

Sponge-Jet Dry Abrasive Blasting Technology

Sponge-Jet and the Oil and Gas Market

Organized by NACE Jubail Section

Al-Jubail Intercontinental Hotel

Jubail Industrial City

March 12th 2017

Sponsored by:



Surface Preparation Solutions for the Oil and Gas Industry

World's Top Petroleum & Petrochemical Companies use and Specify
Sponge-Jet as the best available surface preparation technology.



ExxonMobil



Appropriate Surface Preparation



Cleanliness Levels:

**ISO (SA1, SA2-1/2) or
SSPC (SP5, SP10, SP7)**

Chloride/Chemical

SSPC (SC1, SC2)

Radiological
Decontamination:

to free release

Profiling:

**0 to 150-plus microns
0 to 6-plus mils**



What are Composite Abrasives?

- Composite abrasives are industry acknowledged, products such as Aluminum Oxide, Dupont Starblast® and Steel Grit
- Known for general low dust, excellent profiling and cleaning capabilities as raw abrasives
- These attributes are enhanced when bonded to sponge, with additional benefits of:



- Dramatically reduced ricochet and rebound
- Enhanced surface contaminant removal and retention
- Exponential waste reduction
- High productivity
- Increased worker safety and comfort
- Dramatically reduced blast-related dust



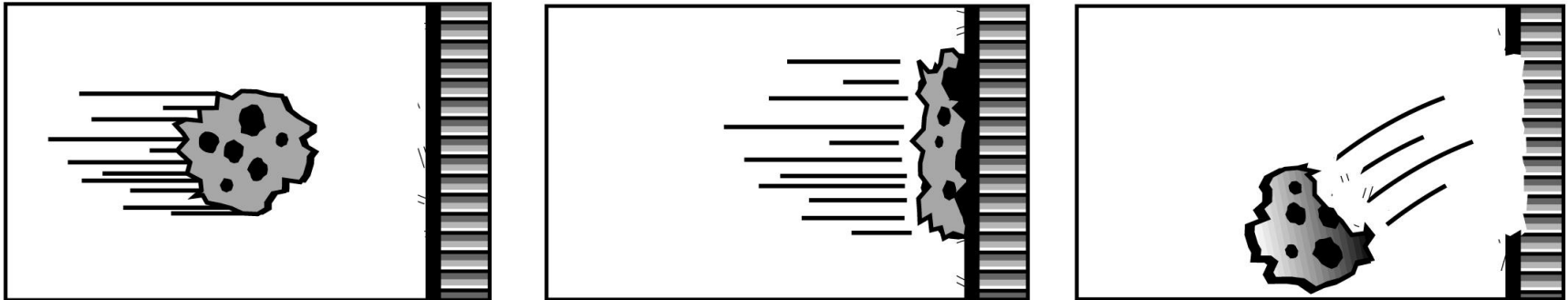
Composite Abrasives

- It is obvious to coating professionals that coatings applied to an appropriately abrasive blasted surface will out perform coatings applied to a hand-tool or water-prepared surface.
- Composite media/Sponge-Jet Sponge Media™ offers the ability to:
 - **Increase the quality of the surface preparation**
 - **Decrease the cost of surface preparation**
 - **Decrease the time required to complete preservation projects**
- NAVSEA has issued Standard Specifications and Preservation Process Instructions for shipbuilding and repairs that approve the use of Sponge Media in areas formerly prepared with hand-tools

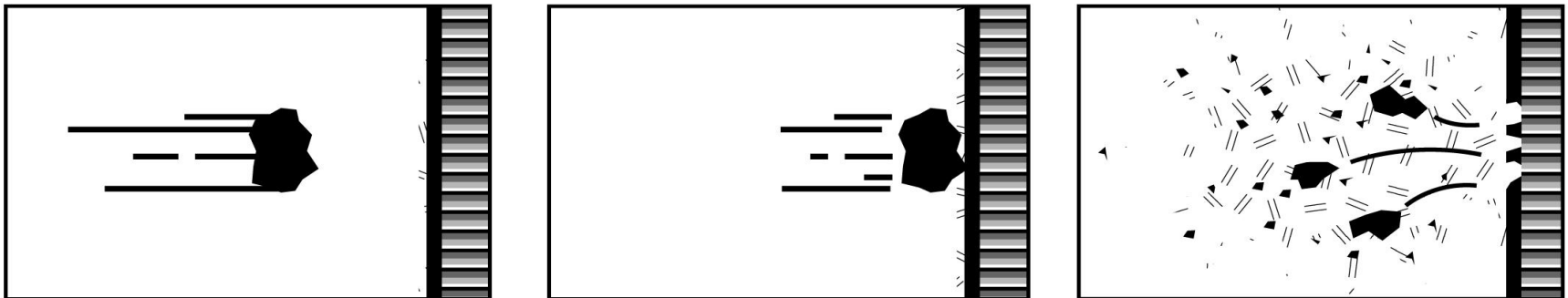


Microcontainment™ Technology

Conventional Abrasive Bonded Into Sponge Media™



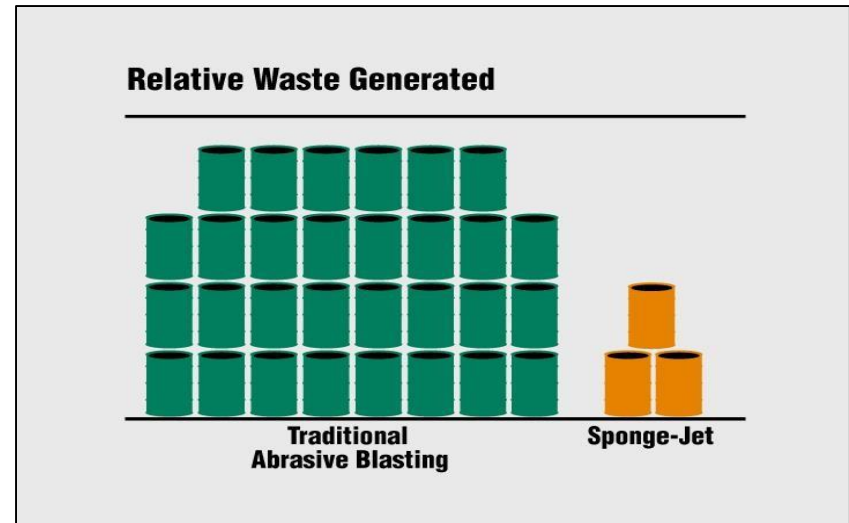
Conventional Abrasive Blasting Media



Reuse Sponge Media up to 15 Times

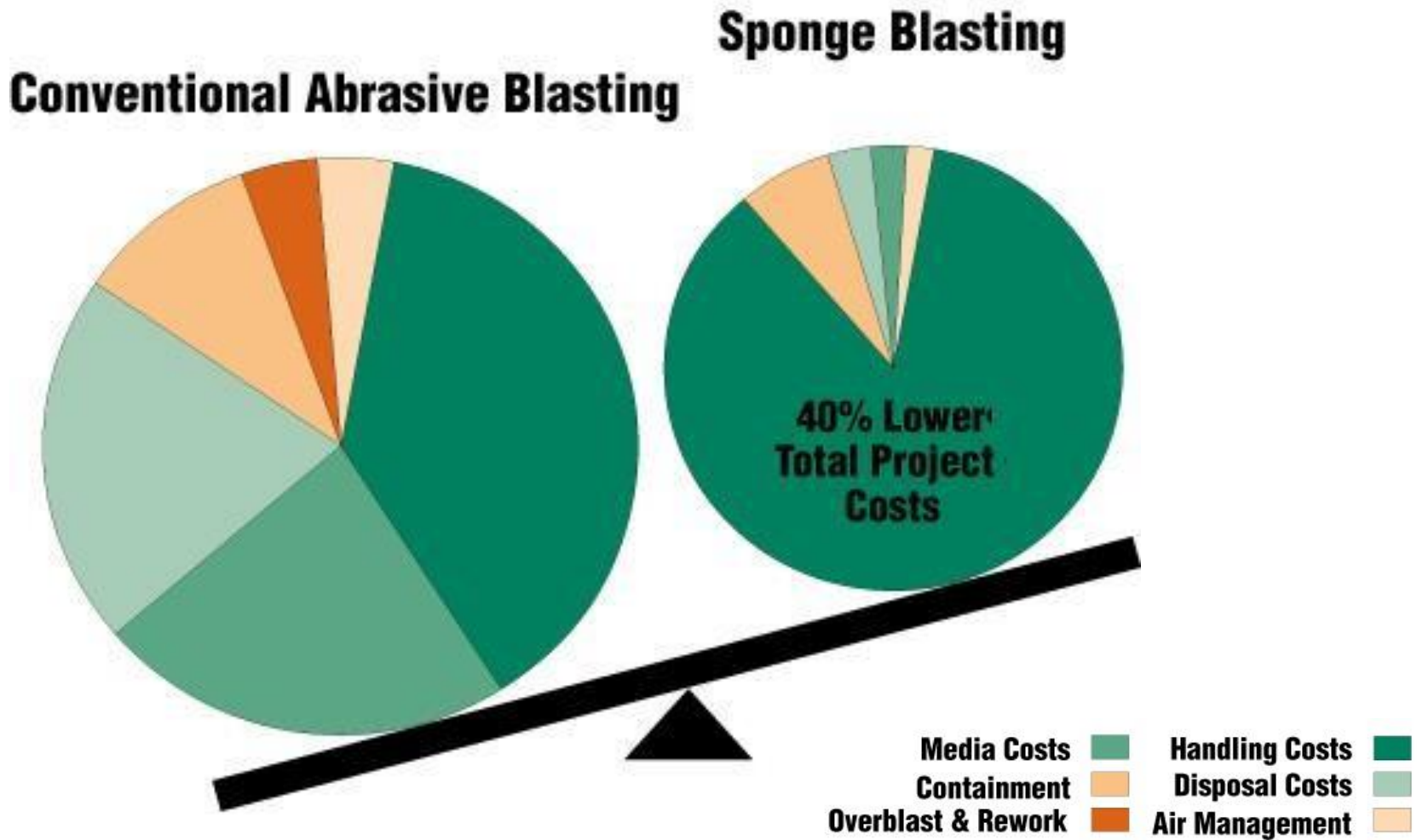


- Use less abrasive media
- Lower handling costs
- Reduce waste and disposal costs



