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:

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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.

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:

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- 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

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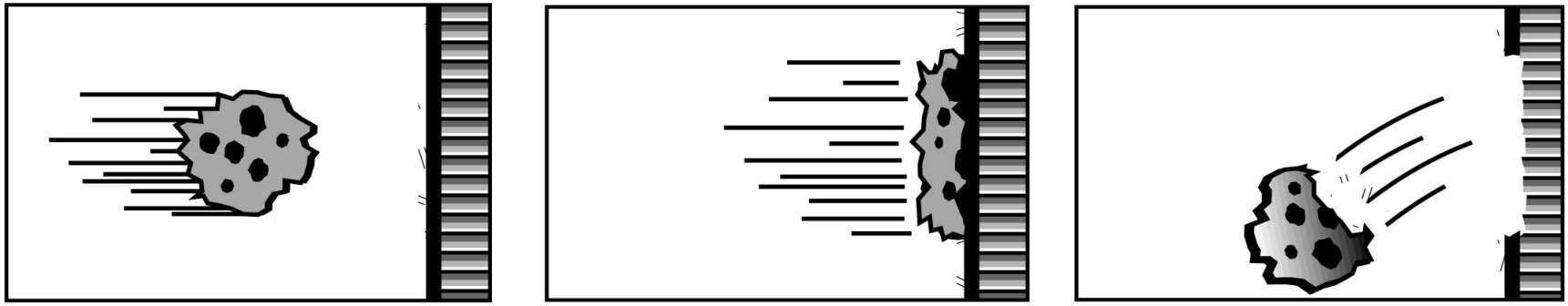
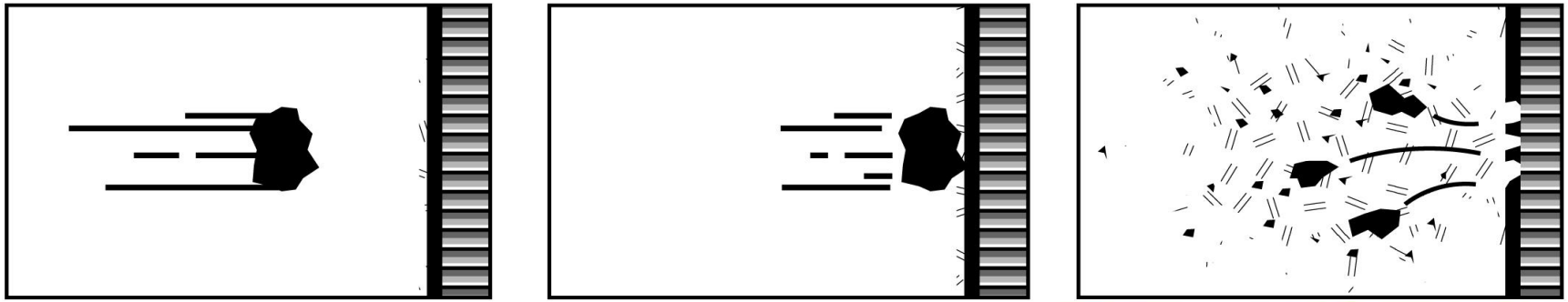
Microcontainment™ Technology

Conventional Abrasive Bonded Into Sponge Media™



Conventional Abrasive Blasting Media



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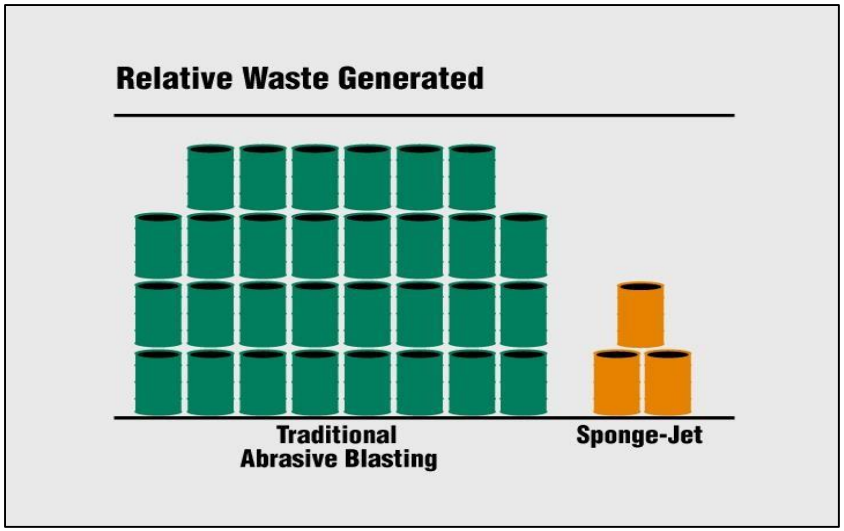
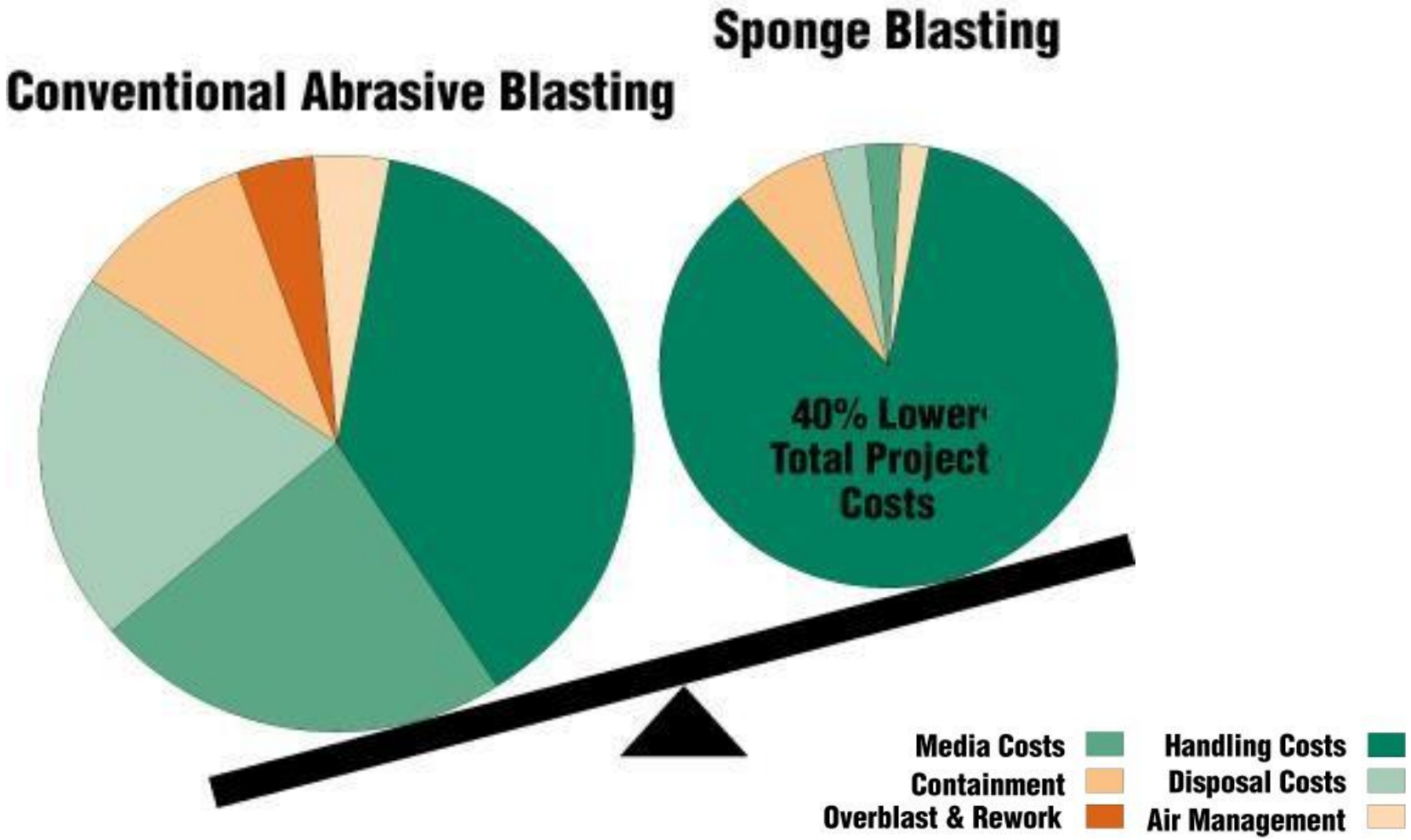
Reuse Sponge Media up to 15 Times

- 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

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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

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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)

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Blast in operating plants

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Platform Applications

Construction:

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

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Platform Applications

Maintenance:

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

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PETROBRAS P-51 Platform

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

PETROBRAS P-37 Platform Production Separators

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Petro/Chemical Refinery Applications

Petro/Chemical Refineries:

- Stripping distillation tower interiors/exteriors
- 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

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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

