GENERAL DYNAMICS
Bath Iron Works

NSRP Cleanable Non-Skid Deck Covering Project

NSRP
NATIONAL SHIPBUILDING RESEARCH PROGRAM™
Taking Shipbuilding and Repair to the Next Level

BIW Process Control
FY2023/24

BIW-Panel Project Scope of Work
Initial Outline

Determine if polysiloxane non-skid can easily and effectively be cleaned and kept clean throughout the new construction process eliminating premature failure and costly rework.

- ✓ Five 12'x16' test areas. Contaminated with grit and industrial debris.
- ✓ Testing effectiveness of different methods of cleaning and care & protection.
- ✓ Visually compare level of cleanliness between different manufactures and types of non-skid polysiloxane vs legacy non-skid.
- ✓ Determine best practices for cleaning and care & protection methods of non-skids**.**

Initial Primer & Non-Skid Plan

Non-Skid Products

Vendor A= ITW MS7CZ and MS375

Vendor B= NCP SiloxoPrime and SiloxoGrip

Vendor C= Randolph Randogrip Metal Primer and Siloxoskid

C2R= Rolled

C2S= Sprayed

Care & Protection Methods

Green Rubber

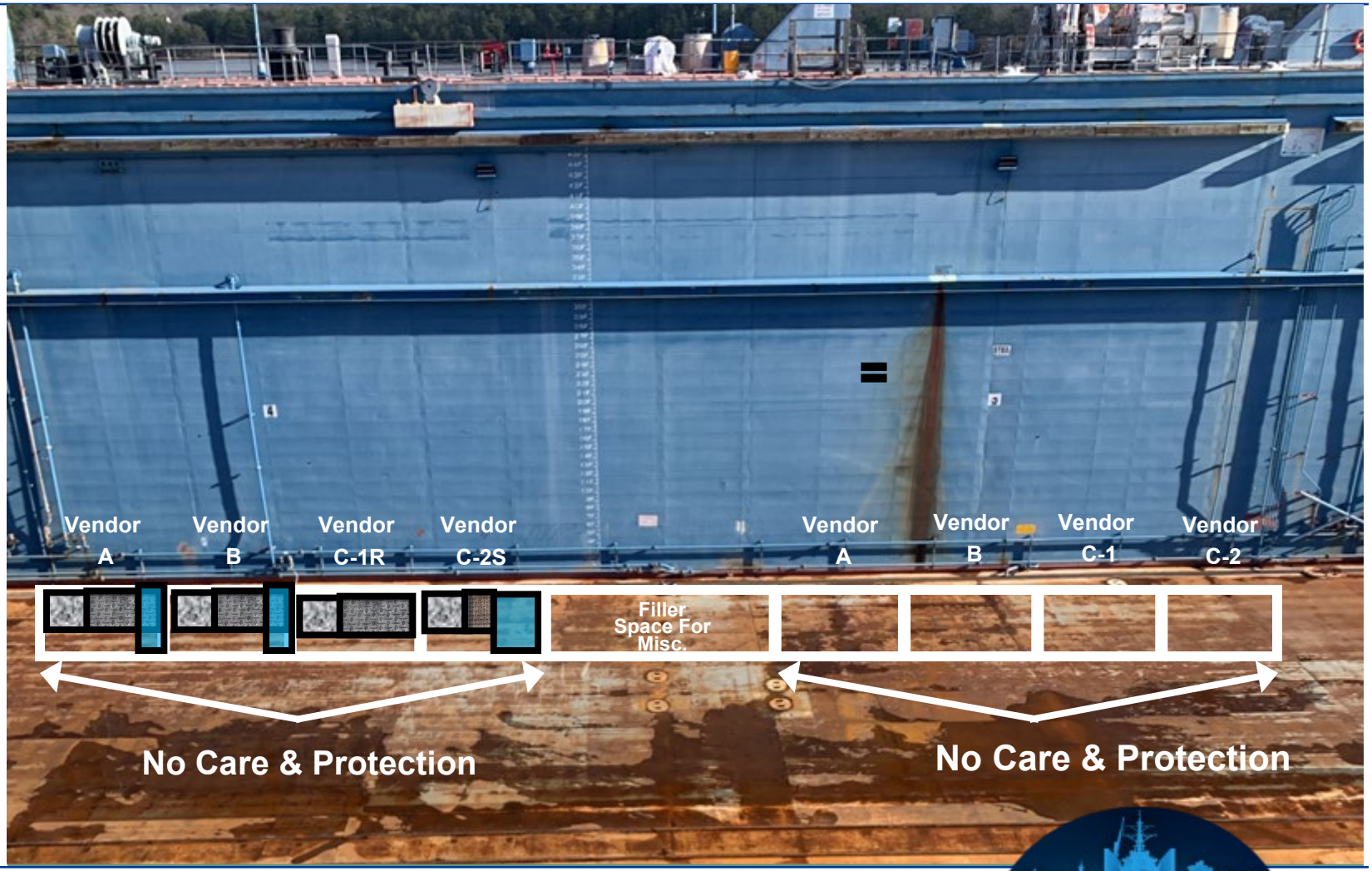
Breather Shield

Rhino Tile over Breather Shield

Intergard 5400 Peelable coating

Rust Runner

Initial Test Platform Scope
Dry Dock Deck



Proposed Testing Materials

Manufacture	Product Description		Kit Size
NCP Coatings	SiloxoPrime Primer	(quote)	5 gl kit
	SiloxoGrip Non-Skid	(quote)	5 gl kit
	Estimated Freight	(quote)	NA
Randolph (SW)	Randogrip Metal Primer	(quote)	5 gl kit
	Randogrip Siloxoskid	(quote)	5 gl kit
American Safety	MS7CZ Epoxy Primer	(contract)	5 gl kit
	MS-375G Non-Skid	(contract)	5 gl kit
Entry Point Int.	Rhino Tile FR – 500 pieces per pallet	(quote)	Pallet
	Ramped Edges – 50 per box	(quote)	Box
	BreatherShield	(quote)	Roll
United Rental	1 week rental HW Pressure Washer	(quote)	1 week
	1 week rental Dry Ice Removal	(quote)	1 week
BIW Miscelanous	In House Use Items:		

BIW – Panel Project SOW

DELIVERABLE SCHEDULE

Deliverable	Team Member(s)	Due Date
Develop Project Plan, Schedule of Events and Test Platforms.	BIW – Brian Thiele BIW – David Kinee	03/30/23 Complete
Develop Inspection Criteria.	BIW – Brian Thiele BIW – David Kinee	07/20/23 Complete
Install Samples to Project Plan (surface prep, prime & nonskid).	BIW – Brian Thiele BIW – David Kinee	08/7/23-9/01/23 Complete
Project Status Update – Q1.	BIW – Brian Thiele BIW – David Kinee	09/20/23 Complete
Monthly Weathering and Visual Inspection Checks.	BIW – Brian Thiele BIW – David Kinee	9/01/23-5/01/24 Complete
Project Status Update – Q2.	BIW – Brian Thiele BIW – David Kinee	12/20/23 Complete
Initial Cleaning Testing, Evaluation and Re-Care & Protect.	BIW – Brian Thiele BIW – David Kinee	11/15/23 C&P has not been reinstalled. The methods used did not withstand the weather conditions. We removed loose items and left those that remained intact. Most of the Intergard 5400 remains intact
Final Cleaning Testing and Care & Protection Evaluation.	BIW – Brian Thiele BIW – David Kinee	05/07/24 – 05/09/24 Complete
Project Status Update – Q3.	BIW – Brian Thiele BIW – David Kinee	03/20/24 Complete
Final Report with Recommendations – Q4.	BIW – Brian Thiele BIW – David Kinee	06/20/2024

TECHNOLOGY TRANSFER / IMPLEMENTATION APPROACH

Cleaning Test Method Ranking Criteria
No Care & Protection Sample Set

No Care & Protection Sample Set:

- **Contamination method-**
  - ✓ All sample sets will be contaminated with blast fines from recycled 30/60HG steel grit and 390 steel shot to simulate industrial debris and left-over steel shot often found after deck blasting
  - ✓ Contamination area will be approximately a 3' wide across the entire length of each sample set
- **Cleaning method-** (cleaning methods will be equidistant on each sample set)
  - ✓ SpongeBlast with plastic
  - ✓ Hot water pressure wash with Iron Out
  - ✓ Dry ice
- **Ranking / Rating will follow a 0 (zero) to 5 rating with 0 being unacceptable to 5 being the best**
  - ✓ **5** = With air blow down only no staining remains
  - ✓ **4** = With proposed cleaning methods no staining
  - ✓ **3** = With proposed cleaning methods 1-10% staining remains
  - ✓ **2** = With proposed cleaning method 11-25% staining remains
  - ✓ **1** = With proposed cleaning method 26-50% staining remains
  - ✓ **0** = With proposed cleaning method greater than 50% staining remains.