Blasting 100sqm, requires either 2,000kg of grit or 200kg of Sponge Jet

Sponge-Jet Total Project Savings



Sponge-Jet Sponge Media™



Silver Sponge Media
with Aluminum Oxide



Brown Sponge Media
with Dupont® Starblast



Red Sponge Media
with Steel Grit

Value-added Benefits

- Blast near other trades and operating equipment
- Limit over-blasting and rework
- Increase the reliability of rotating equipment and compressors
- Reduce transportation and disposal costs by recycling
- Eliminate most of the risks related to traditional surface preparation methods



Value-added Benefits

- Reduce shutdown
- Extend coating life; lessen future maintenance and downtime
- Achieve workplace health and safety goals
- Profile up to 125 microns
- Works with low pressure compressed air (only 7Bar)



Blast in operating plants



شركة حلول الطاقة الخليجية
GULF ENERGY SOLUTIONS CO.

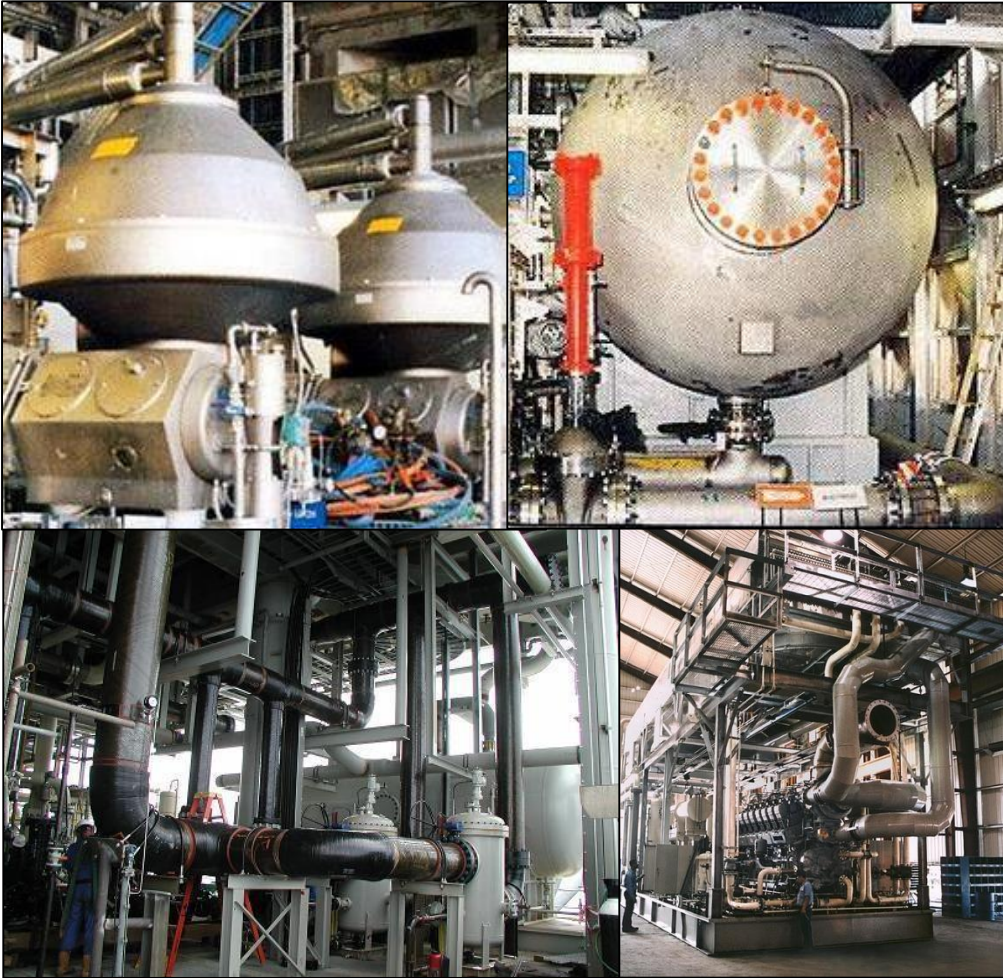
Platform Applications

Construction:

- Confined spaces
- Structural steel
- Preparing erection and anular tank weld seams
- Profiling/paint preparation of new structural steel



Platform Applications



Maintenance:

- Oil and gas separators
- Cleaning coke or burned residue from boilers Pipes and stacks
- Air intakes
- Compressors
- Quarter Accommodations
- Structures
- Legs

PETROBRAS P-51 Platform

- Separators (2)
- Test separator (1)
- Electrostatic Dehydrators (2)
- Slope vessel (2)



PETROBRAS P-37 Platform Production Separators



Petro/Chemical Refinery Applications

Petro/Chemical Refineries:

- Stripping distillation tower interiors/exterior
- Removing Corrosion Under Insulation (CUI) and rust removal of old structural steel
- Interior/exterior tanks
- Pump externals
- Heat exchange condensers
- Cleaning coke or burned residue from boilers
- Boilers
- Removing iron-stained grinding residue from stainless structures



Piping and Infrastructure Applications

Piping/Infrastructure:

- Pipeline externals
- Compressor stations
- Pump stations
- Removing failed coating and corrosion on floating roof-top tank covers
- Sponge blasting heat exchange condensers, pump stations and gassifiers
- Spot-blasting pipeline externals; under-group and arial applications



Customers Are Saying...

Technical Report for Abrasive Blasting on Platform P-VI, Tank TQ-34:



"An effective reduction of labor force of 60% was confirmed in comparison to the other abrasive processes... reduction of labor force refers to the night shift responsible for the disposal of residues."

PETROBRAS:

- Platform P-VI
- Tank blasting project
- Reduced labor by 60% associated with clean-up



Customers Are Saying...

Pemex's Department of Norms and Specifications:



In the "Coating and Protective Systems for Metals" specification report, the Department of Norms and Specifications suggests that "wherever dust restrictions apply, use alternative methods as Polyurethane foam with abrasive particles."

PEMEX:

- Wherever dust restrictions apply, use an alternative like Sponge-Jet



Customers Are Saying...

Using the Sponge-Jet system enabled other trades to keep working while blasting is being carried out.



- Safety and Environmental Control departments are very impressed with no lost time accidents during the shutdowns due to grit/foreign bodies getting into people's eyes.
- The speed of clean-up operations is dramatically faster than grit blasting and the area is clean enough for plant inspection to be carried out immediately after blasting.
- The preferred method for most Engineers running a shutdown.

BP Oil:

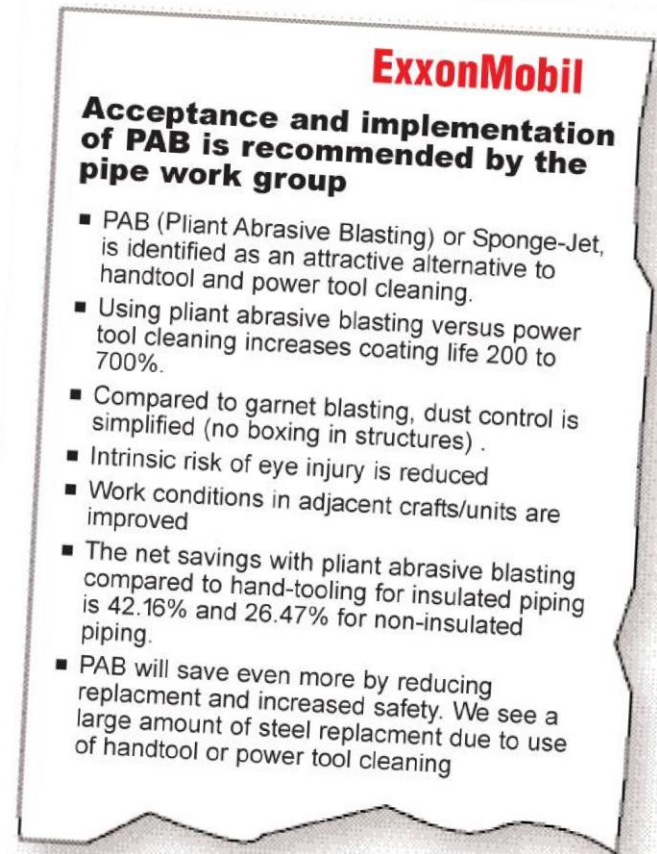
- No lost time accidents during shutdowns (including eye injuries)
- Clean-up is dramatically faster than grit blasting
- Inspection can be done directly after blasting
- Preferred method for most engineers in refinery



Customers Are Saying...