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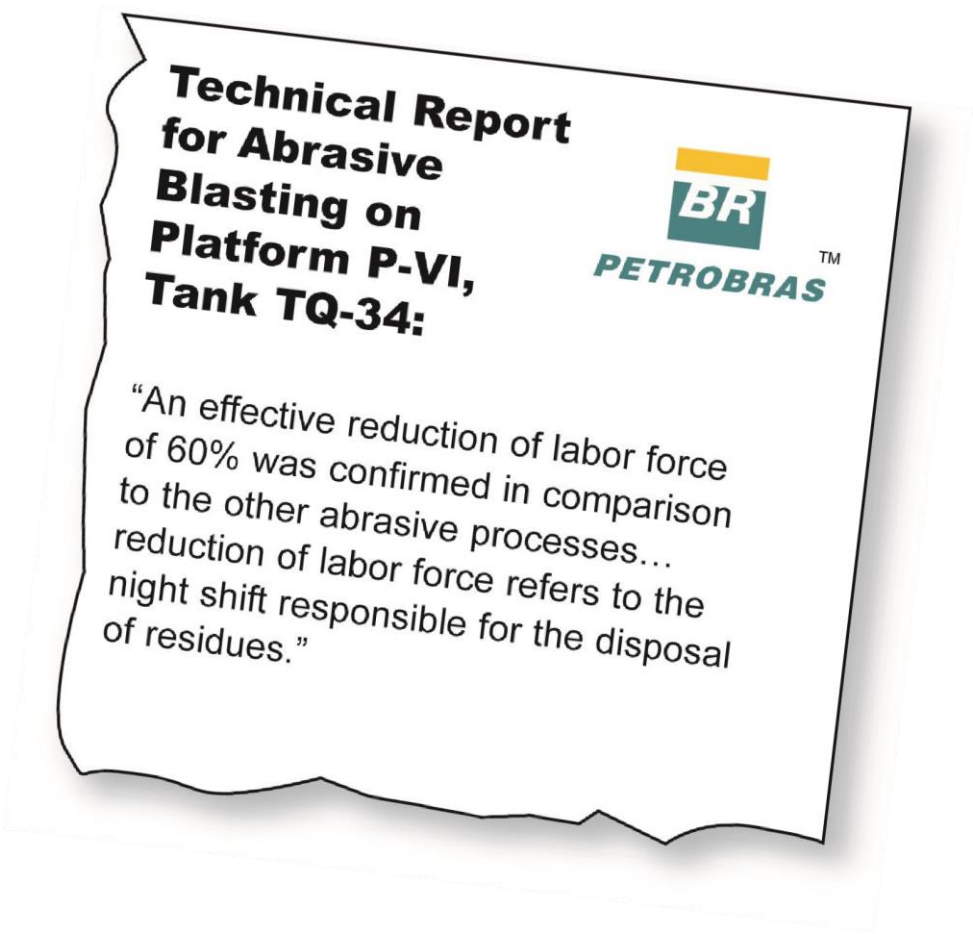
Customers Are Saying…



PETROBRAS:

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

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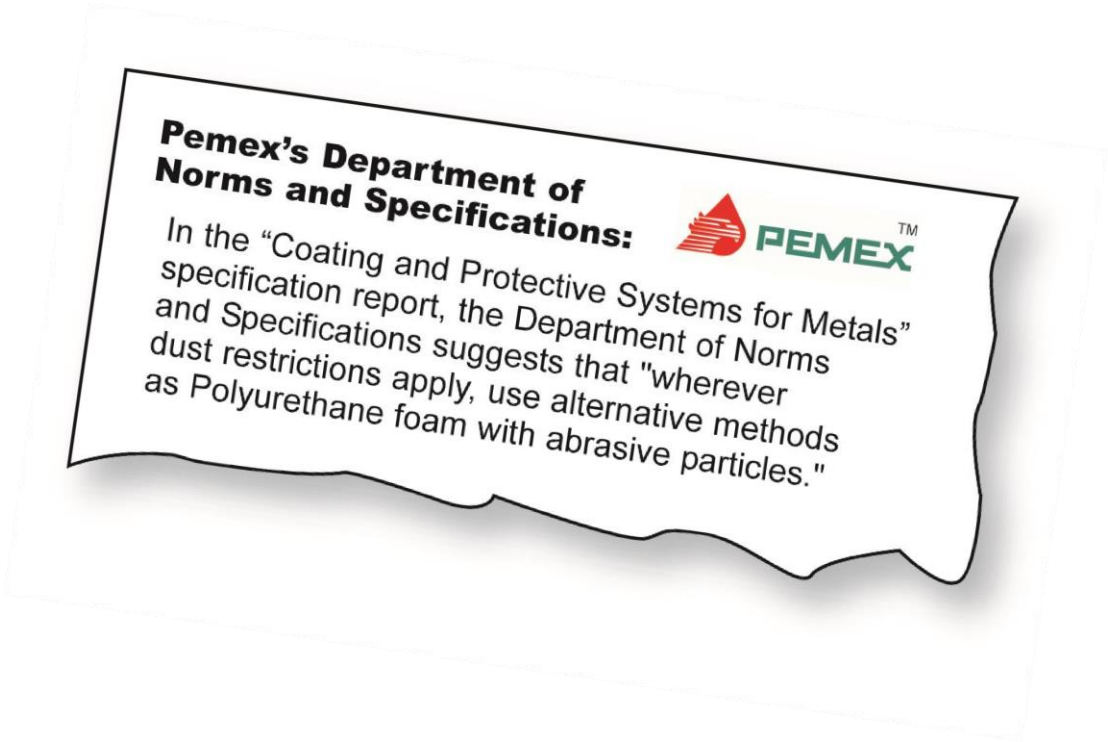

PEMEX:

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

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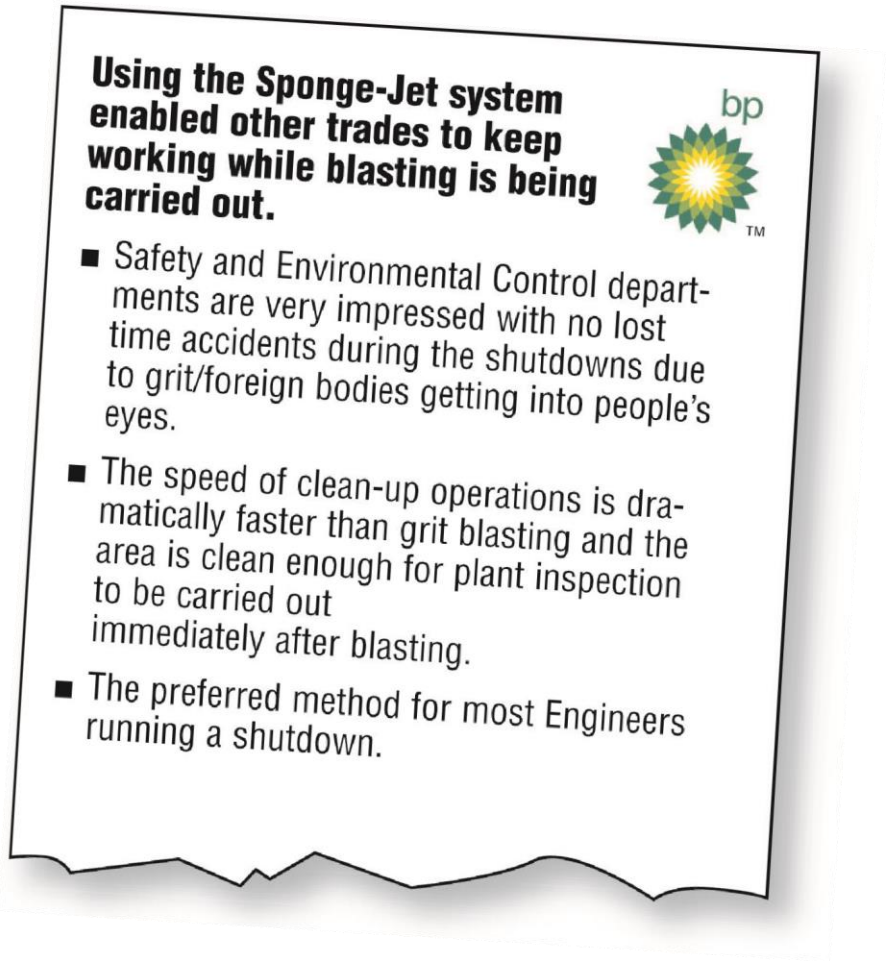
Customers Are Saying…