Cleaning Test Method Ranking Criteria
Care & Protection Sample Set

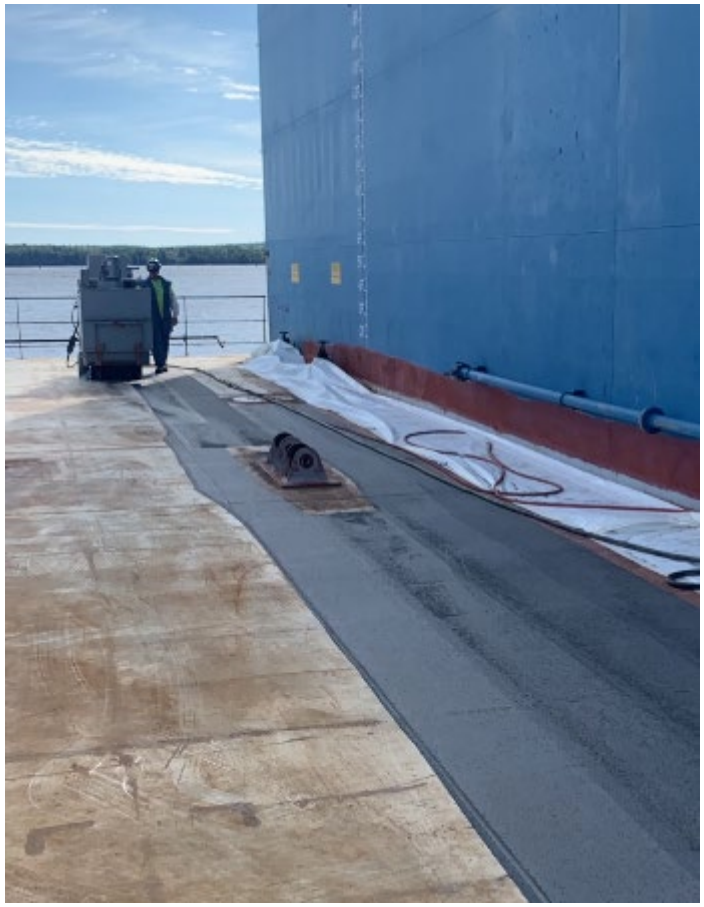
Care & Protection Sample Set:

- **Care & Protection m[illegible]thod-**
  - ✓ Care & Protec[illegible] applied over at leas[illegible] each [illegible]
  - ✓ 50% of that w[illegible] be [illegible] with green r[illegible] and [illegible] with Entry Point BreatherShield and Rhino Tile FR
- **Contam[illegible]**
  - ✓ Al[illegible] and 390 st[illegible] blasting
  - ✓ C[illegible] mple set
- **Cleanin[illegible]**
  - ✓ Sp[illegible]
  - ✓ H[illegible]
  - ✓ D[illegible]
- **Rankin[illegible] best**
  - ✓ **5**
  - ✓ **4**
  - ✓ **3**
  - ✓ **2**
  - ✓ **1**
  - ✓ **0**

Not Tested

Start Of Deck Blasting Surface Prep

460 steel shot a blast media

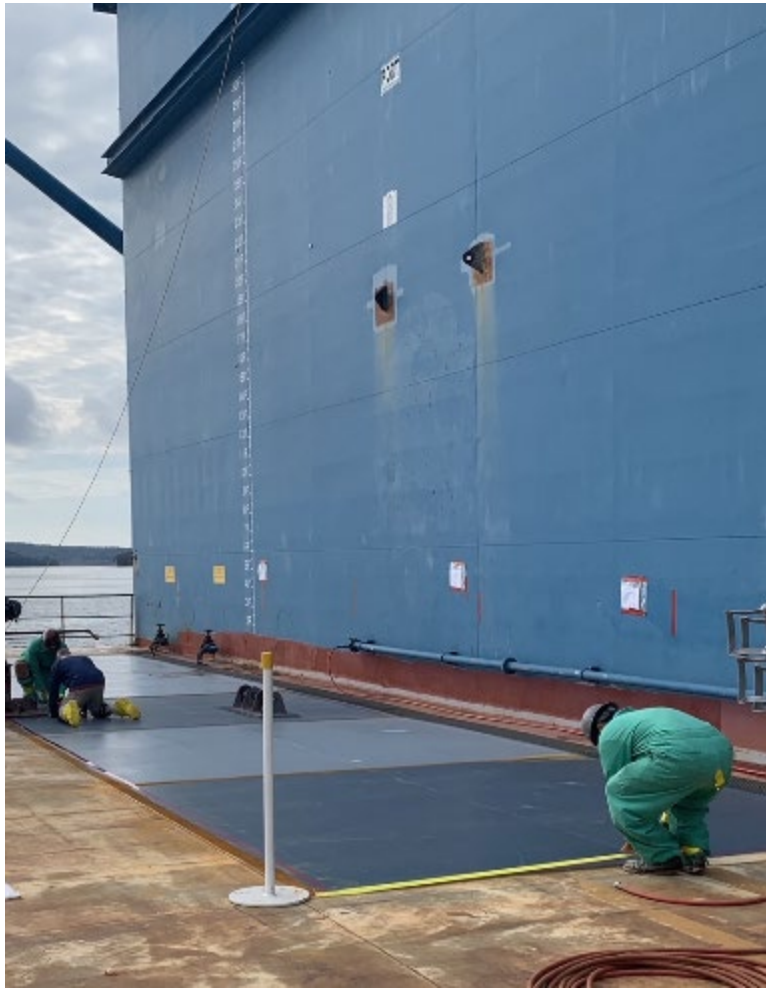


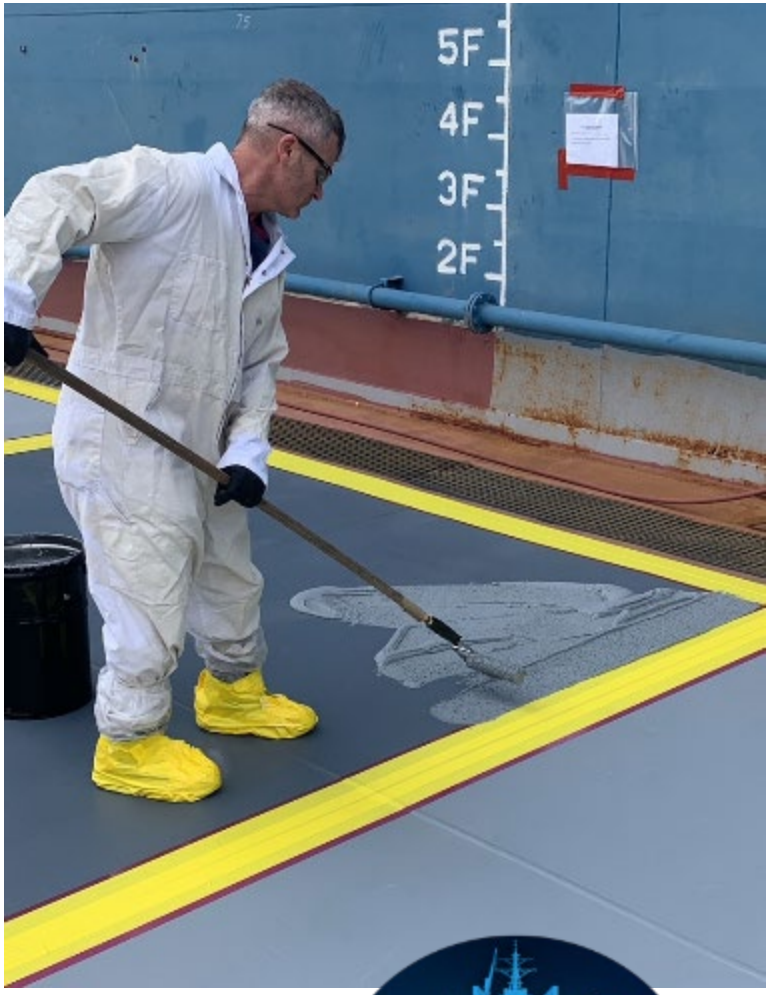
Final Deck Blasting Surface Prep

2 Coats Of Primer Prior To Non-Skid

Some With Proprietary And Some with 23236

Masking And Start Of Non-Skid





Dry Dock Wing Wall View Of Completed Non-Skid

Updated Primer & Non-Skid Plan

No Care & Protection Sample Set: (all sqft listed are approximate)

