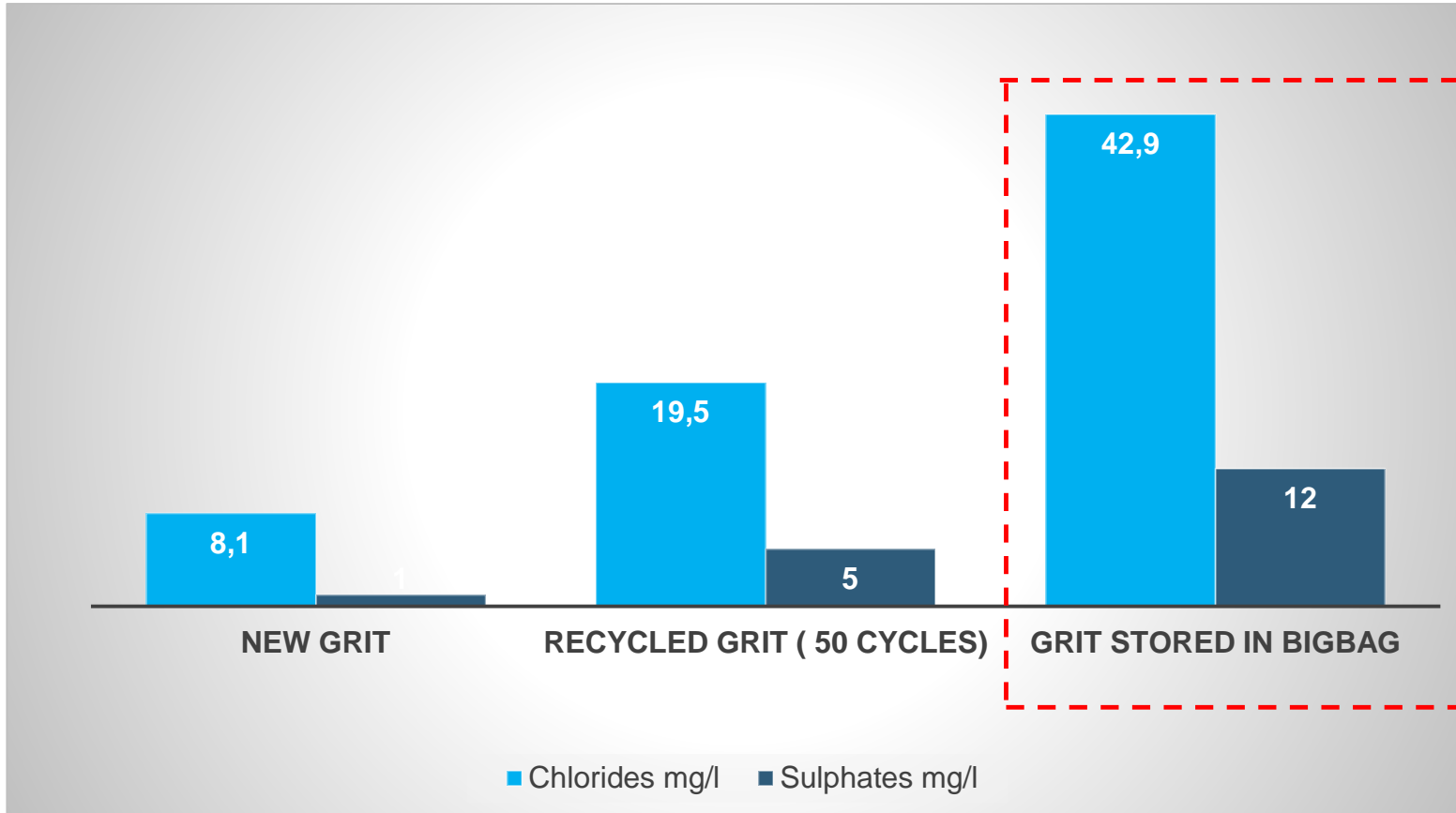
Conductivity
measurement



SSPC-A B2 limit: 1.000 $\mu\text{S}/\text{cm}$ (recycled steel grit)



Measurement of conductivity in accordance with the norm **ASTM D4940 (2010)**



Recycled steel grit stored in bigbags and stayed in the worksite for 3 months under shipyard conditions

Measurement of chlorides in accordance with the norm

EPA 0325.1 (1971)

Measurement of sulphates in accordance with the norms

ASTM D516 (01/2011) and EPA 0375.4 (1978)

Surface Blasting Process Validation

- Customer's Frosio Inspector validated that the requirements according to the IMO MSC 215 for water soluble salt limit.
- Water soluble salt limit equivalent to NaCl was below the limit of 50 mg/m² of sodium chloride**

RESOLUTION MSC.215(82)

PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR DEDICATED SEAWATER BALLAST TANKS IN ALL TYPES OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS

Water soluble salt limit equivalent to NaCl ⁷	$\leq 50 \text{ mg/m}^2$ of sodium chloride.
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