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

bp™

- 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

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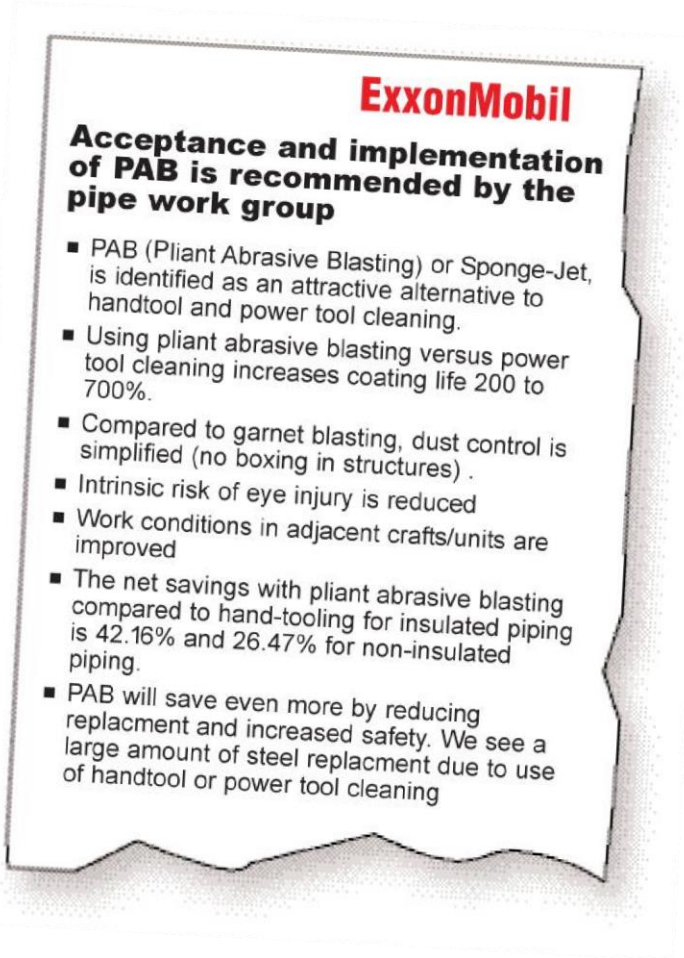
Customers Are Saying…

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



ExxonMobil

Acceptance and implementation of PAB is recommended by the pipe work group

- PAB (Pliant Abrasive Blasting) or Sponge-Jet, is identified as an attractive alternative to handtool and power tool cleaning.
- Using pliant abrasive blasting versus power tool cleaning increases coating life 200 to 700%.
- Compared to garnet blasting, dust control is simplified (no boxing in structures) .
- Intrinsic risk of eye injury is reduced
- Work conditions in adjacent crafts/units are improved
- The net savings with pliant abrasive blasting compared to hand-tooling for insulated piping is 42.16% and 26.47% for non-insulated piping.
- PAB will save even more by reducing replacment and increased safety. We see a large amount of steel replacment due to use of handtool or power tool cleaning

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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