- **Vendors-**
  - ✓ Vendor A = American Safety (MS7CZ Primer & MS375G), 12’ x 12’ – rolled
  - ✓ Vendor B = NCP Coatings (SiloxoPrime & SiloxoGrip), 12’ x 12’ – rolled
  - ✓ Vendor C = Randolph (Randogrip Primer & Randogrip Siloxoskid) 12’ x 12’ – rolled
  - ✓ Vendor C1-S = Randolph (SeaGuard 5000HS Primer & Randogrip Siloxoskid) 12’ x 10’ – sprayed
  - ✓ Vendor C1-R = Randolph (SeaGuard 5000HS Primer & Randogrip Siloxoskid) 12’ x 10’ – rolled
  - ✓ Vendor B1-S = NCP Coatings (SeaGuard 5000HS & SiloxoGrip), 12’ x 10’ – sprayed

Care & Protection Sample Set: (all sqft listed are approximate)

- **Vendors-**
  - ✓ Vendor A = American Safety (MS7CZ Primer & MS375G), 12’ x 12’ – rolled
  - ✓ Vendor B = NCP Coatings (SiloxoPrime & SiloxoGrip), 12’ x 12’ – rolled
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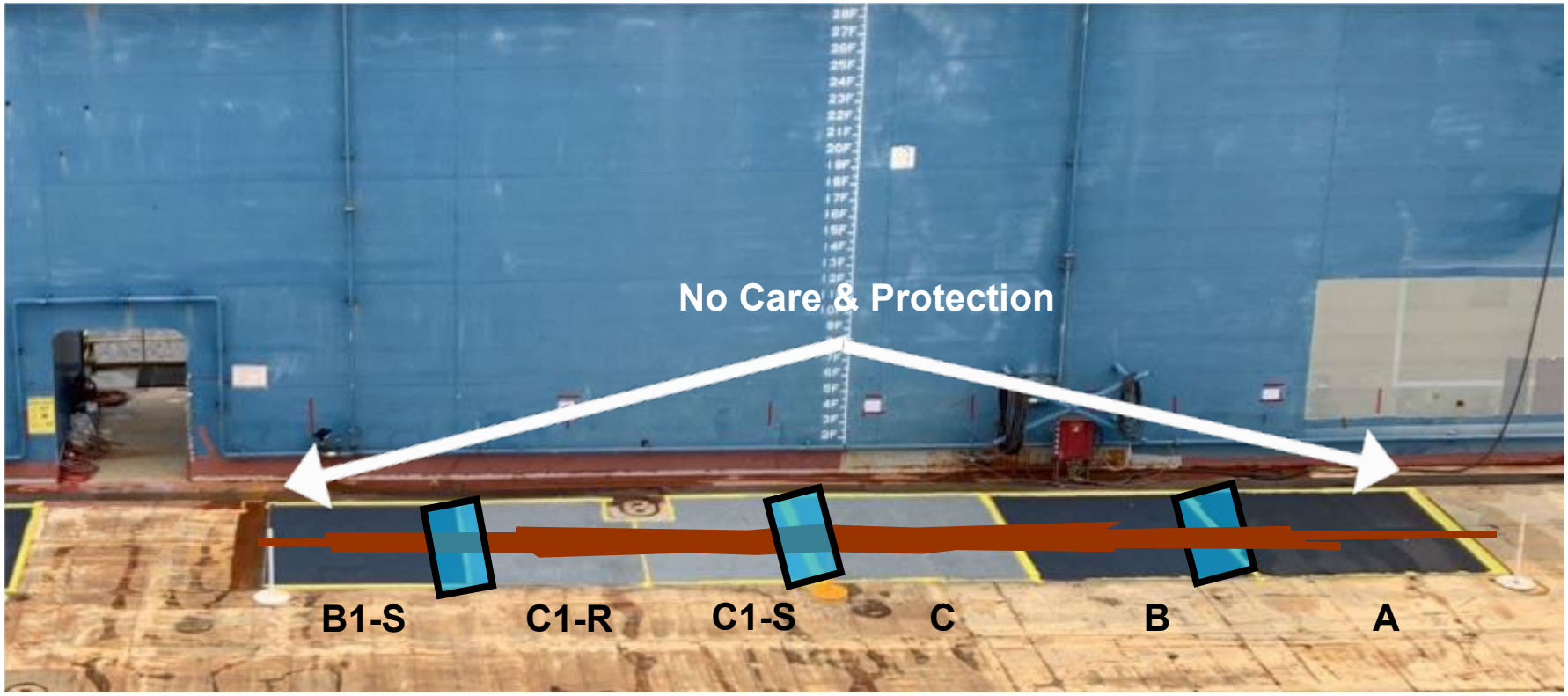
  - ✓ Vendor C1-S = Randolph (SeaGuard 5000HS Primer & Randogrip Siloxoskid) 12’ x 10’ – sprayed
  - ✓ Vendor C1-R = Randolph (SeaGuard 5000HS Primer & Randogrip Siloxoskid) 12’ x 10’ – rolled
  - ✓ Vendor B1-S = NCP Coatings (SeaGuard 5000HS & SiloxoGrip), 12’ x 10’ – sprayed