ExxonMobil:

- Identified as attractive alternative to hand tool and power tool cleaning
- Expect to increase coating life 200% to 700% compared to power tool cleaning
- Dust control is simplified
- Work conditions in adjacent crafts are improved
- Net Savings...
 - 42% on insulated Piping
 - 27% on non-insulated



Blister Generation & Osmotic Drive



- Coatings are semi-permeable membranes subjects to vapor bypass
- Blister formation is generally related to one or more of the following differentials around the coating
 - Pressure
 - Electric Potential
 - Salts or chloride concentrations.
 - Temperature
- These differential generate an effect known as Osmotic Drive, that allows the pass of vapor or humidity from one side of the coating to the other, finally generating Blisters
- By eliminating or controlling these differentials we will be able to reduce the chance of Blisters to be created

Blistering / Osmotic Drive

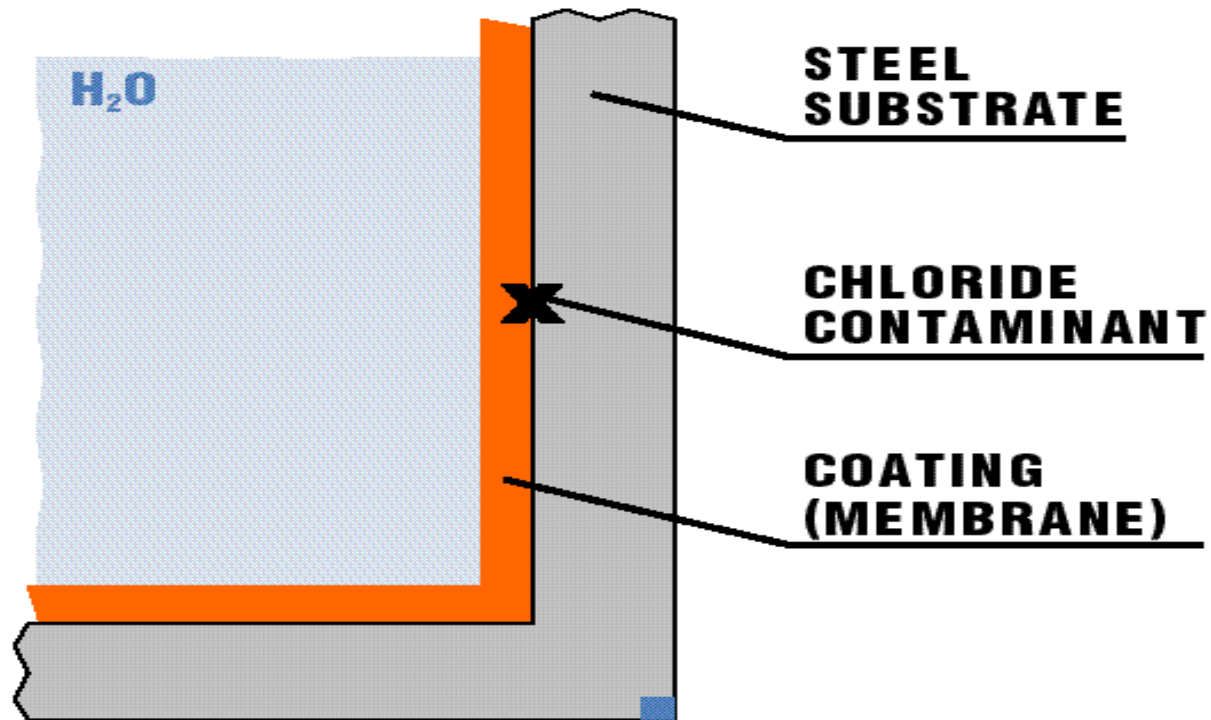


FIGURE 1.A

Blistering / Osmotic Drive

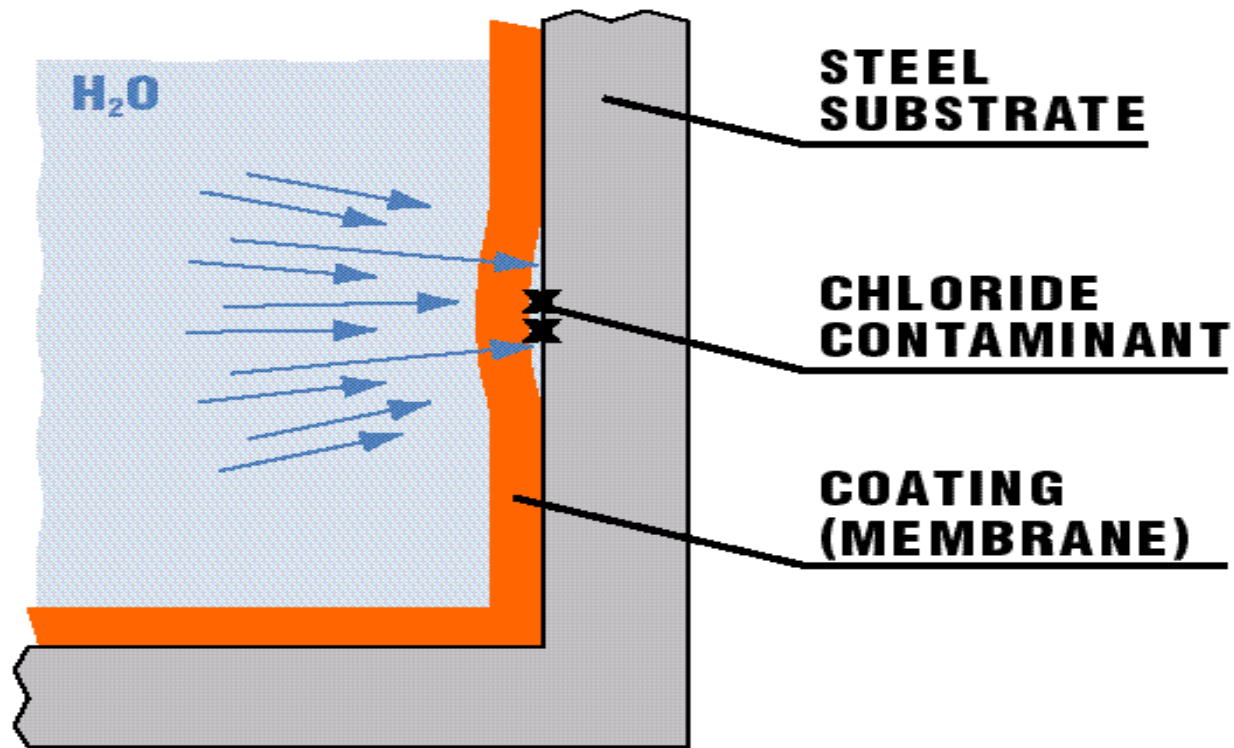


FIGURE 1.B

Blistering / Osmotic Drive