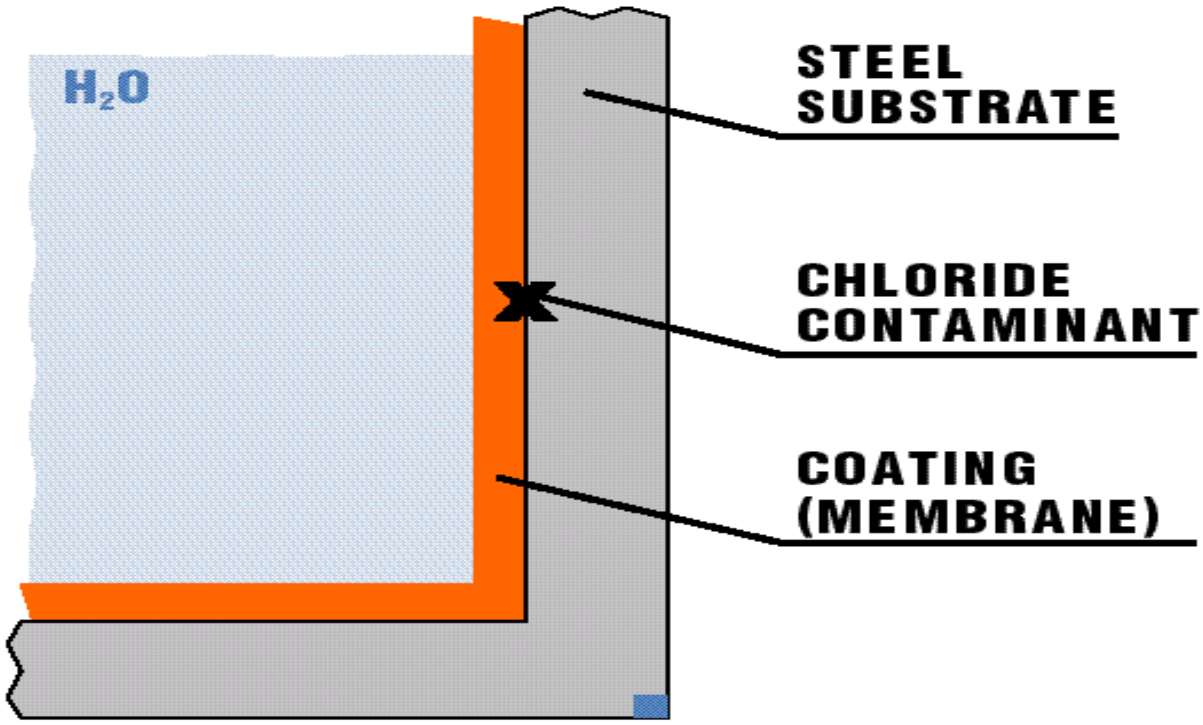

FIGURE 1.A

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Blistering / Osmotic Drive

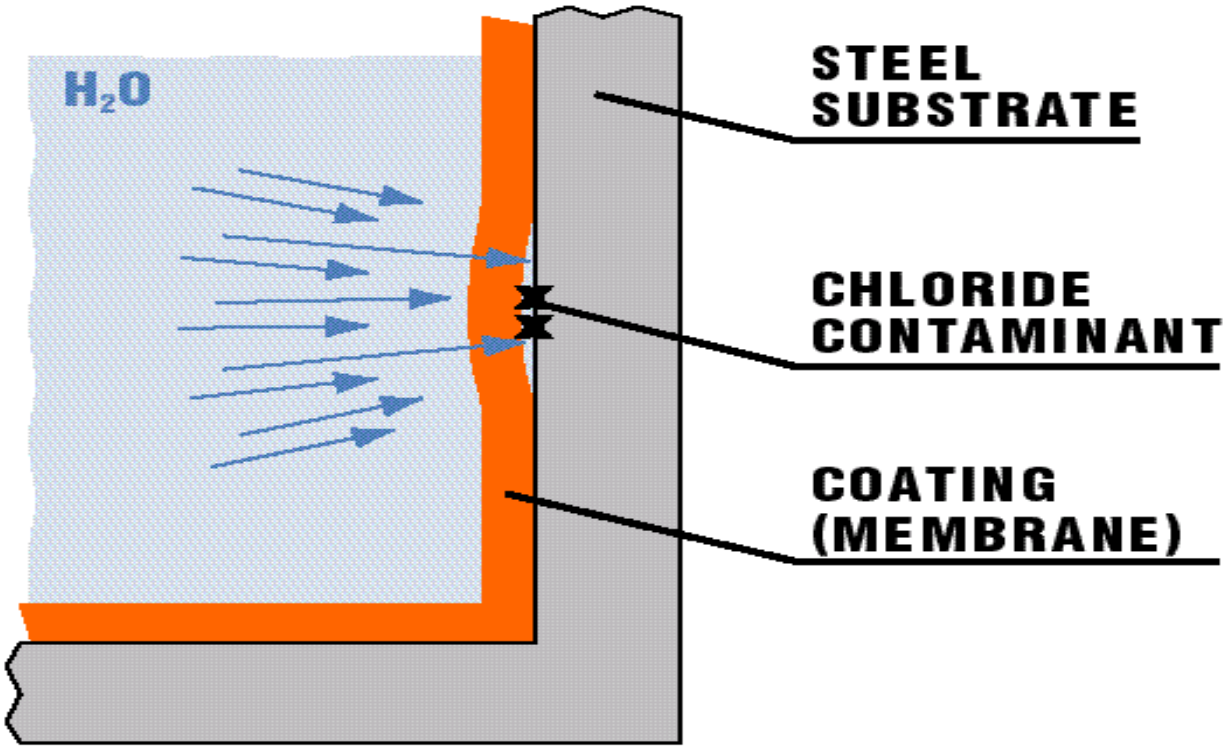

FIGURE 1.B

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Blistering / Osmotic Drive

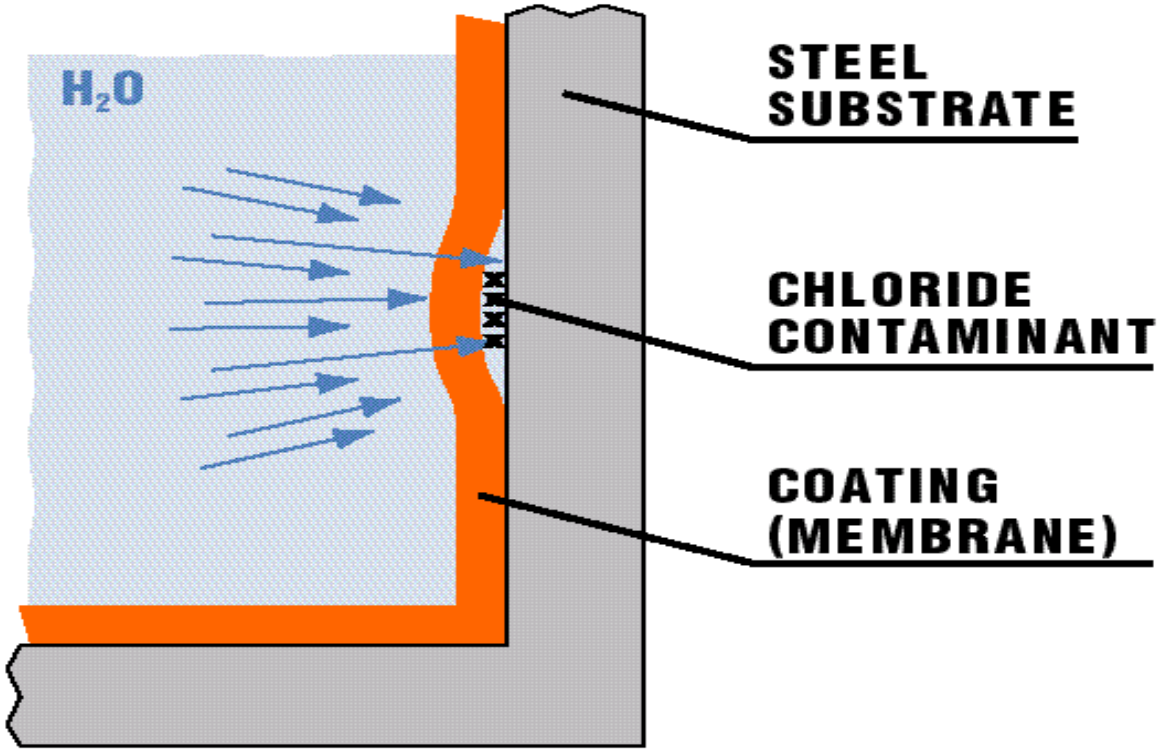

FIGURE 1.C

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Blistering / Osmotic Drive

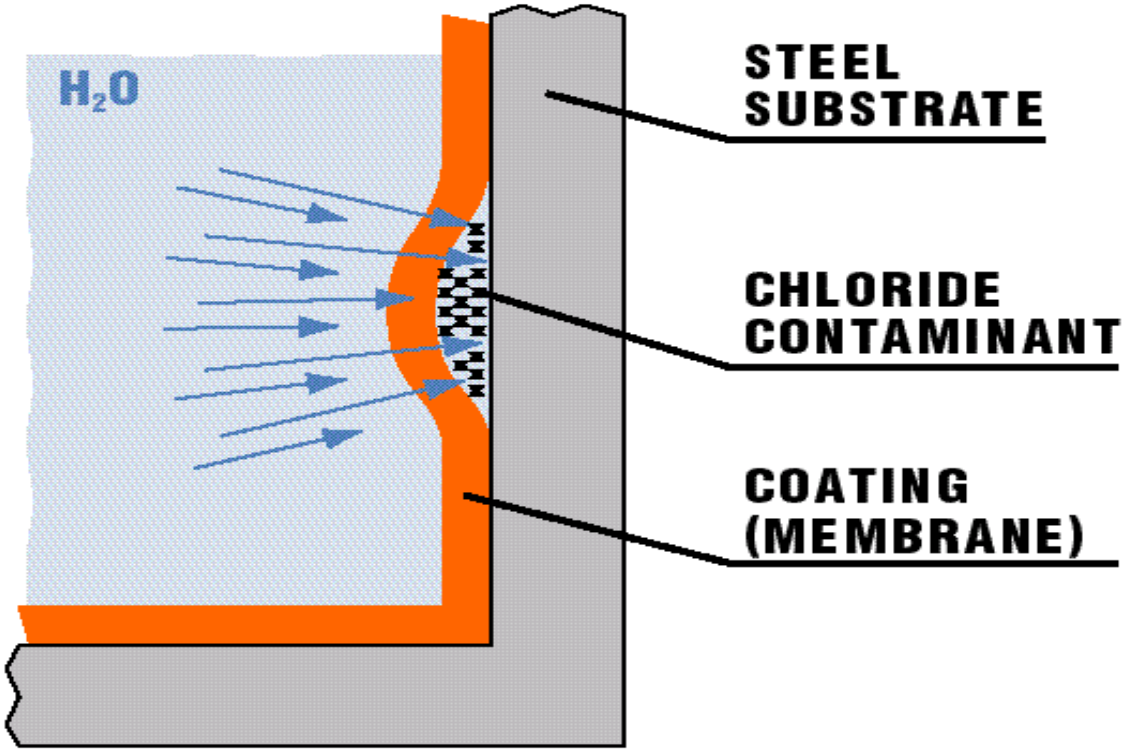

FIGURE 1.D

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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/cm^2 (SC2) with single-pass blasting with composite Sponge Media abrasives

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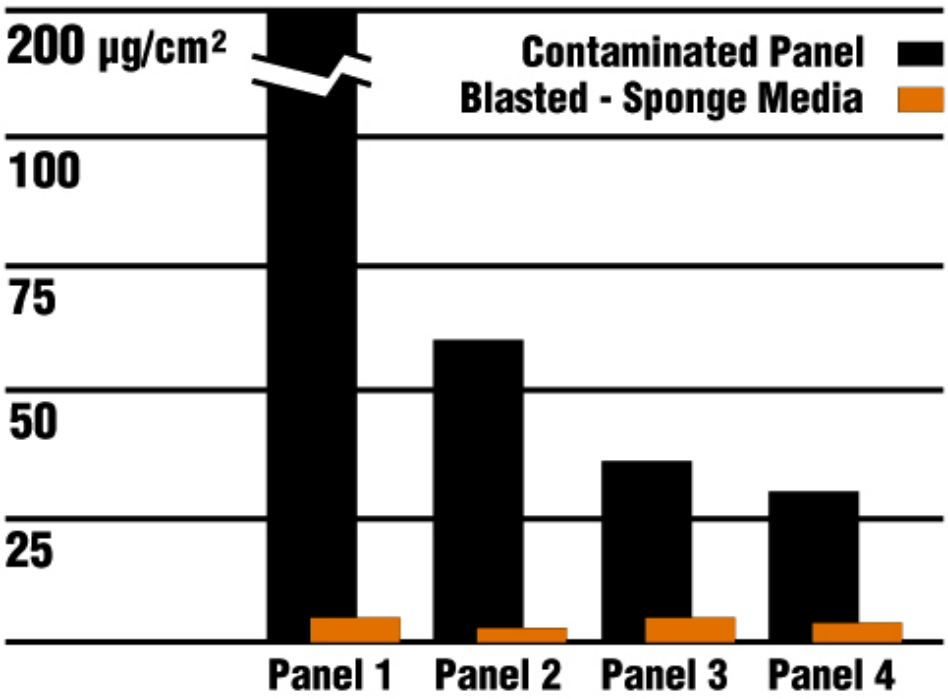
Residual Chloride Comparison - A



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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

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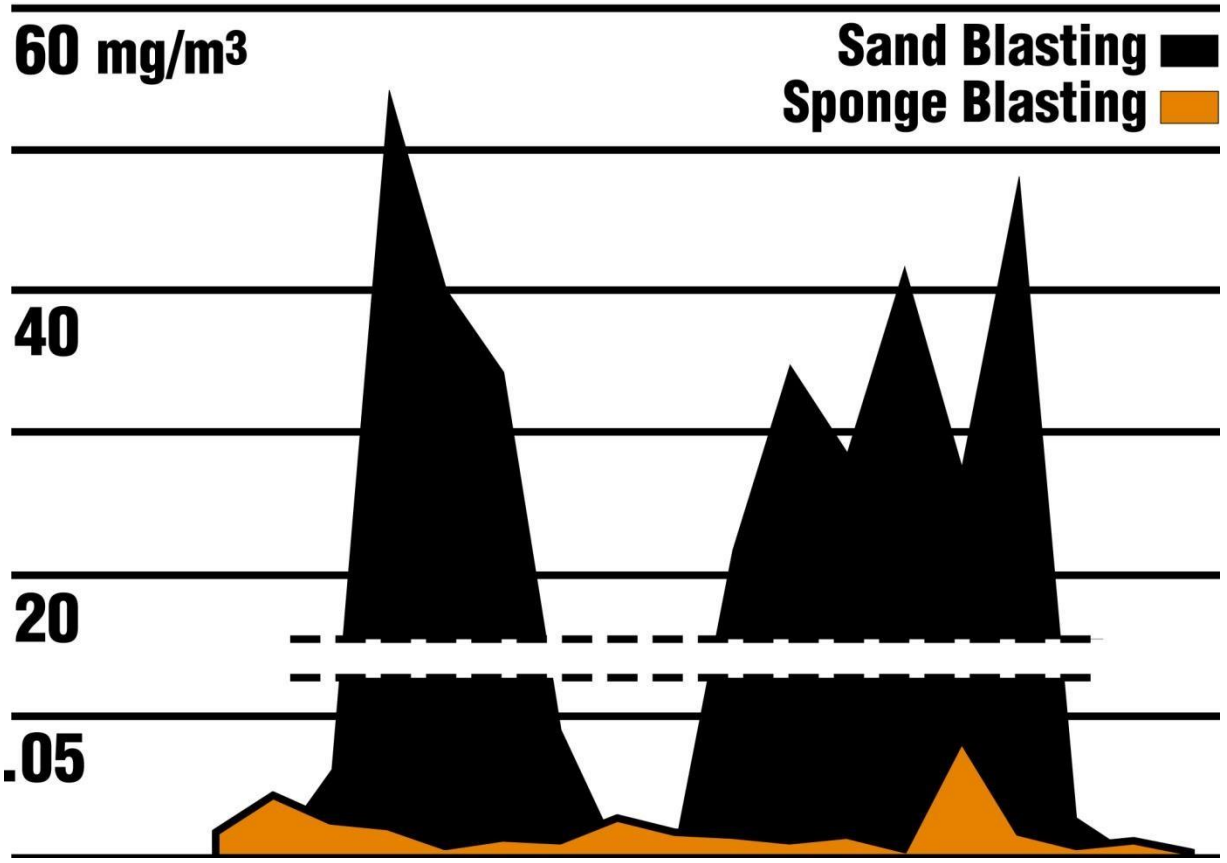
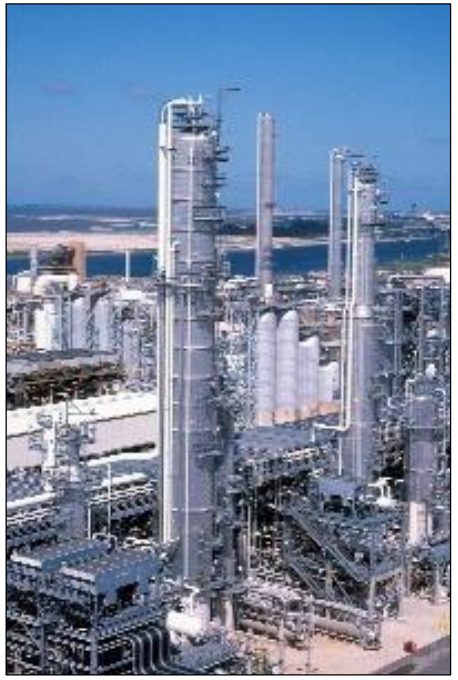
Airborne Contaminant Comparison