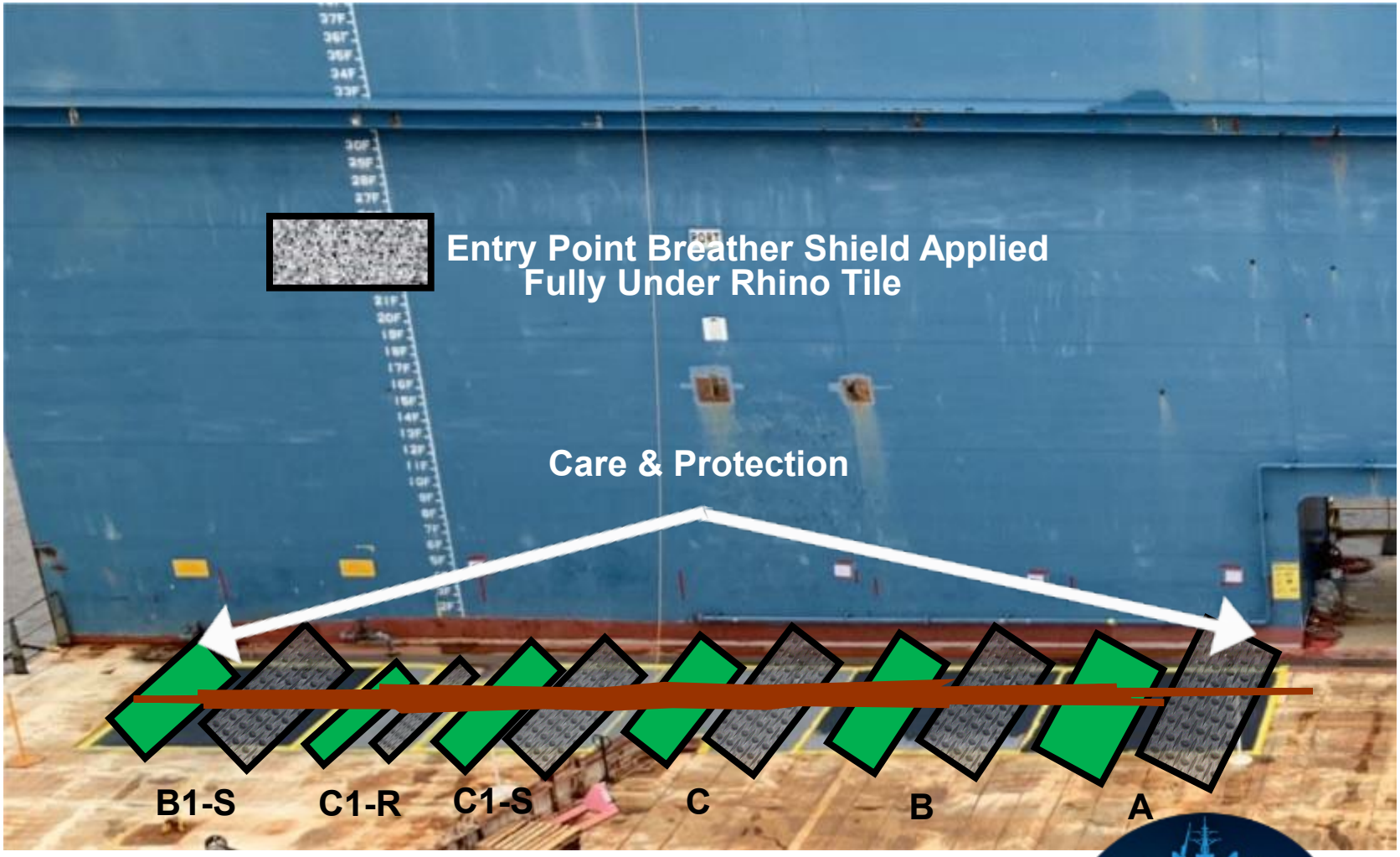
Revised Test Platform

No Care & Protection



Revised Test Platform

With Care & Protection



No Care & Protection Area

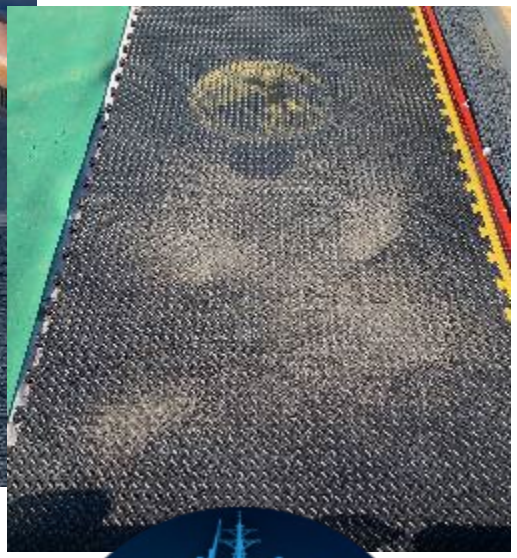
IP5400 spray applied on approx. 18in of all sample sets