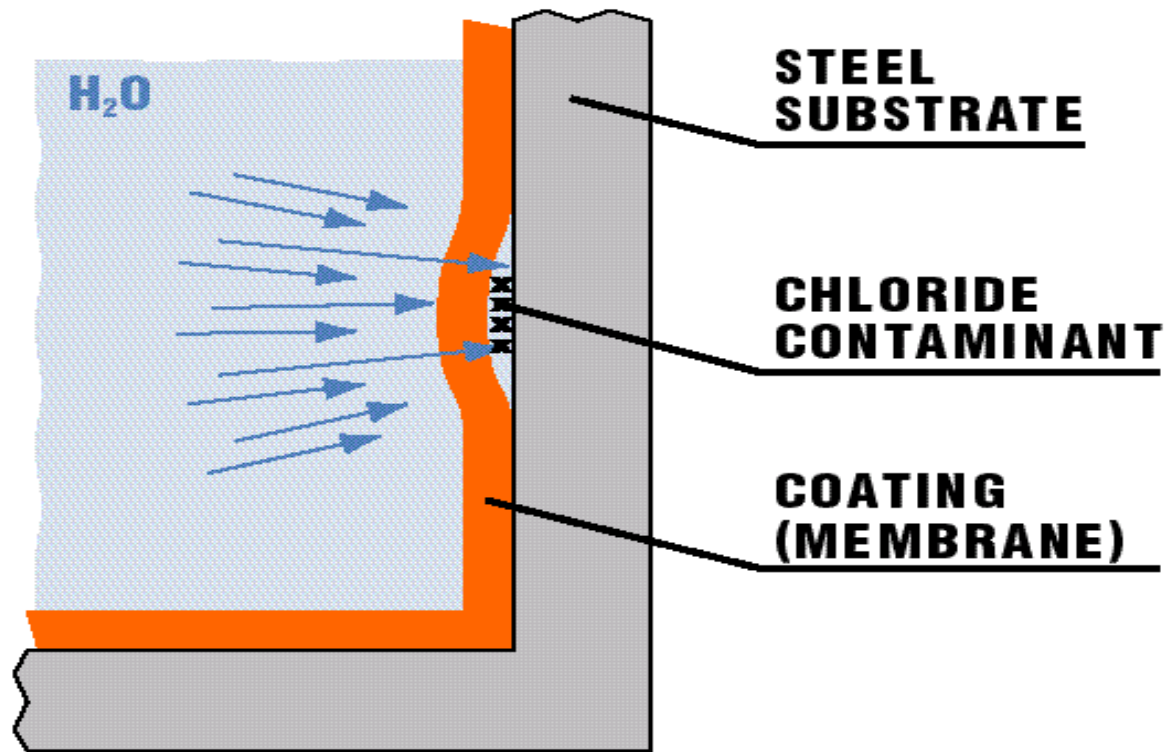


FIGURE 1.C

Blistering / Osmotic Drive

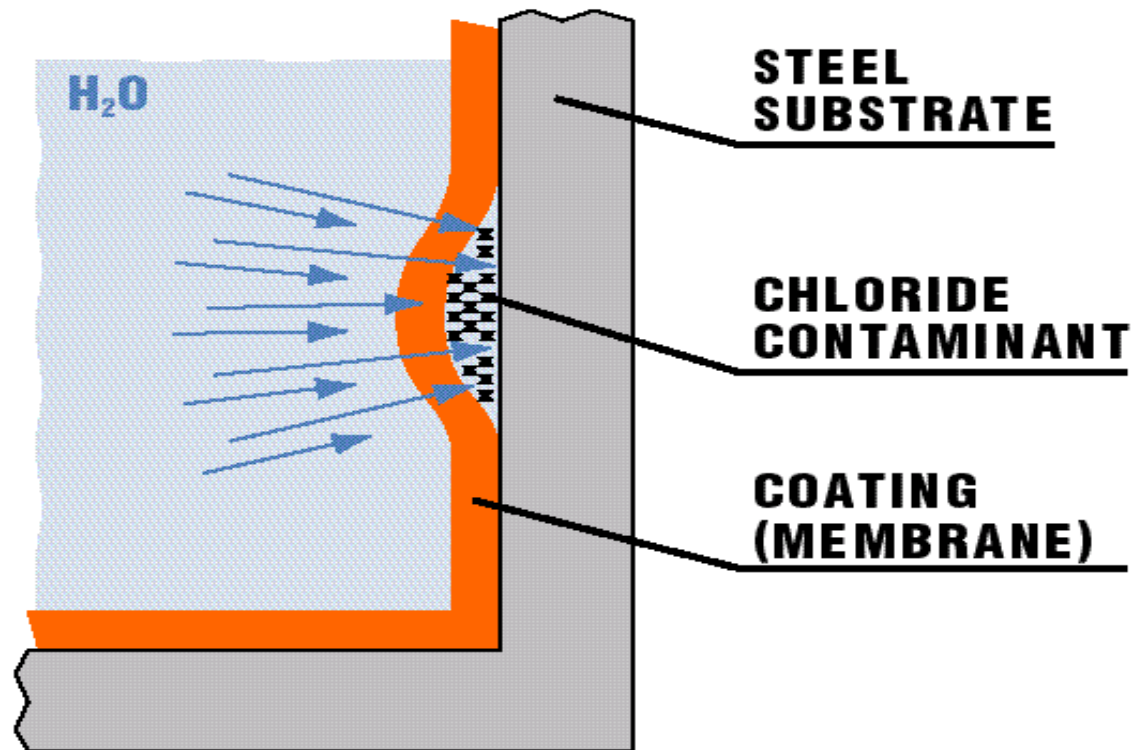
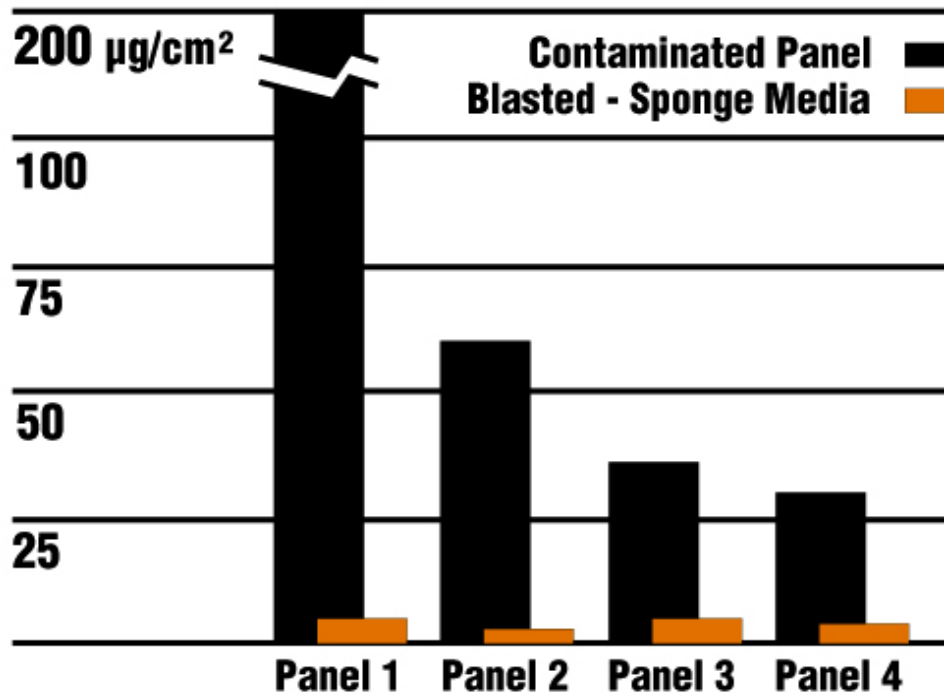


FIGURE 1.D

Chloride Removal

- Composite Media removes or reduces surface contaminants, such as chlorides from substrates as it prepares the surface
- This is accomplished in one step rather than the conventional wash / blast / wash procedure
- Surface chloride levels were reduced from 200 micrograms per square centimeter, down to less than 7mg/cm² (SC2) with single-pass blasting with composite Sponge Media abrasives

Residual Chloride Comparison - A



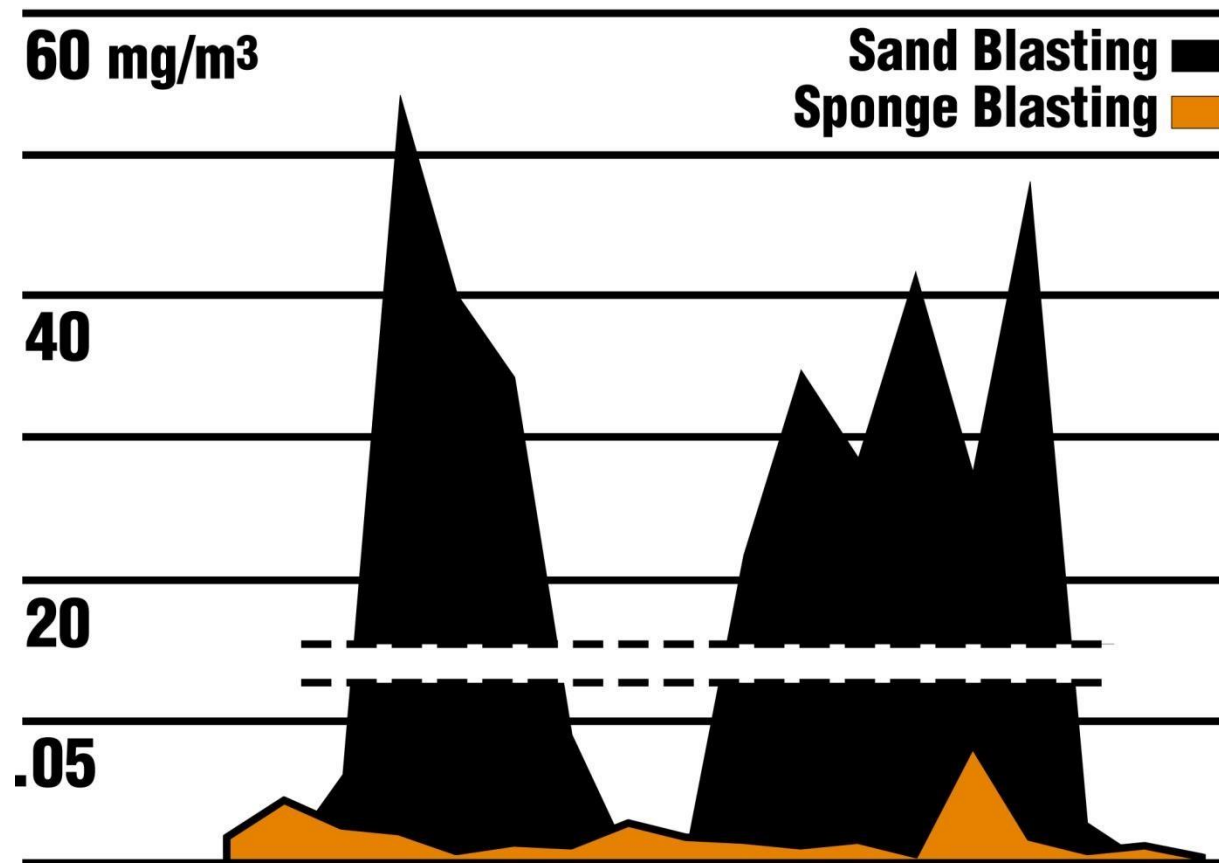
- Composite Media removes or reduces surface contaminants, such as chlorides from substrates as it prepares the surface
- This is accomplished in one step rather than the conventional wash / blast / wash procedure
- Surface chloride levels were reduced from 200 micrograms per square centimeter, down to less than 7mg/cm² (SC2) with single-pass blasting with composite Sponge Media abrasives

Air particles and BP's (breathable particles)