Offshore is our business



Blast Where You Want.™

SPONGE-JET®

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CHLORIDE REMOVAL

WITH SPONGE-JET'S

"RECYCLABLEENCAPSULATED ABRASIVE MEDIA"

CHLORIDE REMOVAL

with

"RECYCLABLE ENCAPSULATED ABRASIVE MEDIA"

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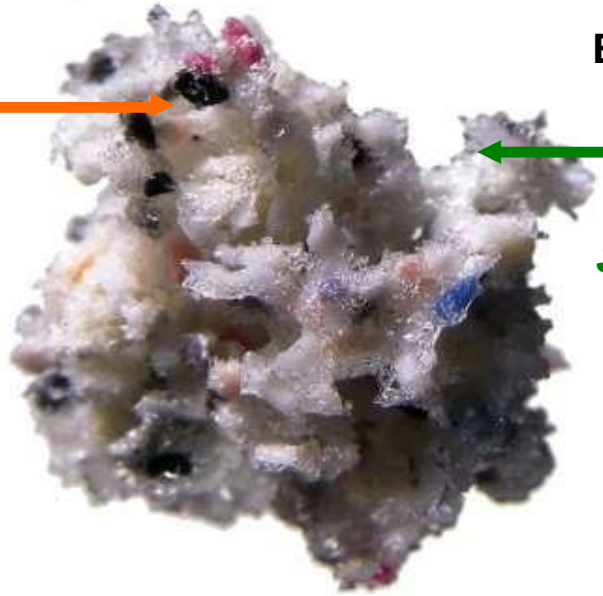
ABSTRACT: This Paper Presents

- 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

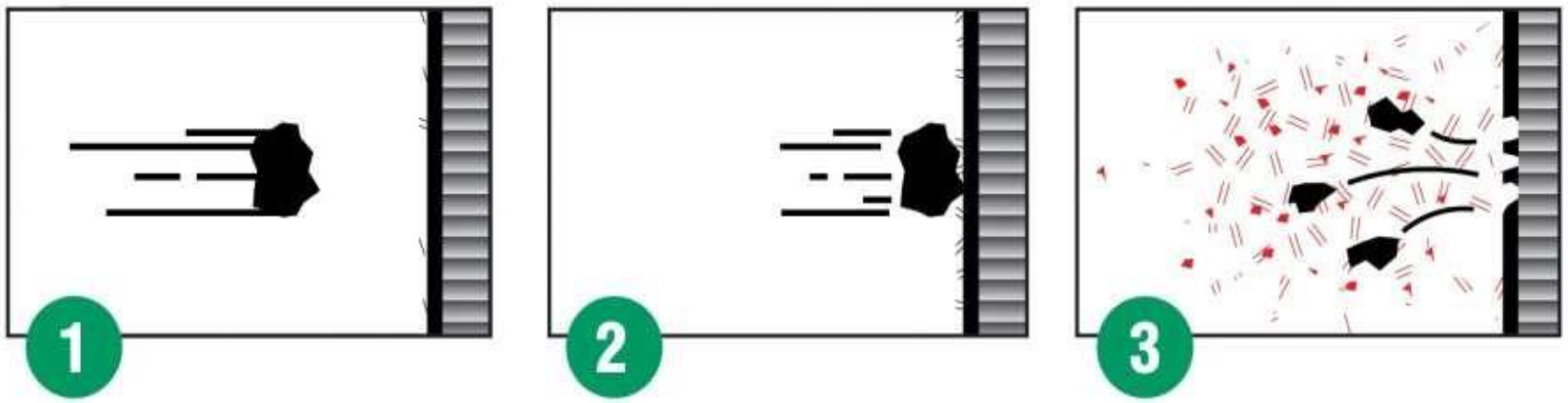
1 Abrasive



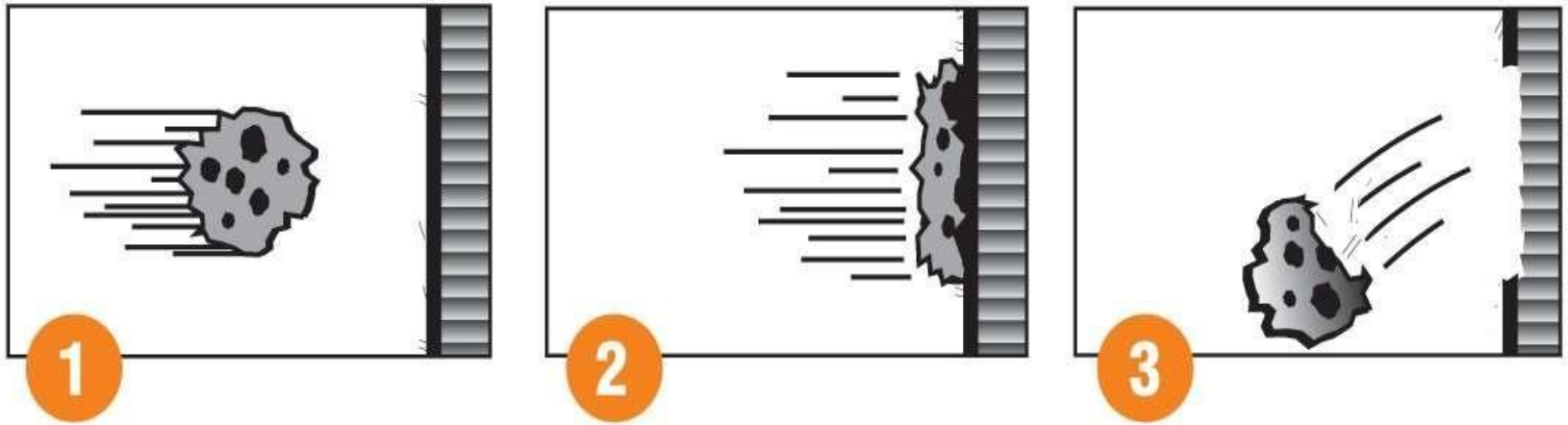
Encapsulating Sponge Material 1

Small cells expand after impact and "vacuum" the surface of small residual dust and contaminants; they also capture fragmenting abrasive and coating

BACKGROUND ON ENCAPSULATED ABRASIVE MEDIA



Conventional Abrasive Blasting



Encapsulated Abrasive Media

BACKGROUND ON ENCAPSULATED ABRASIVE MEDIA

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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