Care & Protection Area

Green Rubber ½ & Rhino Tile with Breather Shield ½

Initial Contamination

40/50 Steel Grit on both C&P and Non-C&P



Initial Weathered Contamination

40/50 Steel Grit on both C&P and Non-C&P

Start Of Cleaning Testing 5/7 – 5/9

Light Sweep Of Heavy Contaminants & Inspection of 5400

Set Up Of Dry Ice Blasting
2.5 Pellets

Sample A Dry Ice Before & After

Sample B Dry Ice Before & After

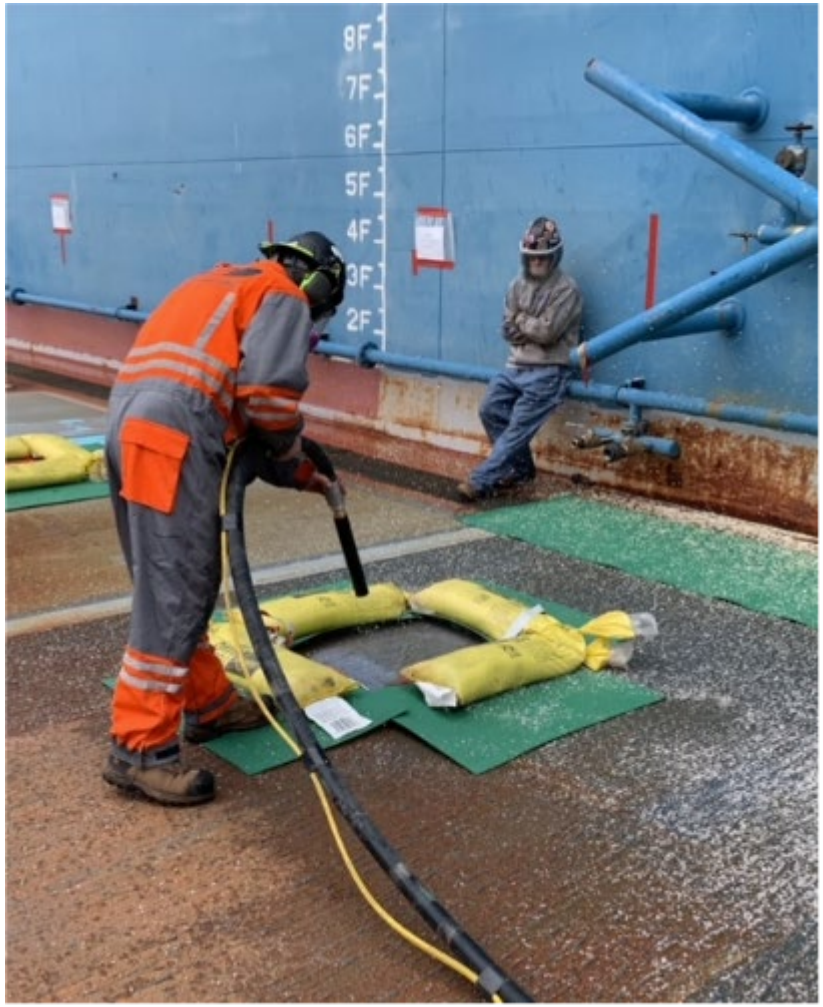
Sample C Dry Ice Before & After

Sample C1-S Dry Ice Before & After

Sample C1-R Dry Ice Before & After

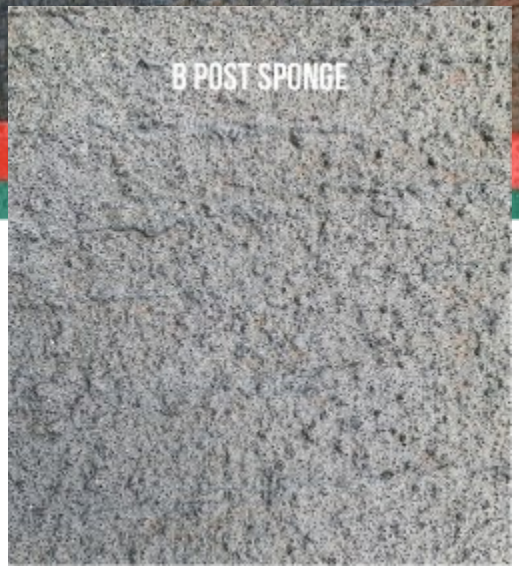
Sample B1-S Dry Ice Before & After

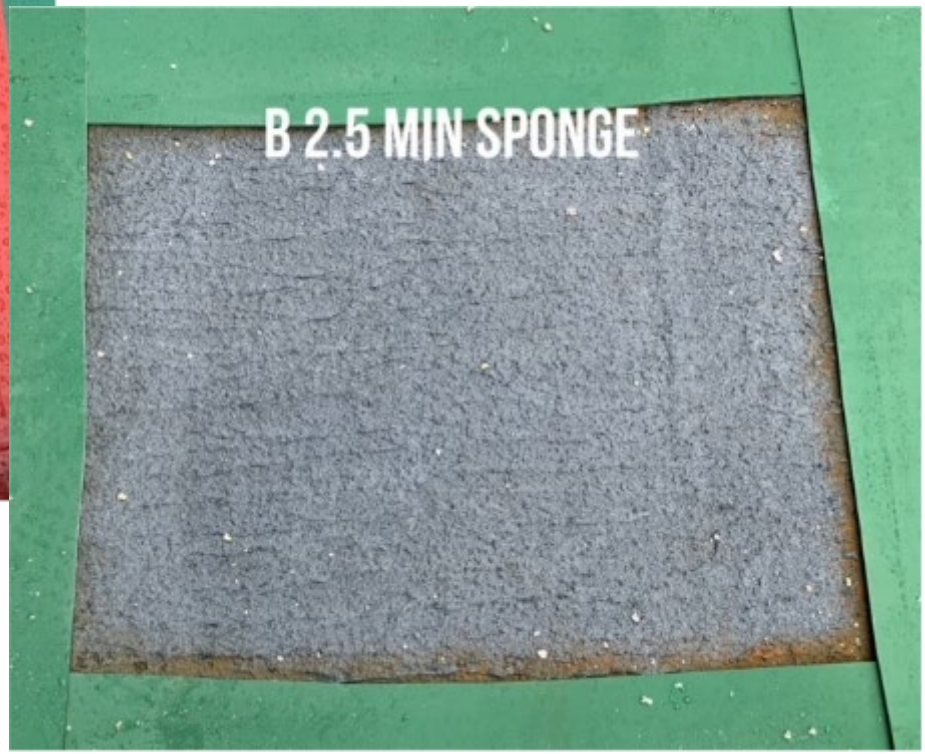
Set Up Of SpongeJet
Sponge Blast With Plastic Sponge



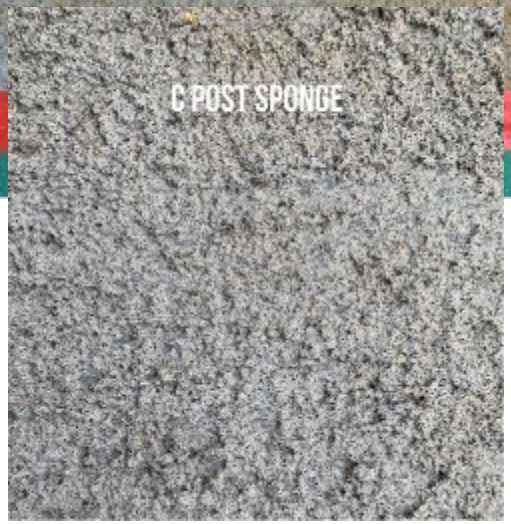
Sample A SpongeJet Before, After & Close Up

Sample B SpongeJet Before, After & Close Up





Sample C SpongeJet Before, After & Close Up



Sample C1-S SpongeJet Before, After & Close Up

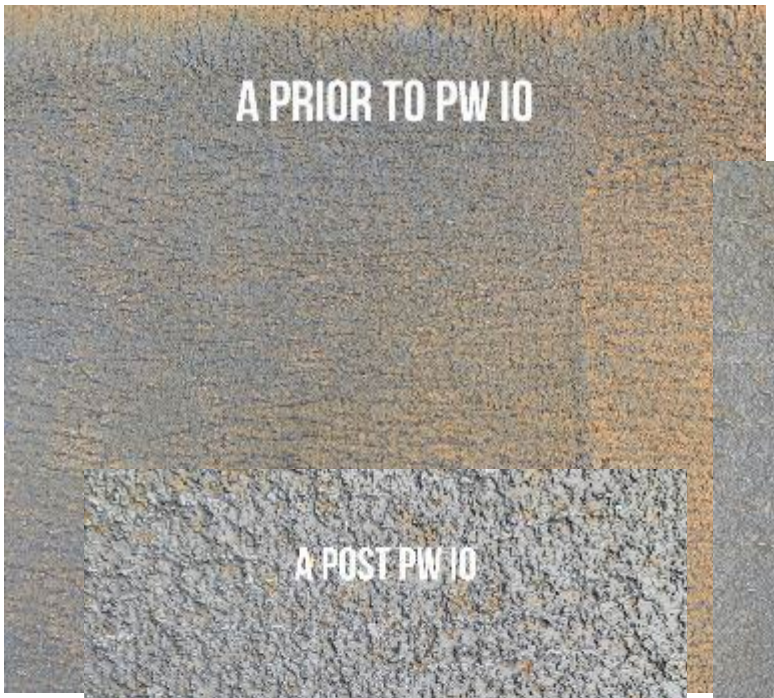
Sample C1-R SpongeJet Before, After & Close Up