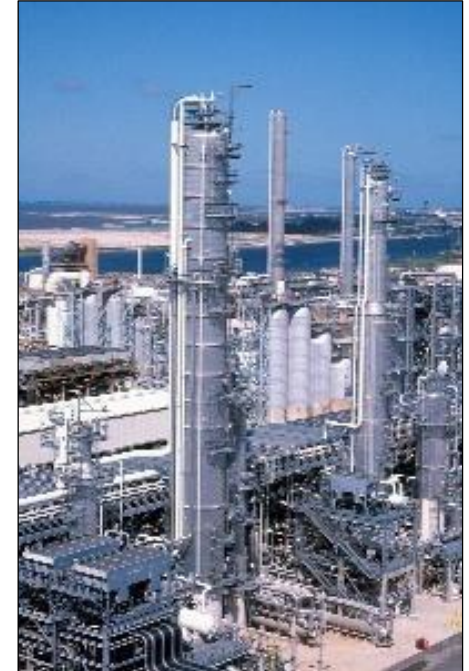


A recent study performed by the MRI labs, concluded that the level of emissions and breathable particles generated by Sponge Media blasting while blasting in an open space, is significantly lower than levels measured on the outside of a filtered blasting cabin while blasting with any of the traditionally used dry abrasive

Airborne Contaminant Comparison



Offshore is our business



Blast Where You Want.™

CHLORIDE REMOVAL

WITH SPONGE-JET'S

“RECYCLABLE ENCAPSULATED ABRASIVE MEDIA”

CHLORIDE REMOVAL

with

“RECYCLABLE ENCAPSULATED ABRASIVE MEDIA”

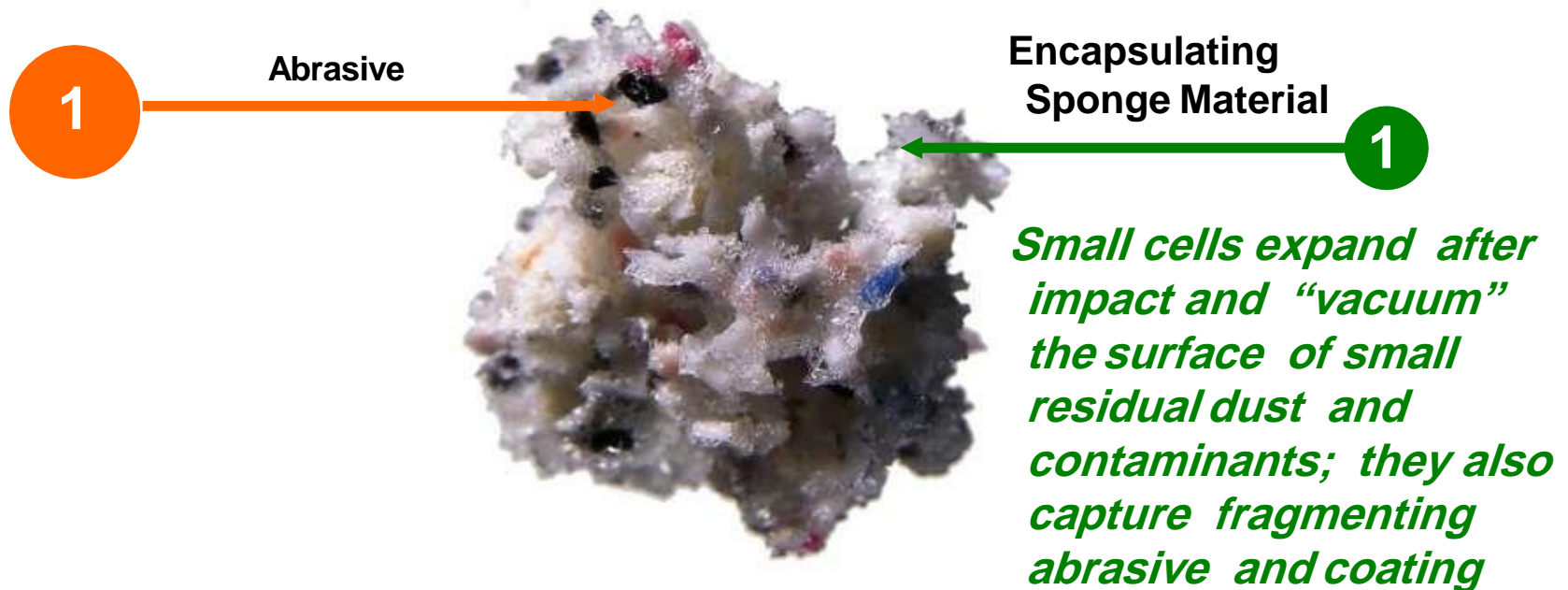


©2008 Sponge-Jet Inc. All rights reserved.

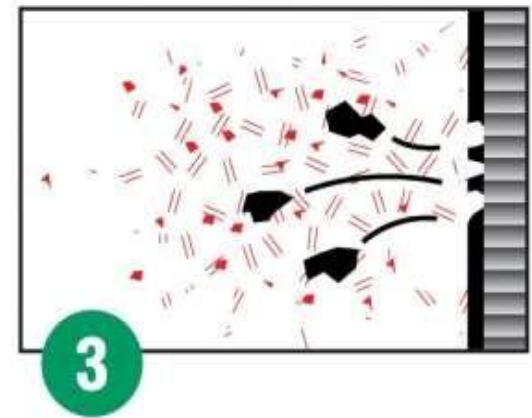
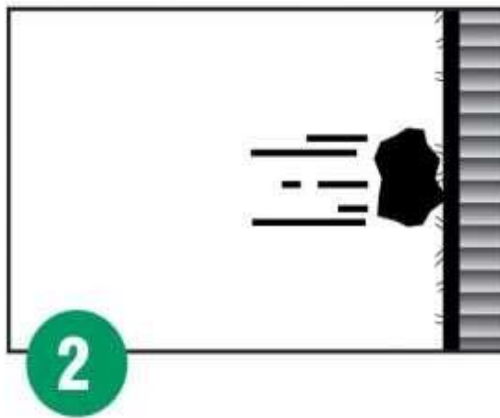
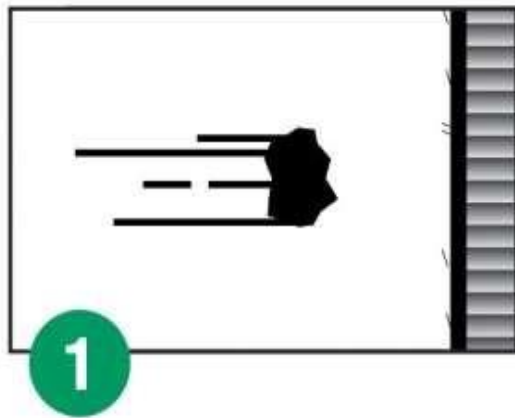
ABSTRACT: This Paper Presents

- Define “Recyclable Encapsulated Abrasive Media”.
- Overview of the Chloride Issue
- 2002 Study showed high levels of chloride removal with non recycled sponge media
- Recent tests indicate that chloride removal can be effectively performed while recycling media
- Blasting with “Recyclable Encapsulated Abrasive Media” can frequently reduce chloride concentrations to below typically specified levels in a single process
- Cost and Speed are favorable to other technologies, which require multi-step procedures such as abrasive blast, water or chemical wash and final abrasive blast to achieve specified levels of surface contaminants

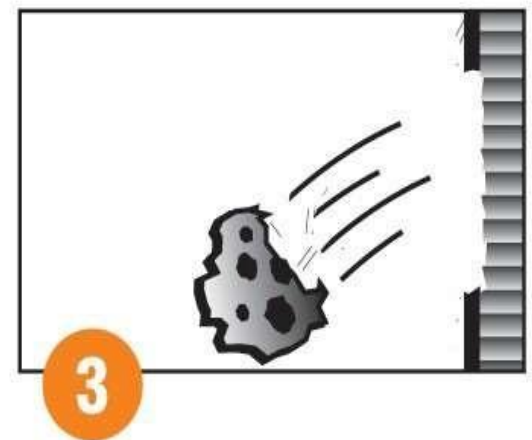
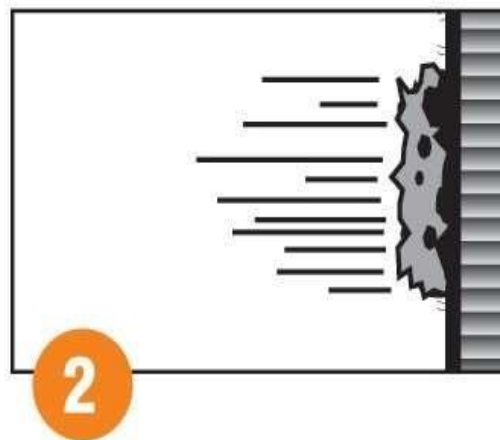
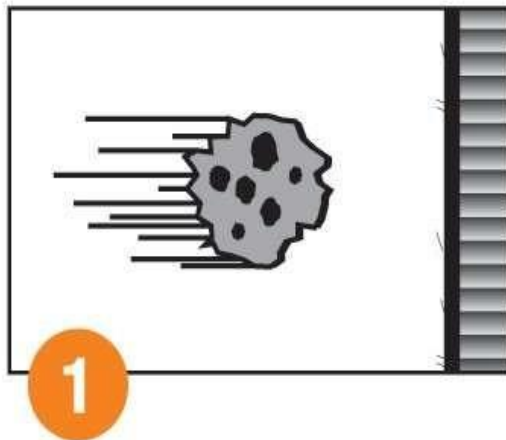
BACKGROUND ON ENCAPSULATED ABRASIVE MEDIA