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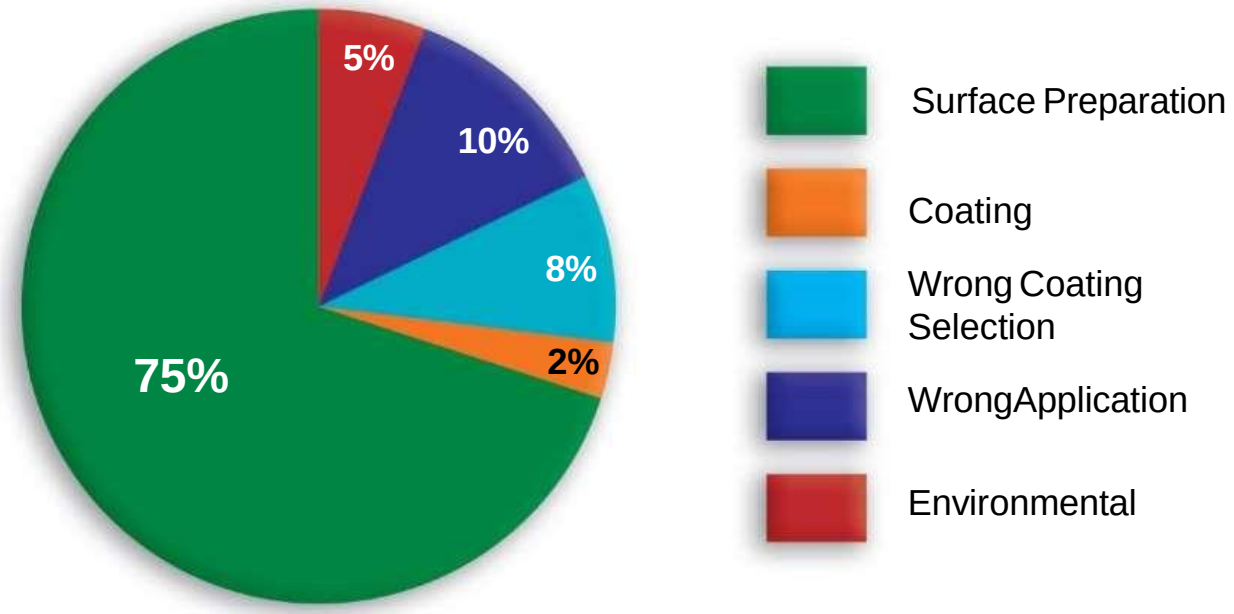
Overview of Chloride Issue: Why all the concern?

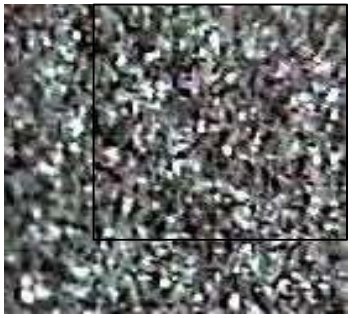
Why Do Coatings Fail?



Overview of Chloride Issue: Goals of Surface Preparation

Proper Surface Preparation:

Cleanliness (Visual)

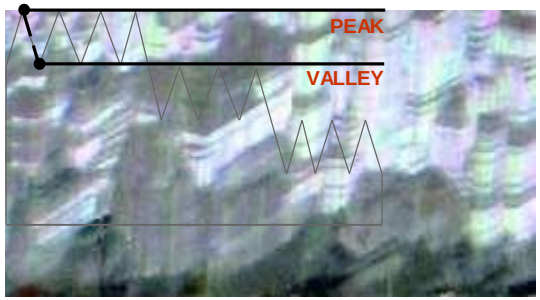


Decontamination (Invisible)

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 – 5µg/cm²**

- **US NAVY**
  - **1990's 10 µg/cm² (100 mg/m²) non-immersion and 5 µg/cm² (50 mg/m²) immersion**

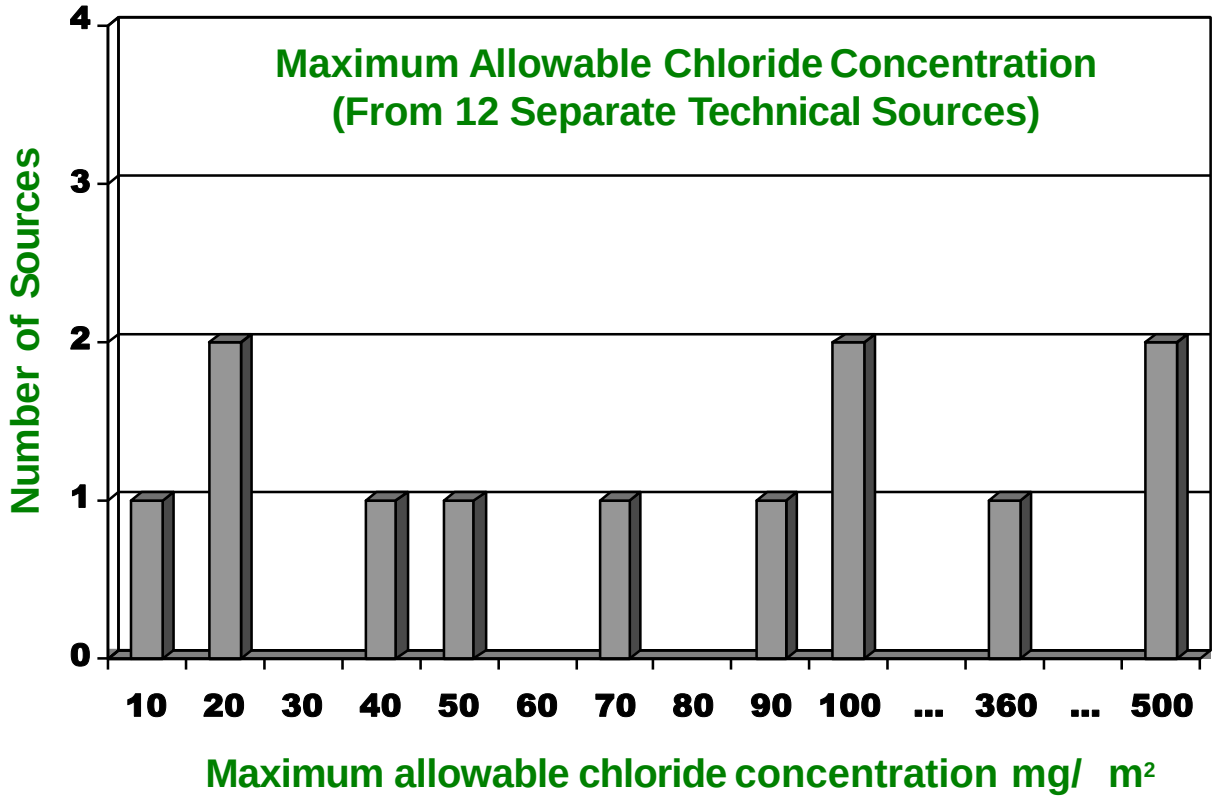
  - **2000 5 µg/cm² (50 mg/m²) non-immersion and 3 µg/cm² (30 mg/m²) immersion**

Increased Emphasis on Residual Chloride

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

	Chloride	Soluble Ferrous	Sulfates
SC 1	0 µg/cm^2	<0 µg/cm^2	<0 µg/cm^2
SC 2	<7 µg/cm^2 (70 mg/m^2)	<10 µg/cm^2	<17 µg/cm^2
SC 3	50 µg/cm^2 (500 mg/m^2)	<50 µg/cm^2	n/a

South Korean Study Published through IMO



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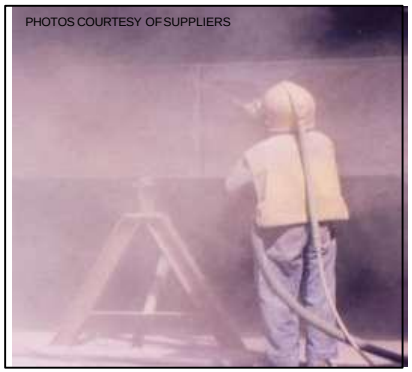
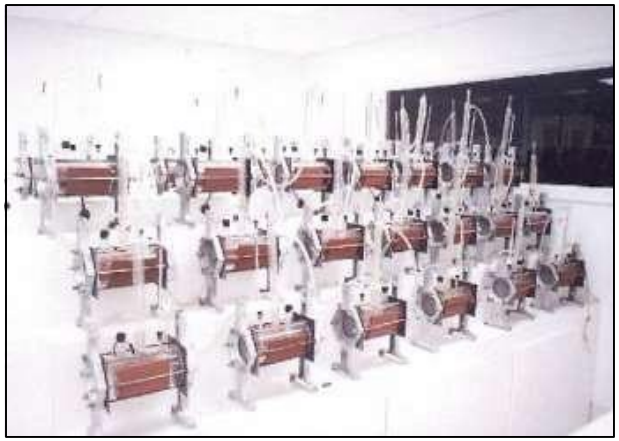
Methods for Chloride Removal