Sample B1-S SpongeJet Before, After & Close Up

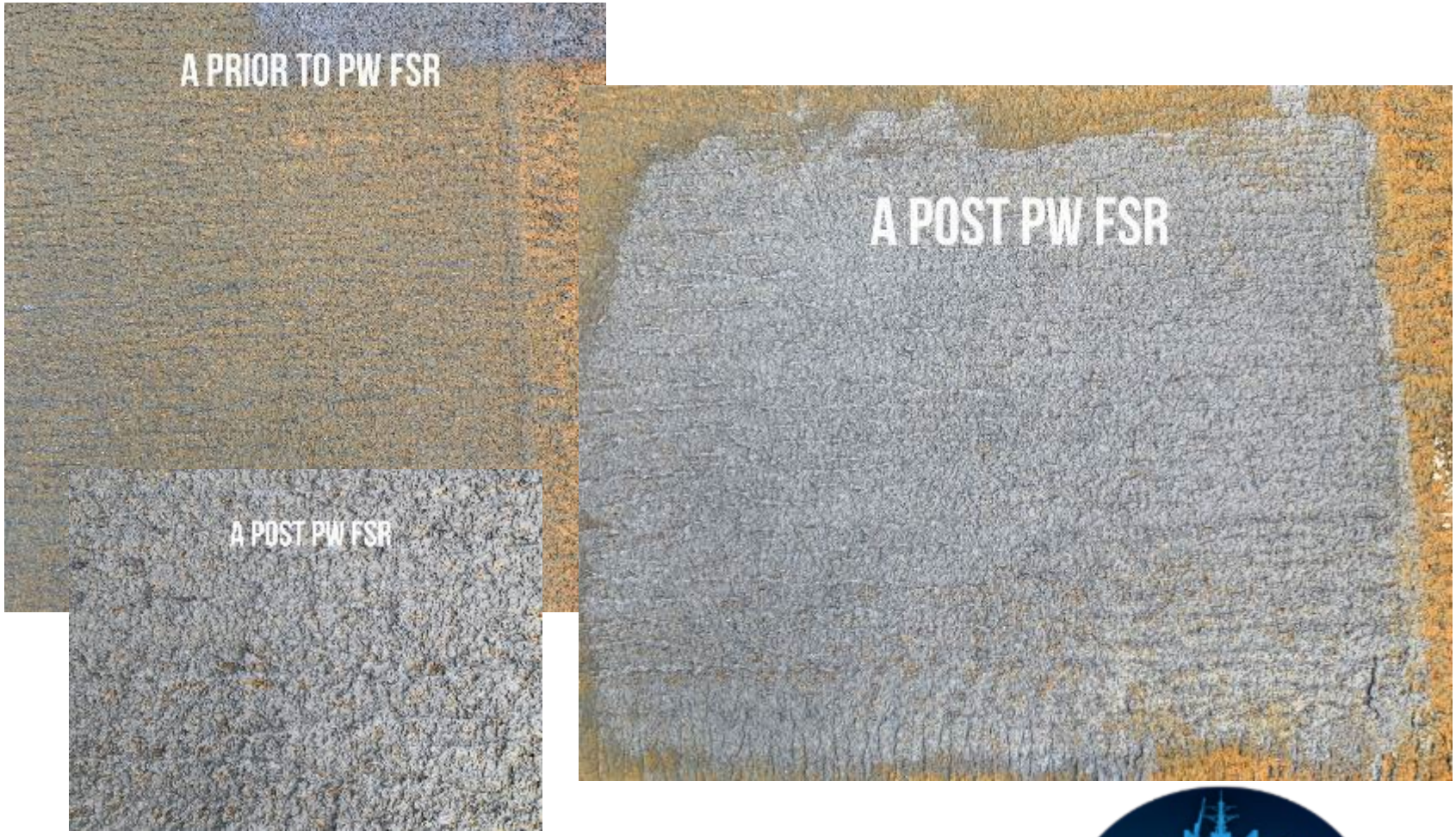
Set Up Of Hot Water Pressure Wash

Approx. 3,500 PSI at 200F– Iron Out Scrubbed In & FSR Rolled In

Sample A Pressure Wash With Iron Out Before, After & Close Up



Sample A Pressure Wash With FSR Before, After & Close Up



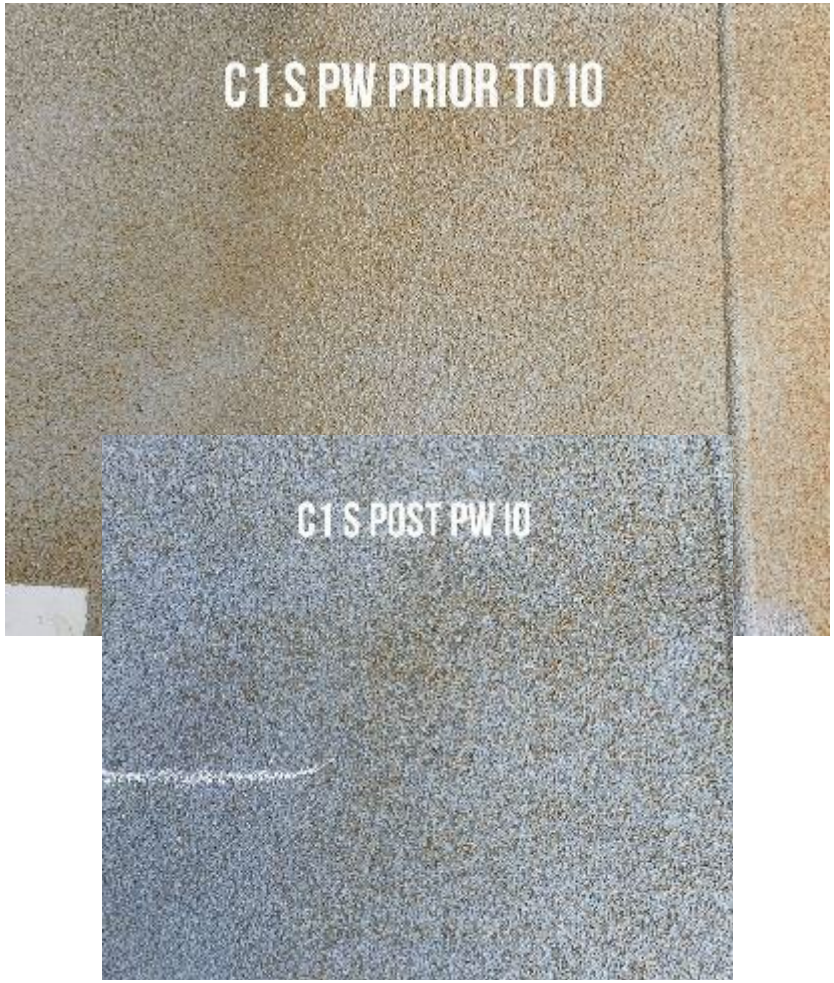
Sample B Pressure Wash With Iron Out Before, After & Close Up

Sample B Pressure Wash With FSR Before, After & Close Up

Sample C Pressure Wash With Iron Out Before, After & Close Up

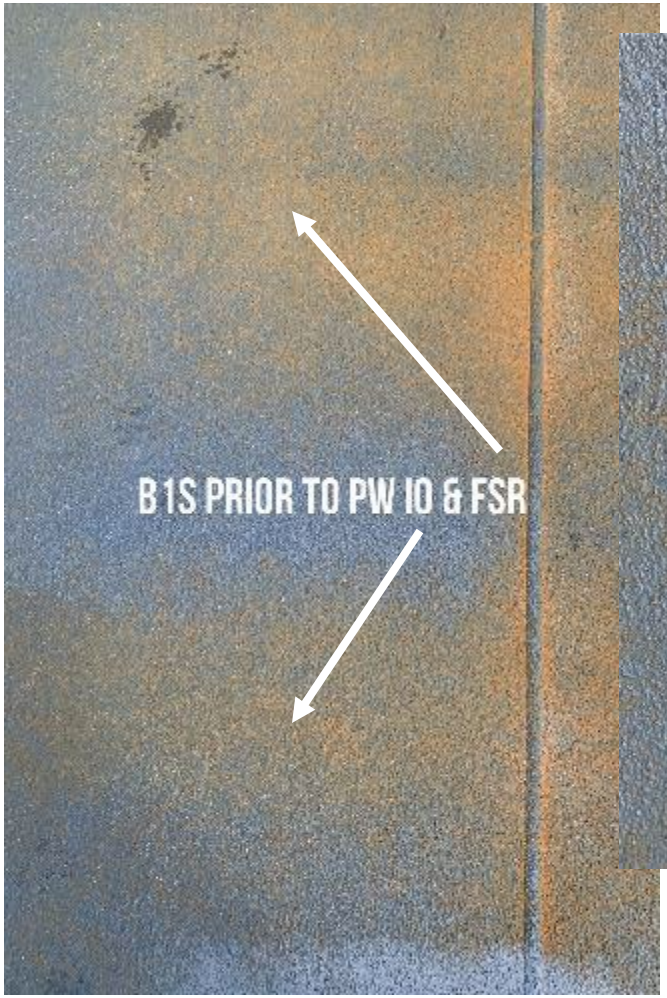
Sample C Pressure Wash With FSR Before, After & Close Up

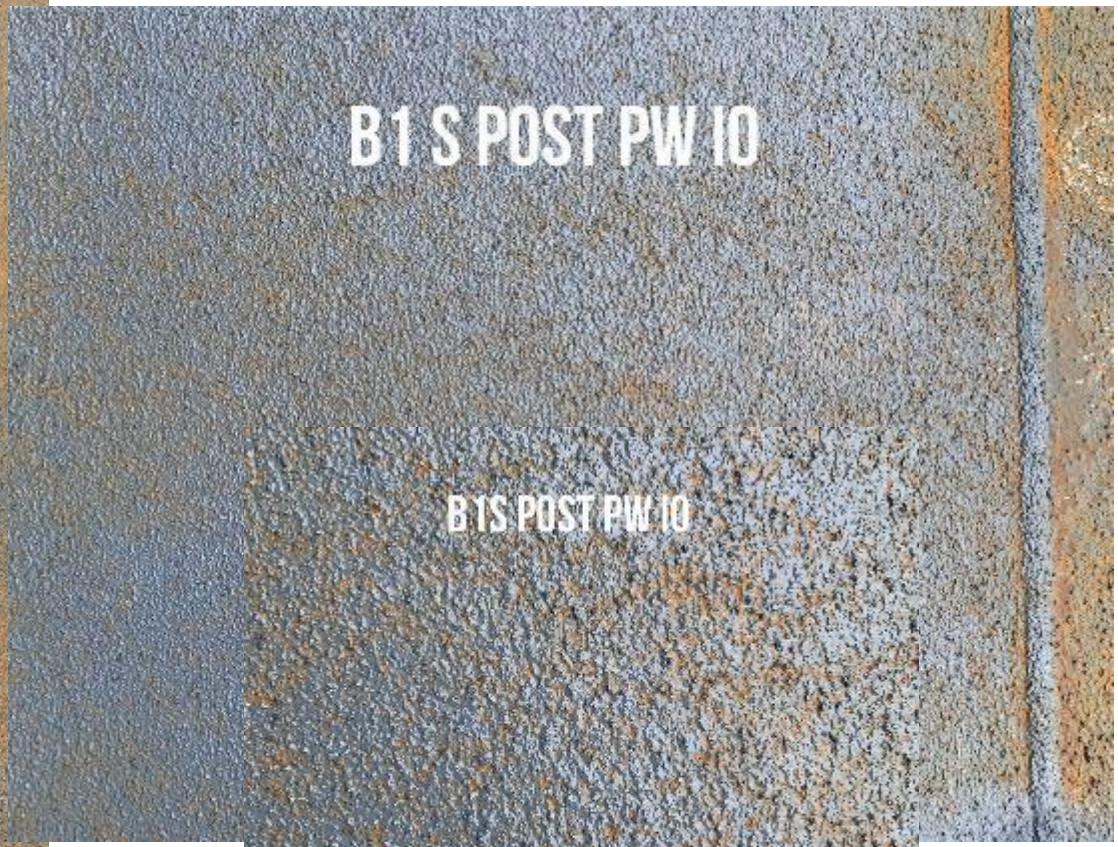
Sample C1-S Pressure Wash With Iron Out Before, After & Close Up



Sample C1-S Pressure Wash With FSR Before, After & Close Up

Sample B1-S Pressure Wash With Iron Out Before, After & Close Up





Sample B1-S Pressure Wash With FSR Before, After & Close Up

Near Future – Post MegaRust

- Compiling results from 0-5 ranking parameters.
- Review methods utilized and propose improvements based on results.
- Size of platform would enable some additional testing not associated with current scope of work.
- Work with Elzly on final report out.