BACKGROUND ON ENCAPSULATED ABRASIVE MEDIA



Conventional Abrasive Blasting



Encapsulated Abrasive Media

BACKGROUND ON ENCAPSULATED ABRASIVE MEDIA



BACKGROUND ON ENCAPSULATED ABRASIVE MEDIA

Encapsulated Abrasive Media



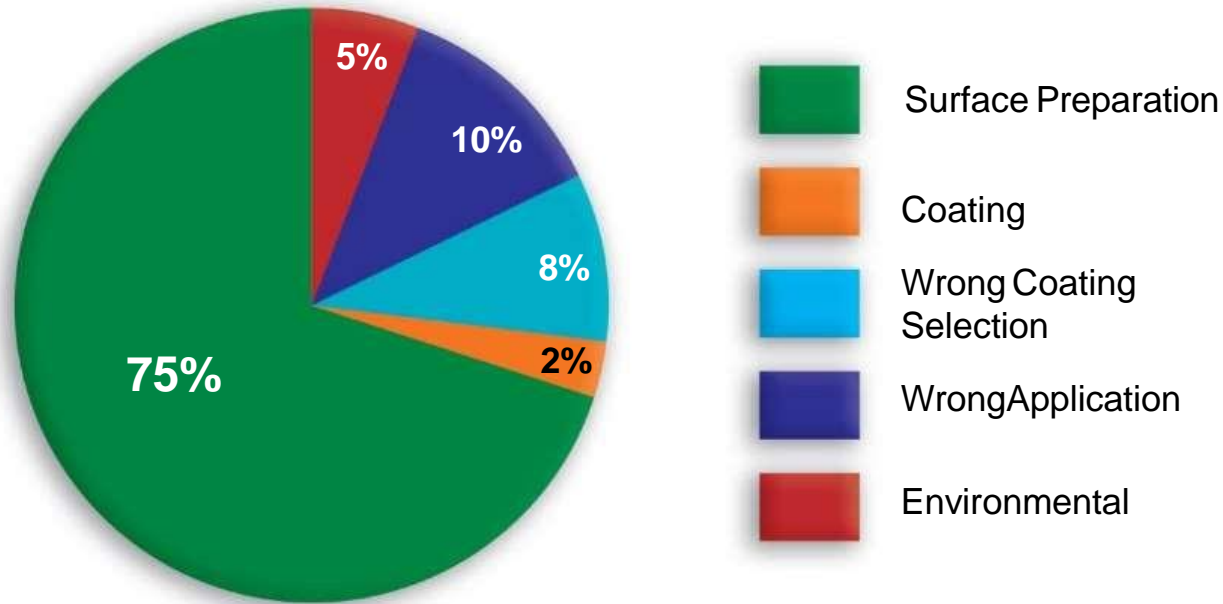
Ordinary Blasting



Encapsulated Abrasive Media blasting can reduce dust levels as much as 98% compared to conventional abrasive blasting

Overview of Chloride Issue: Why all the concern?

Why Do Coatings Fail?



Overview of Chloride Issue: Goals of Surface Preparation

Proper Surface Preparation:

Cleanliness (Visual)

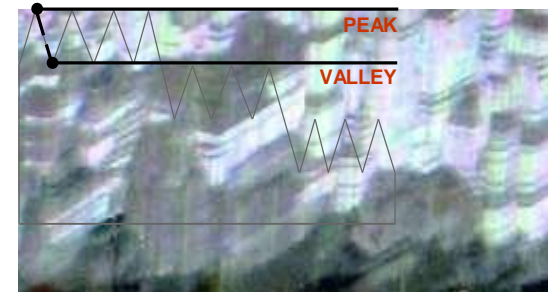


Decontamination (Invisible)

CHLORIDES & SULFATES
OIL RESIDUE
LEAD
ASBESTOS
PCBs
LOW-LEVEL RADIATION

Profile (Measurable)

Microns / Mils



“75% of coating failures are the result of poor surface preparation”

“It should be remembered that when defects are exposed by blast cleaning and subsequently removed by grinding, it is necessary to re-prepare the immediate area to retain the surface profile.”

“All coating systems will perform better on properly cleaned surfaces with a good surface profile”



SOURCE: NACE Coating Inspector Program (Level 1)

Overview of Chloride Issue

- Coatings are semi-permeable membranes subject to vapor transport
- Blister formation is often a result of one or more differentials across the coating:
 - Pressure
 - Temperature
 - Electrical Potential
 - **Soluble Concentrations**
(salts / chlorides)
- Differentials create osmotic drive, vapor transport and blistering
- Coating life can often be improved by reducing any differential across the coating - such as Chloride concentration



Increased Emphasis on Residual Chloride

- NASA – $5\mu\text{g}/\text{cm}^2$

- US NAVY

- 1990's $10\mu\text{g}/\text{cm}^2$ (100 mg/m²) non-immersion and $5\mu\text{g}/\text{cm}^2$ (50 mg/m²) immersion

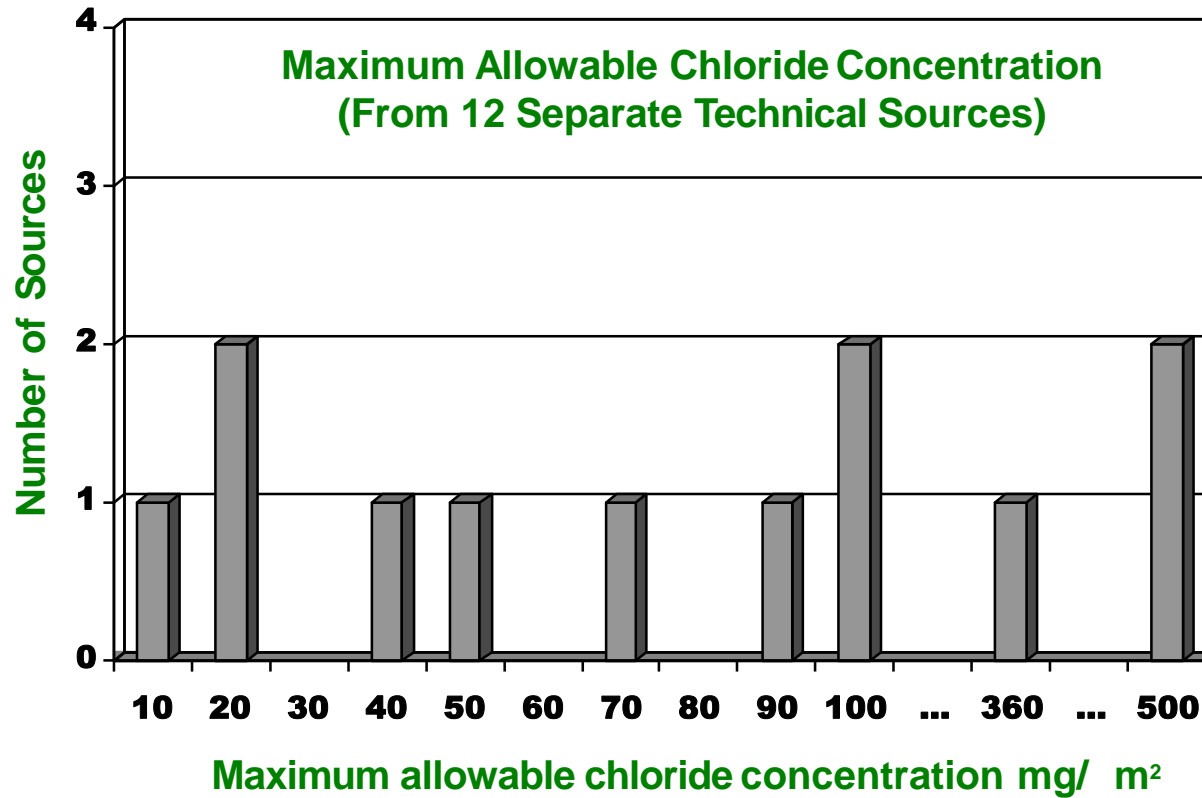
- 2000 $5\mu\text{g}/\text{cm}^2$ (50 mg/m²) non-immersion and $3\mu\text{g}/\text{cm}^2$ (30 mg/m²) immersion

Increased Emphasis on Residual Chloride

SSPC has established standard levels of defined cleanliness for *invisible contaminants*

	Chloride	Soluble Ferrous	Sulfates
SC 1	0 $\mu\text{g}/\text{cm}^2$	<0 $\mu\text{g}/\text{cm}^2$	<0 $\mu\text{g}/\text{cm}^2$
SC 2	<7 $\mu\text{g}/\text{cm}^2$ (70 mg/m^2)	<10 $\mu\text{g}/\text{cm}^2$	<17 $\mu\text{g}/\text{cm}^2$
SC 3	50 $\mu\text{g}/\text{cm}^2$ (500 mg/m^2)	<50 $\mu\text{g}/\text{cm}^2$	n/a

South Korean Study Published through IMO



©2008 Sponge-Jet Inc. All rights reserved.