- 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

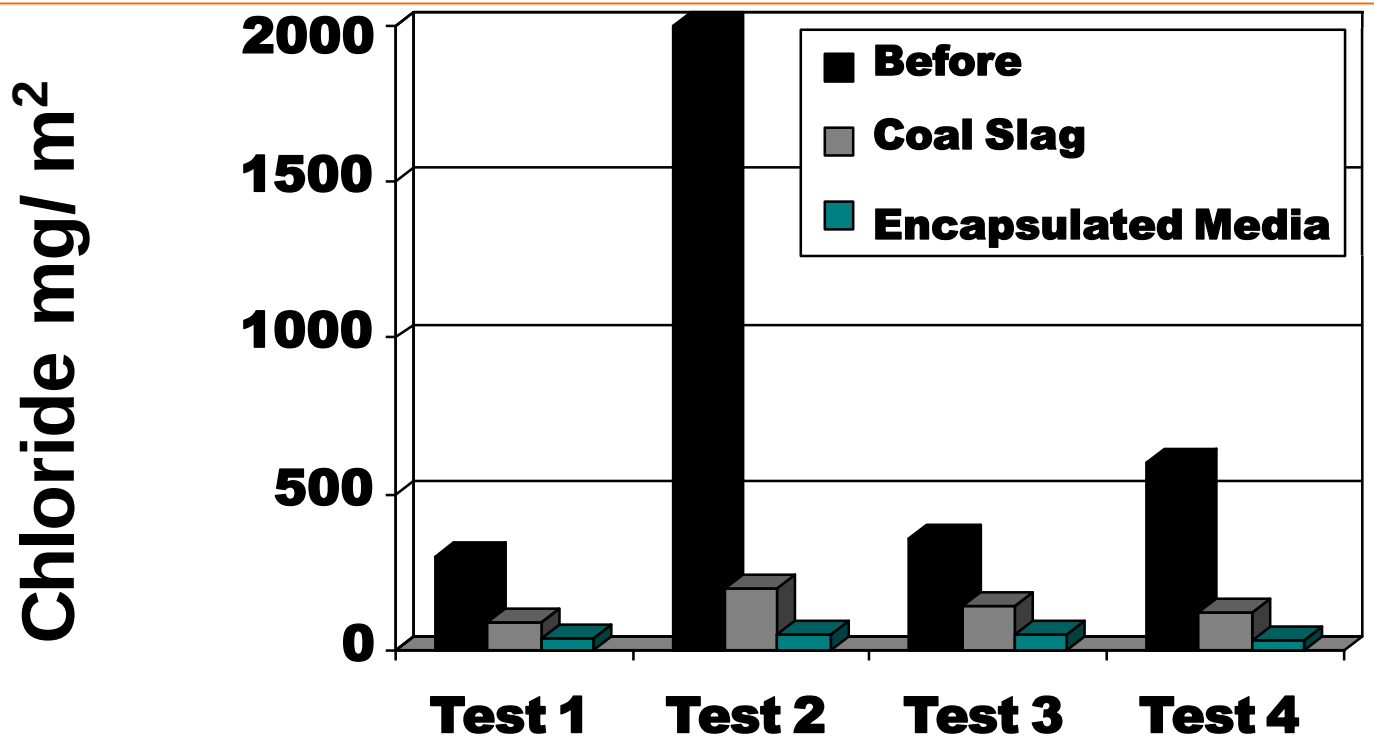


- Panels contaminated in ASTM B117 Salt Fog Cabinet
- Initial Chloride 400 µg/cm² **(4000 mg/m²)**
- To achieve less than 10 µg/cm² **(100 mg/m²)** via standard aluminum oxide blasting required a three step process:
  - -Blasting
  - -Demineralized water wash
  - -Rusting and Re-blasting
- To achieve less than 10 µg/cm² **(100 mg/m²)** via encapsulated media blasting required a single blast

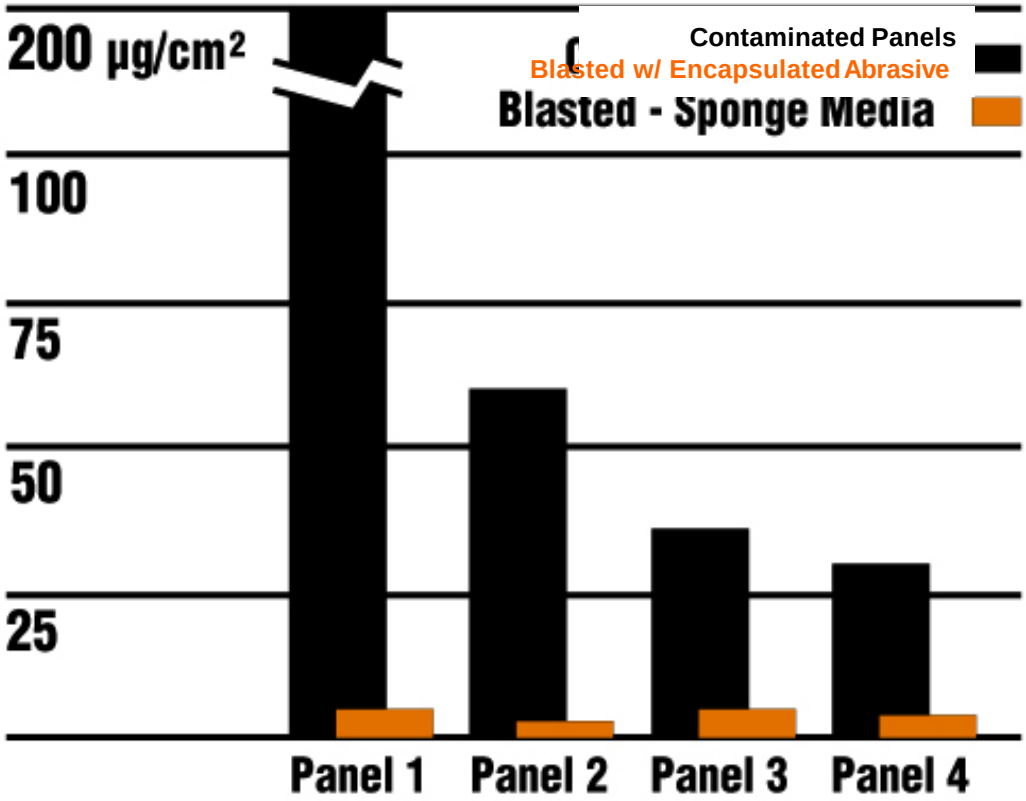
2001 Study Confirms Encapsulated Media is Effective at Chloride Removal – but no recycling occurred

- 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 µg/cm^2 to 20 µg/cm^2 with the coal slag prepared panels
- Remaining chloride levels were consistently below 5 µg/cm^2 with the encapsulated media prepared panels