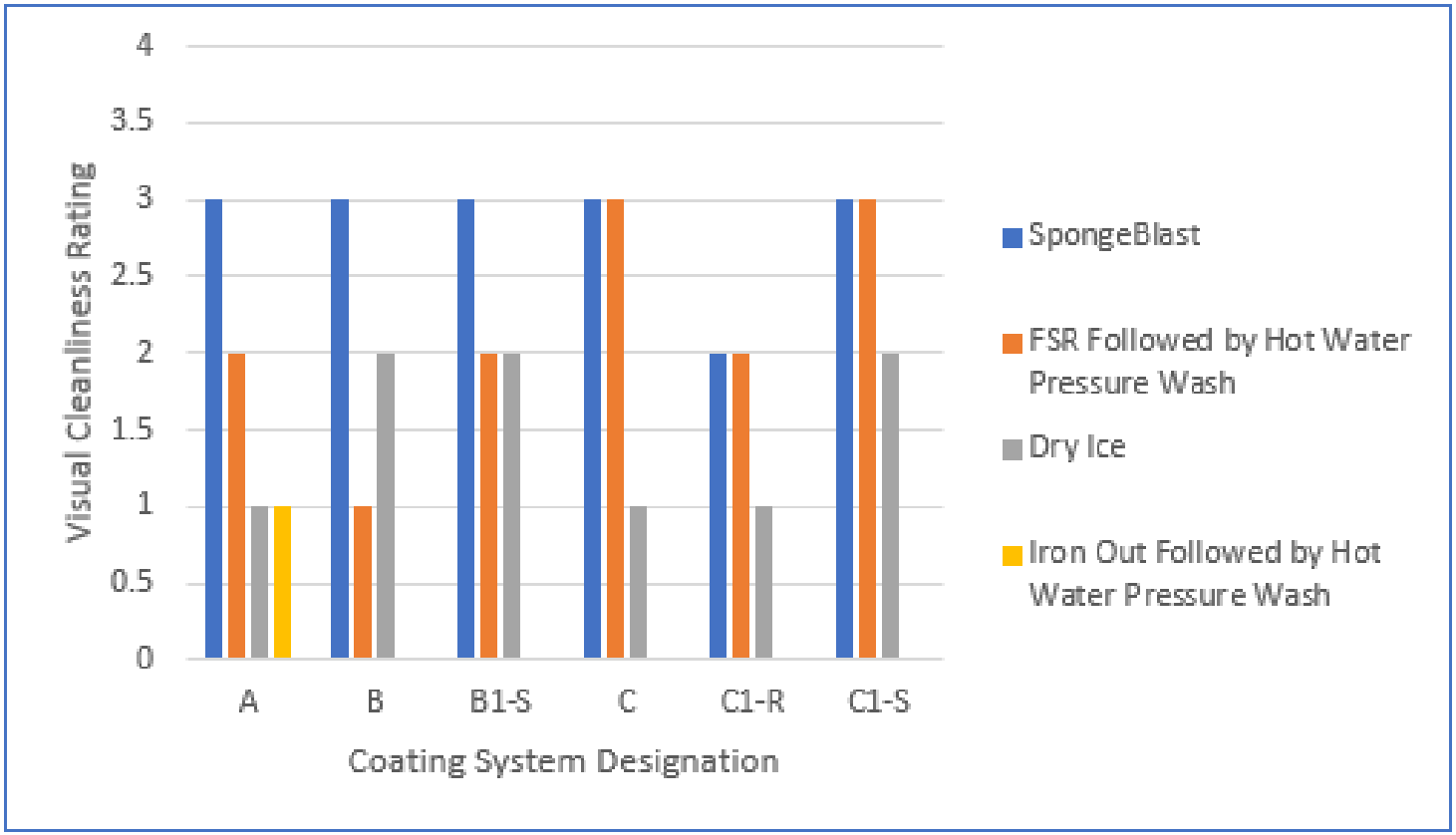
Q&A

Overall Ranking 0-5 Results Per Cleaning Method

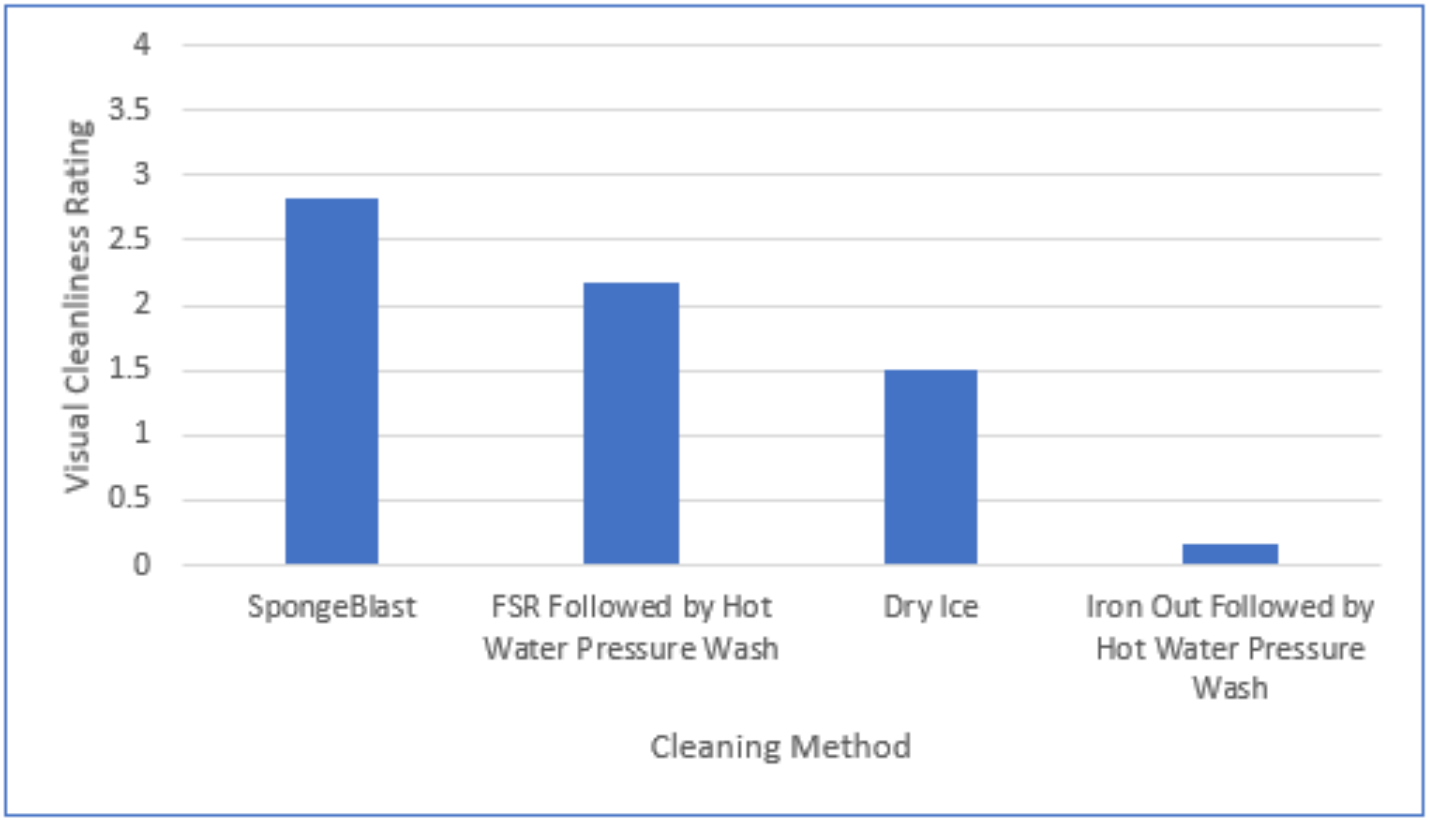
Table 5: Recorded Visual Cleanliness Data