17

Methods for Chloride Removal

- Conventional Abrasive Blasting followed by a rinse with Steam, Water or chemical treatment. Followed by a second blast
- UHP or HP water blast in conjunction with traditional abrasive blasting when profile is required
- Encapsulated Abrasive Blasting



1997 First Laboratory Data indicating Encapsulated Media is Effective at Chloride Removal



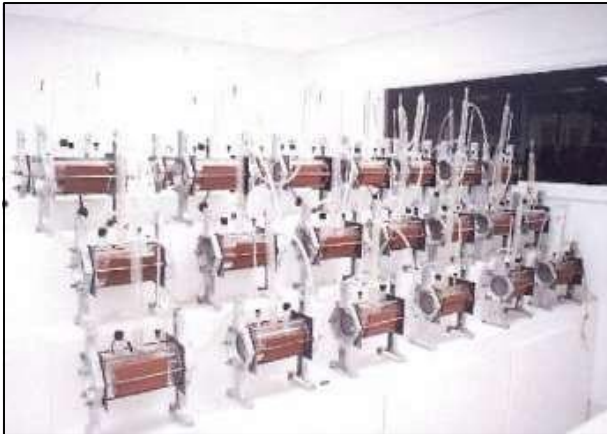
- Panels contaminated in ASTM B117 Salt Fog Cabinet
- Initial Chloride $400 \mu\text{g}/\text{cm}^2$ (**4000 mg/m²**)
- To achieve less than $10 \mu\text{g}/\text{cm}^2$ (**100 mg/m²**) via standard aluminum oxide blasting required a three step process:

-Blasting

-Demineralized water wash

-Rusting and Re-blasting

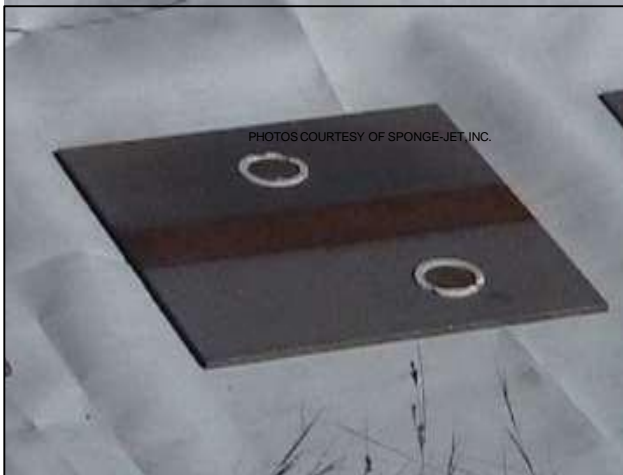
- To achieve less than $10 \mu\text{g}/\text{cm}^2$ (**100 mg/m²**) via encapsulated media blasting required a single blast



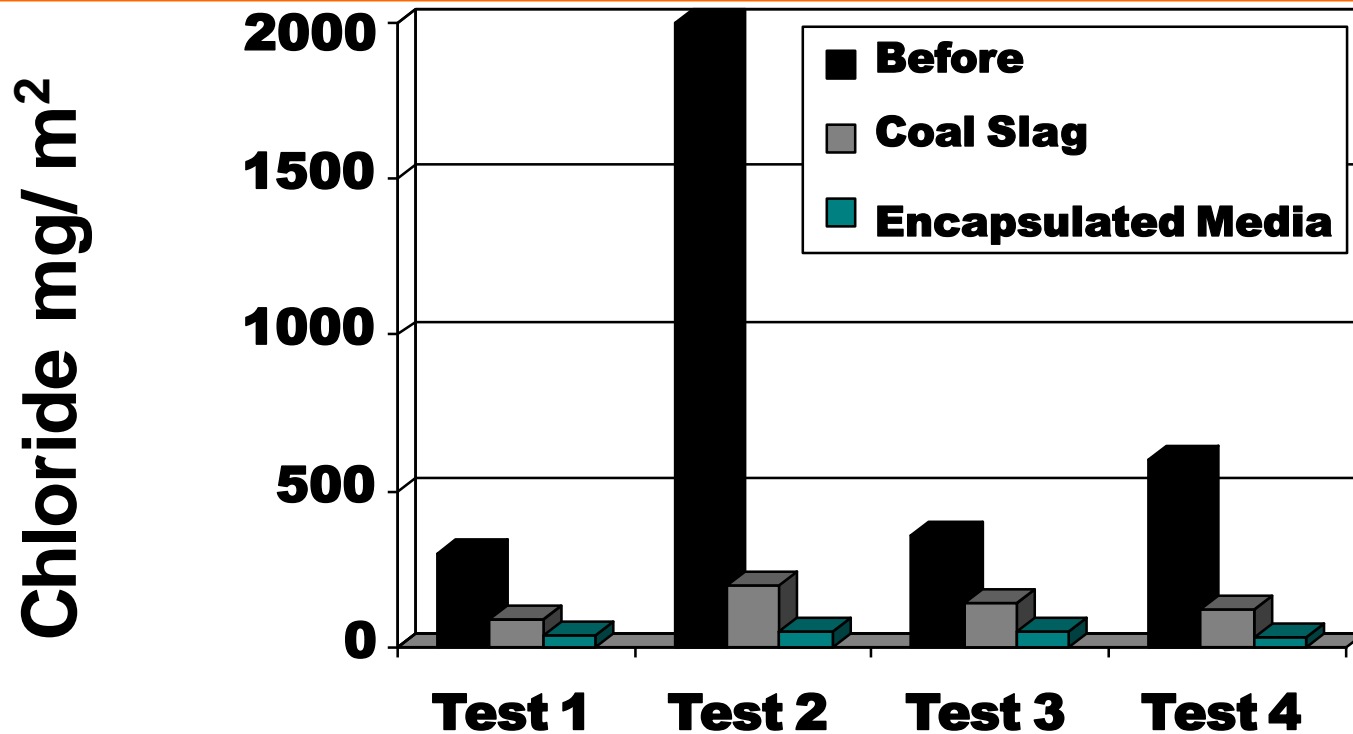
2001 Study Confirms Encapsulated Media is Effective at Chloride Removal – but no recycling occurred



- Four panels were contaminated with varying levels of sea salt
- Half of each panel blasted to SSPC-SP5 with 12/40 coal slag
- Half of each panel blasted to SSPC-SP5 with encapsulated media containing 30 grit aluminum oxide
- Remaining chloride levels were between 9 $\mu\text{g}/\text{cm}^2$ to 20 $\mu\text{g}/\text{cm}^2$ with the coal slag prepared panels
- Remaining chloride levels were consistently below 5 $\mu\text{g}/\text{cm}^2$ with the encapsulated media prepared panels

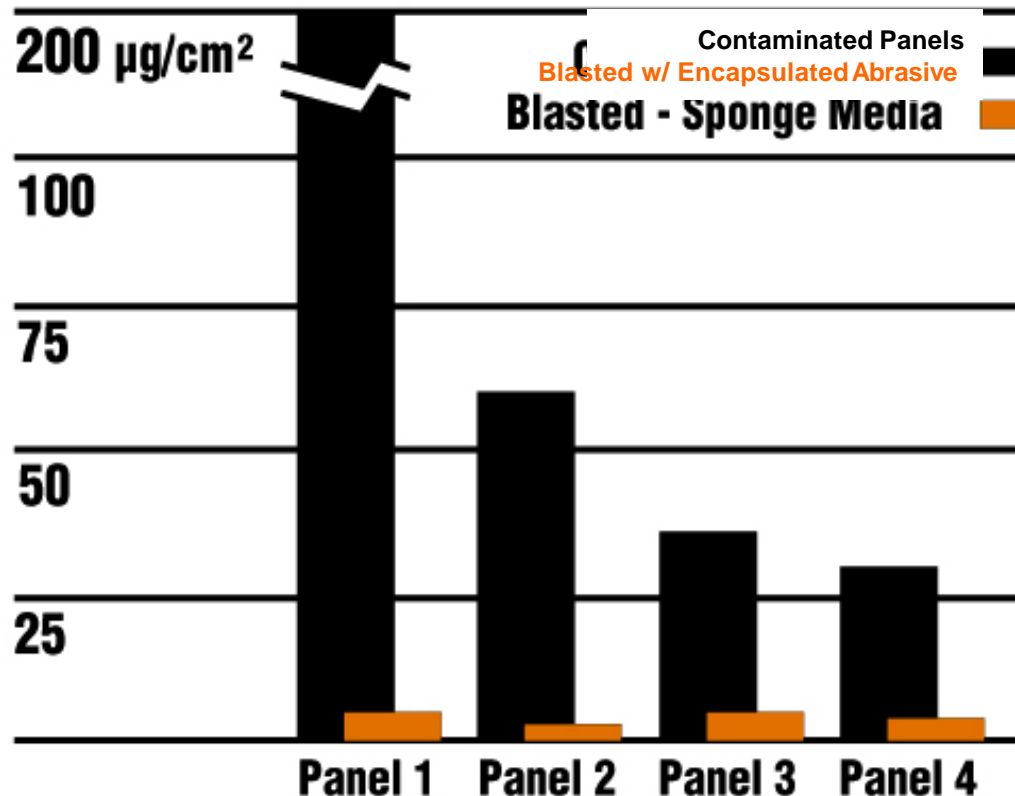


Chloride Removal Comparison

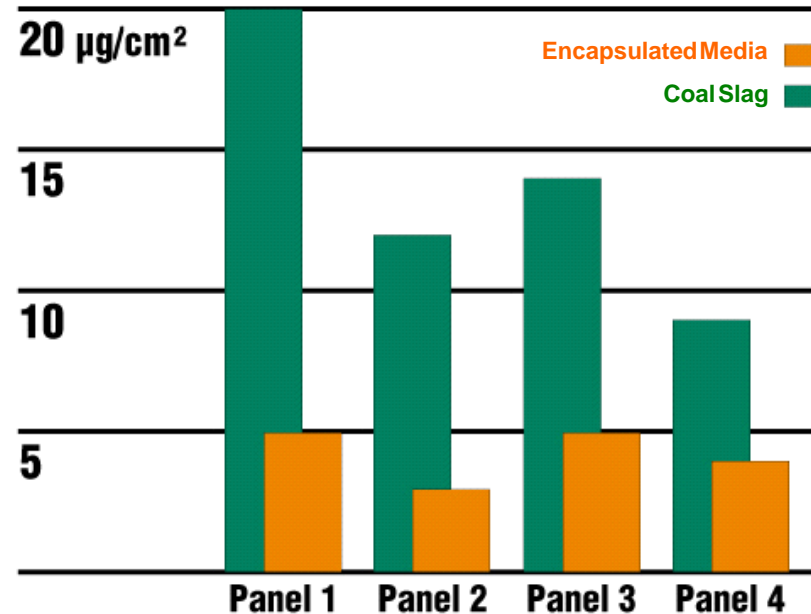


21

Residual Chloride Comparison -A



Residual Chloride Comparison - B



©2008 Sponge-Jet Inc. All rights reserved.