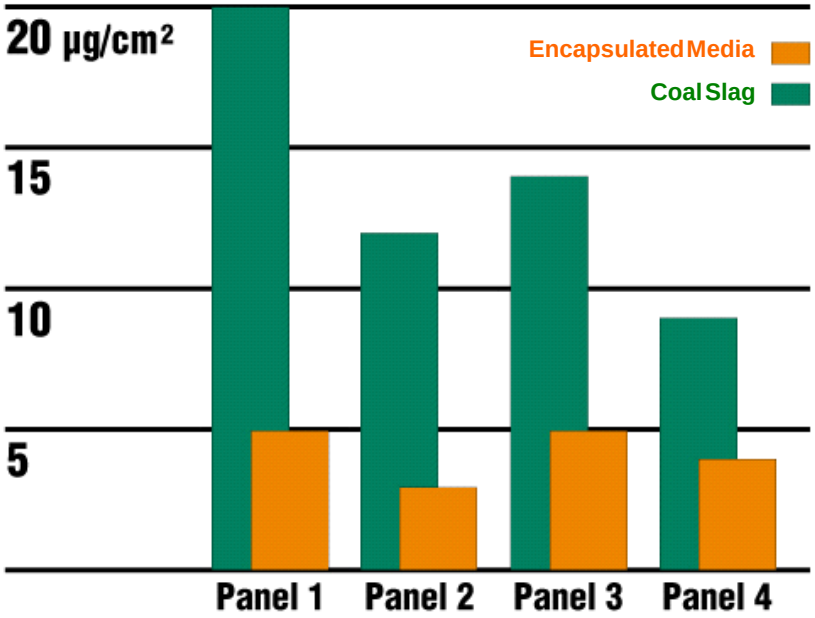
Chloride Removal Comparison



Residual Chloride Comparison -A



Residual Chloride Comparison - B

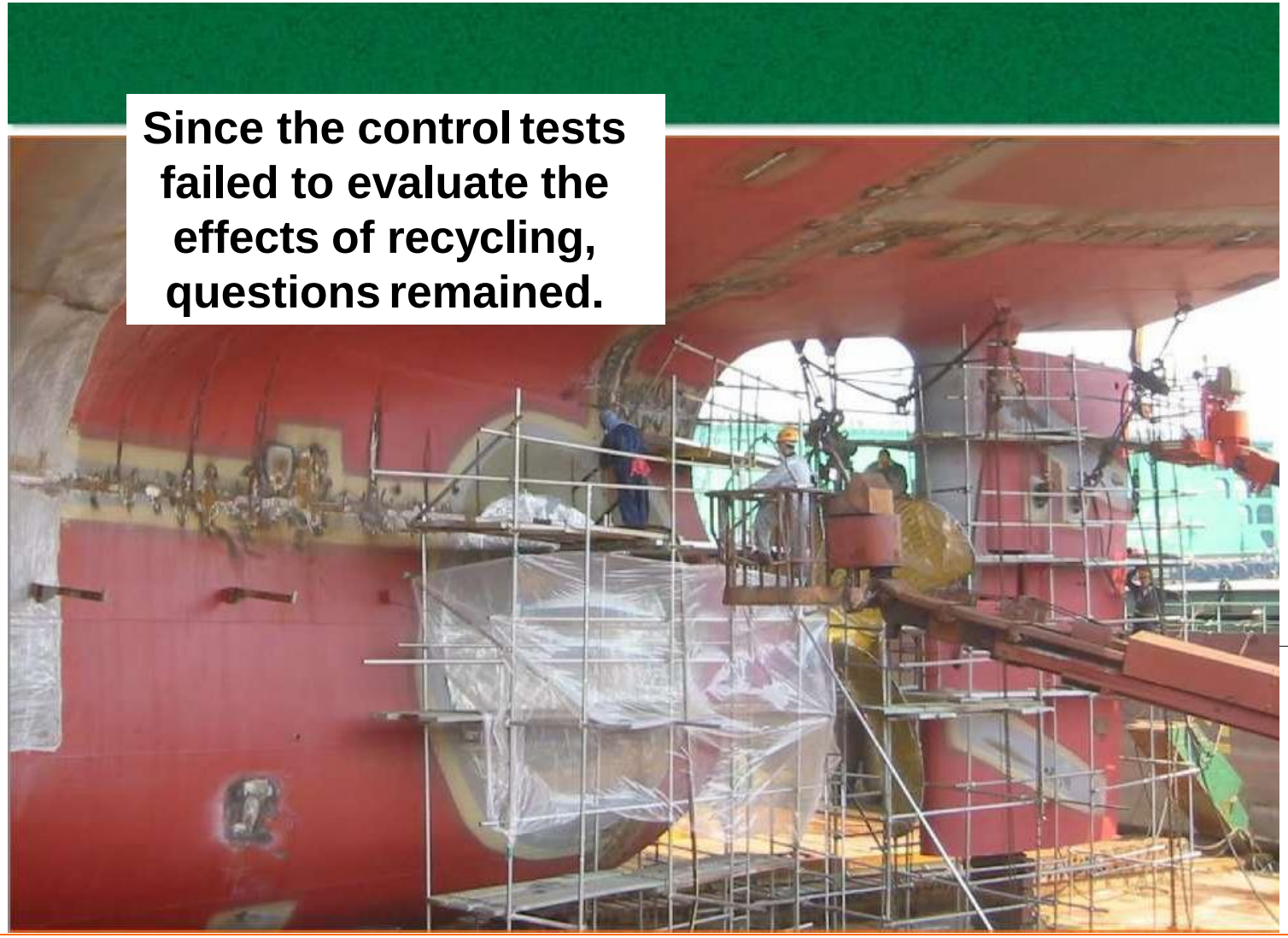


2002 Case History - Newark Airport

PHOTOS COURTESY OF GENERAL MAGNAPLATE, INC.

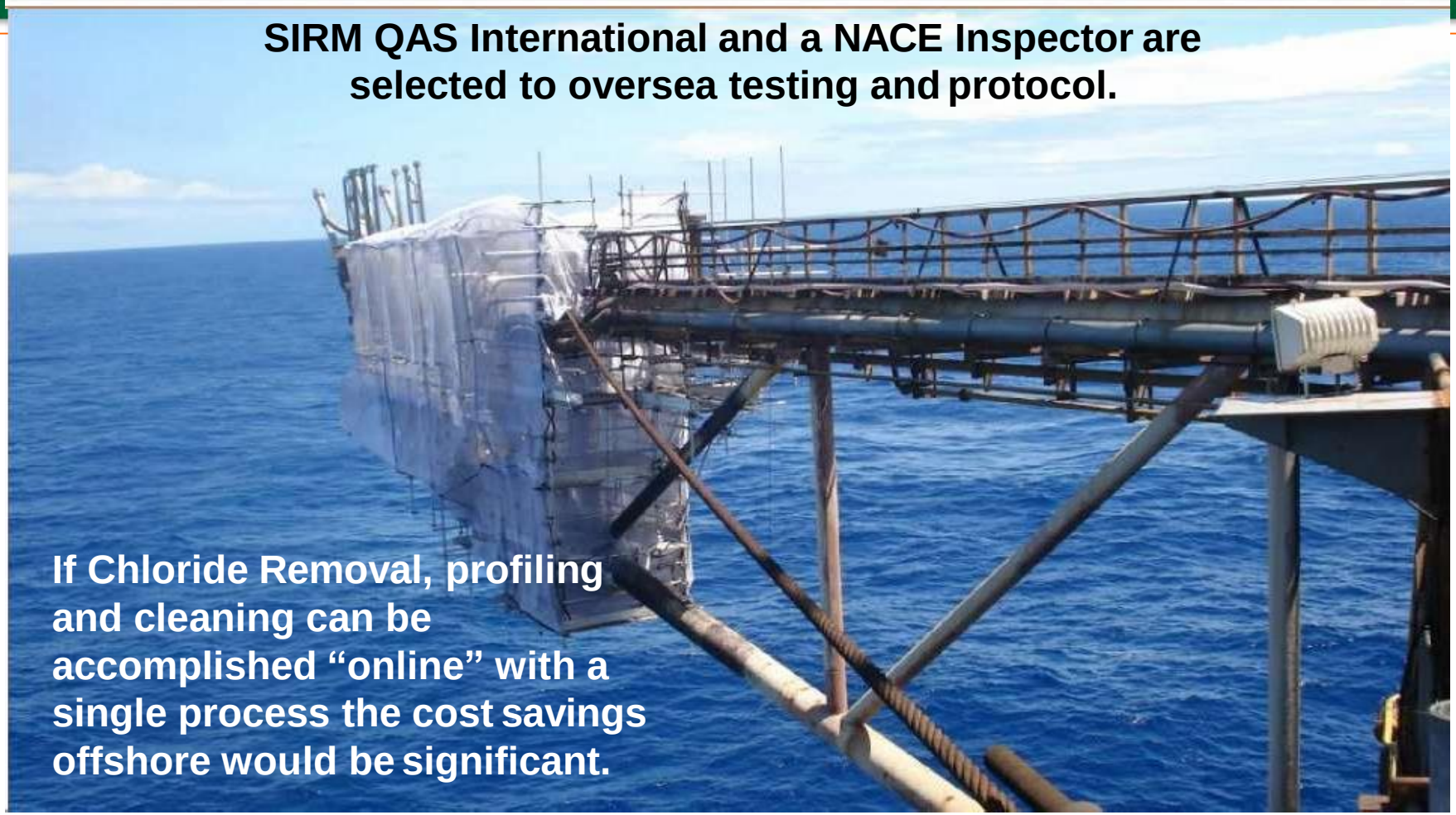
- Spot repairs on cooling water pipe
- Prior to abrasive blasting, chloride levels were 40 µg/cm² **(400 mg/m²)**
- Encapsulated abrasive media was used to abrasive blast the surface to a SSPC-SP5 cleanliness with a 3-5 mil profile
- Chloride measurements after blasting were below the 3 µg/cm² **(30 mg/m²)** detectable limit of the test
- Media Recycling did occur but controls and documentation were limited

Recycling of the Encapsulated Abrasive still Questioned



SPONGE-JET

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

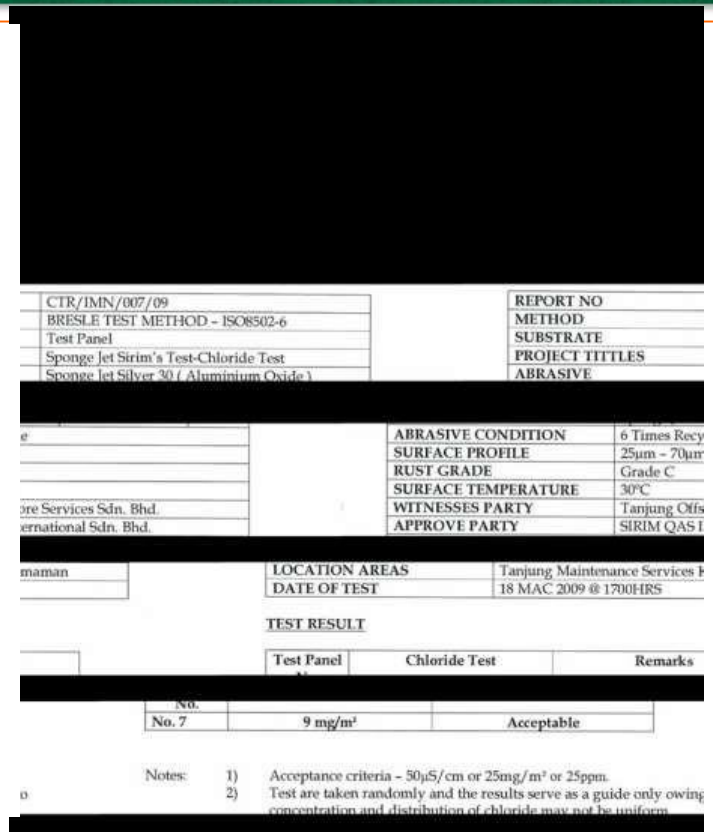


Challenge – Can they reliably Meet specification?

- ✓ 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 TITTLES
Sponge Jet Silver 30 (Aluminium Oxide)	ABRASIVE

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

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

TEST RESULT

Test Panel No.	Chloride Test	Remarks
No. 7	9 mg/m²	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

SPONGE-JET

شركة حلول الطاقة الخليجية
GULF ENERGY SOLUTIONS CO.

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/m^2 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..