Cleaning Process	Coating System Designation	Primer	Topcoat	Application	Visual Cleanliness Rating	Visual Cleanliness Average
Dry Ice	A	MS-7CZ	MS-375G	Rolled	1	1.5
	B	SiloxoPrime	SiloxoGrip	Rolled	2	
	C	Randogrip Primer	Randogrip Siloxoskid	Rolled	1	
	C1-S	Seaguard 5000HS	Randogrip Siloxoskid	Sprayed	2	
	C1-R	Seaguard 5000HS	Randogrip Siloxoskid	Rolled	1	
	B1-S	Seaguard 5000HS	SiloxoGrip	Sprayed	2	
SpongeJet Blast	A	MS-7CZ	MS-375G	Rolled	3	2.8
	B	SiloxoPrime	SiloxoGrip	Rolled	3	
	C	Randogrip Primer	Randogrip Siloxoskid	Rolled	3	
	C1-S	Seaguard 5000HS	Randogrip Siloxoskid	Sprayed	3	
	C1-R	Seaguard 5000HS	SiloxoGrip	Rolled	2	
	B1-S	Seaguard 5000HS	Randogrip Siloxoskid	Sprayed	3	
Iron Out Followed by Hot Water Pressure Wash	A	MS-7CZ	MS-375G	Rolled	1	0.2
	B	SiloxoPrime	SiloxoGrip	Rolled	0	
	C	Randogrip Primer	Randogrip Siloxoskid	Rolled	0	
	C1-S	Seaguard 5000HS	Randogrip Siloxoskid	Sprayed	0	
	C1-R	Seaguard 5000HS	Randogrip Siloxoskid	Rolled	0	
	B1-S	Seaguard 5000HS	SiloxoGrip	Sprayed	0	
FSR Followed by Hot Water Pressure Wash	A	MS-7CZ	MS-375G	Rolled	2	2.2
	B	SiloxoPrime	SiloxoGrip	Rolled	1	
	C	Randogrip Primer	Randogrip Siloxoskid	Rolled	3	
	C1-S	Seaguard 5000HS	Randogrip Siloxoskid	Sprayed	3	
	C1-R	Seaguard 5000HS	Randogrip Siloxoskid	Rolled	2	
	B1-S	Seaguard 5000HS	SiloxoGrip	Sprayed	2	

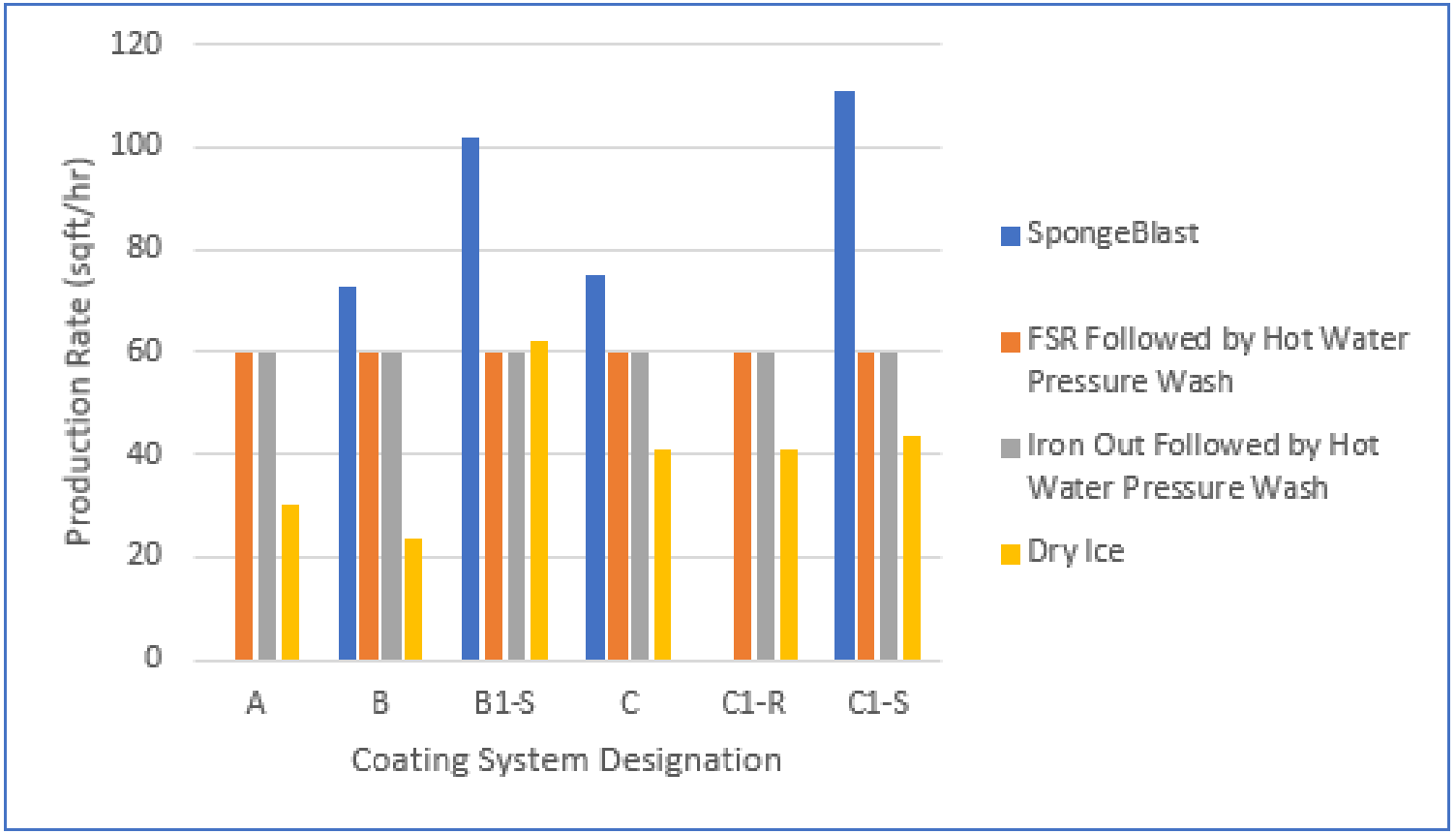
Overall Ranking 0-5 Represented in Graph Per Non-Skid System



Overall Ranking By Cleaning Method



Results Of Production Rates Per Cleaning Method



Results / Suggestions At A High Level

- **SpongeJet blasting left the least amount of corrosion staining with approximately 10% remaining. FSR followed by hot water pressure washing resulted in approximately 25% staining. Dry Ice yielded approximately 50% staining. And, Iron Out yielded greater than 50% staining.**
  - **Although SpongeJet left the least amount of staining it did remove some of the wear layer of the non-skid and did expose aggregate on some samples.**
  - **Additional testing at different pressures and standoff point would be advisable.**

- **Additional analysis shows that on average, less staining remained on the surface of the spray applied non-skids than the rolled alternatives. This is likely due to fewer deep ridges for rust and debris to be trapped within the peak to valley patterns.**

- **It was determined that utilizing FSR with hot water pressure washing would leave an acceptable level of staining. The polysiloxane non-skids had even better results especially on spray application. Production rates were deemed acceptable as well.**

Thank You!!

Q&A