2002 Case History - Newark Airport

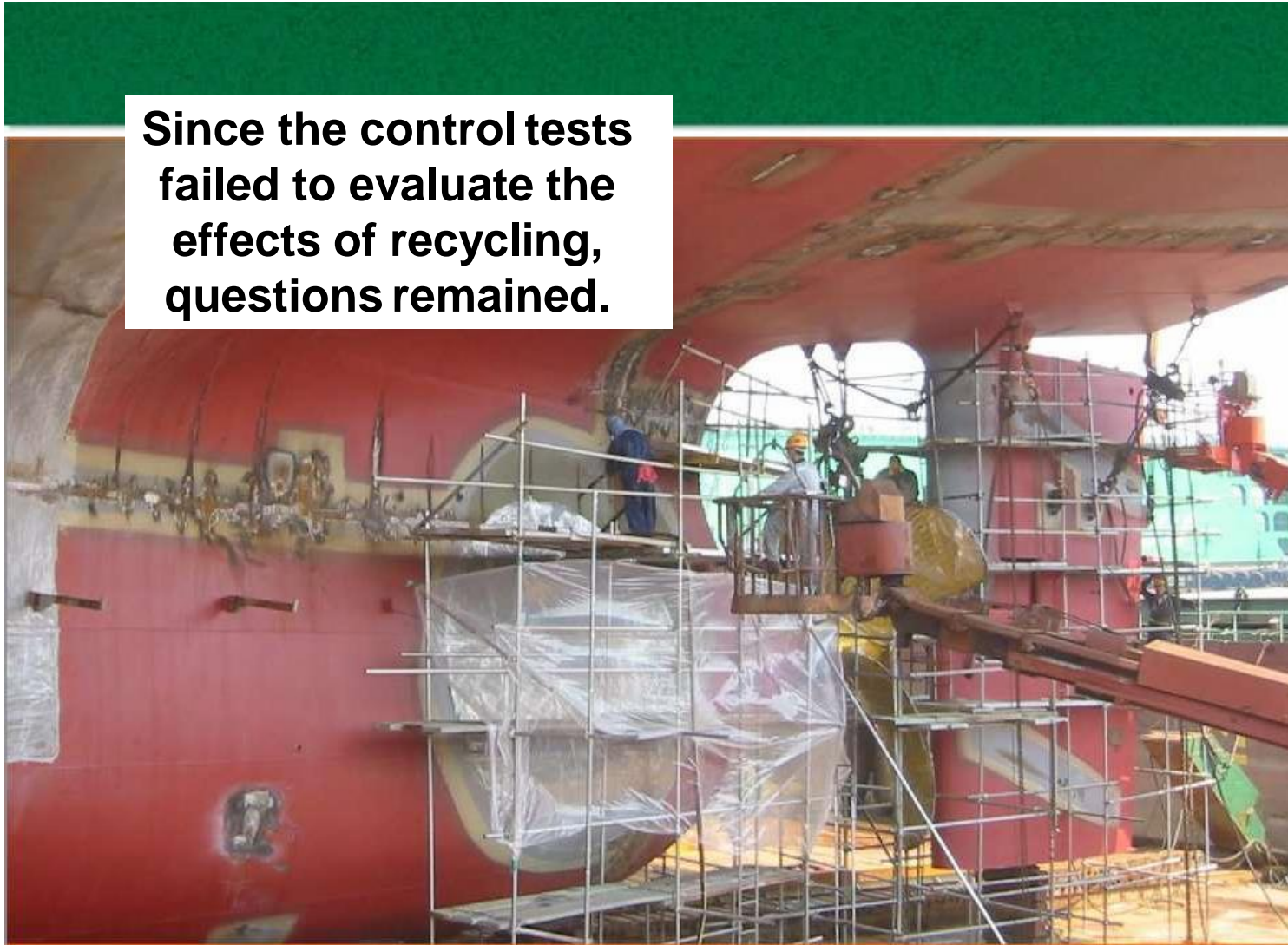


PHOTOS COURTESY OF GENERAL MAGNAPLATE, INC.

- Spot repairs on cooling water pipe
- Prior to abrasive blasting, chloride levels were $40 \mu\text{g}/\text{cm}^2$ (**400 mg/m²**)
- Encapsulated abrasive media was used to abrasive blast the surface to a SSPC-SP5 cleanliness with a 3-5 mil profile
- Chloride measurements after blasting were below the $3 \mu\text{g}/\text{cm}^2$ (**30 mg/m²**) detectable limit of the test
- Media Recycling did occur but controls and documentation were limited

Recycling of the Encapsulated Abrasive still Questioned

Since the control tests failed to evaluate the effects of recycling, questions remained.



2009 Large Offshore Service Company for PETRONAS contracts to perform rigorous tests

**SIRM QAS International and a NACE Inspector are
selected to oversee testing and protocol.**

**If Chloride Removal, profiling
and cleaning can be
accomplished “online” with a
single process the cost savings
offshore would be significant.**

Challenge – Can they reliably Meet specification?

- ✓ PETRONAS requires chloride levels below 25 mg/m²
- ✓ Can 25 mg/m² be reliably achieved
- ✓ Will PETRONAS engineering accept encapsulated abrasive as the general method of surface preparation

GOAL

- 1) Quantify ability to remove chlorides
- 2) Do chlorides in recycled media increase
- 3) Document achievement of surface profile for PETRONAS approval

CTR/IMN/007/09		REPORT NO
BRESLE TEST METHOD - ISO8502-6		METHOD
Test Panel		SUBSTRATE
Sponge Jet Sirim's Test-Chloride Test		PROJECT TITLES
Sponge Jet Silver 30 (Aluminium Oxide)		ABRASIVE

ABRASIVE CONDITION		6 Times Recy
SURFACE PROFILE		25um - 70um
RUST GRADE		Grade C
SURFACE TEMPERATURE		30°C
WITNESSES PARTY		Tanjung Offs
APPROVE PARTY		SIRIM QAS I

LOCATION AREAS		Tanjung Maintenance Services B
DATE OF TEST		18 MAC 2009 @ 1700HRS

TEST RESULT		
Test Panel	Chloride Test	Remarks
No. 7	9 mg/m ²	Acceptable

Notes: 1) Acceptance criteria - 50µS/cm or 25mg/m² or 25ppm.
 2) Test are taken randomly and the results serve as a guide only owing concentration and distribution of chloride may not be uniform.

©2008 Sponge-Jet Inc. All rights reserved.

Test Protocol utilized ISO 8502-6: 1995 Bresle Method

- ✓ Chloride contaminated test panels, Rust Grade C, Grade A with existing High Build Marine Coating
- ✓ Test Panels + Target Panels to fully use media and expose it to contaminants with each cycle
- ✓ Average starting chlorides 82 mg/m² then cleaned to Sa2 ½ remaining media blasted on target plate
- ✓ Media recovered, recycled and blasted again repeated for 7 cycles
- ✓ Complete documentation by oversight inspectors



Test Results

SIRM TEST		Surface Test Bresle	Abrasive Media Test Kitagawa Tube
Test Panel	Sponge Recycles	Plate mg/m2	Media mg/m2
Control	Not Blasted	82	15
1	New	Error*	20
2	1	Error*	
3	2	14.5	
4	3	14.5	
5	4	11.5	
6	5	11	52
7	6	9	

* NOTE: The data from the first two blast cycles was later found to be in accurate due to some cross contamination of salt laden water due to a leak in an after cooler unit.

Increased recycling improved cleaning efficiency!

- ✓ Results showed that Chlorides do remain in the “**Recyclable Encapsulated Abrasive Media**” but have no net effect on chloride removal
- ✓ Consistent with earlier testing the “**Recyclable Encapsulated Abrasive Media**” was extremely effective at Chloride Removal and consistently met the specified
- ✓ Based on results PETRONAS was satisfied and now allows and specifies this process for surface preparation throughout its facilities and assets
- ✓ Contractors now perform paint removal, surface profiling, blasting to Sa 2 ½ visual cleanliness and chloride removal below 25 mg/m² all in one step

Conclusion

- **“Recyclable Encapsulated Abrasive Media”** is an effective DRY method to remove surface contaminants such as chlorides without the use of water or chemicals
- Blasting with **“Recyclable Encapsulated Abrasive Media”** can frequently reduce chloride concentrations to below typically specified levels in a single process and is superior to conventional abrasive blasting in cleaning effectiveness
- Cost and Speed of **“Recyclable Encapsulated Abrasive Media”** is favorable to other technologies which require multi-step procedures such as (abrasive blast + water or chemical wash + final abrasive blast) all to achieve specified levels of surface contaminants

THANK YOU..