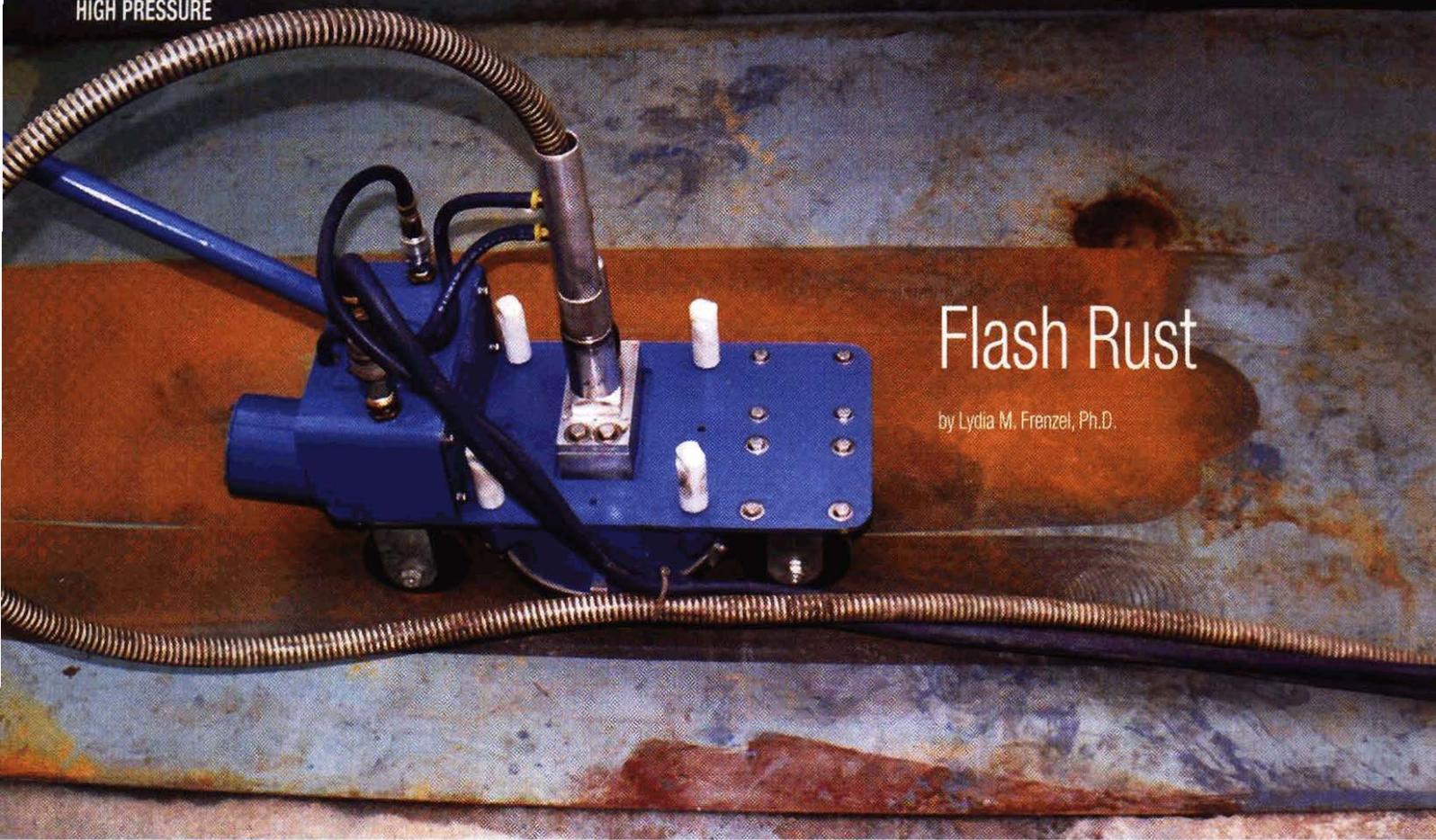


HIGH PRESSURE



Flash Rust

by Lydia M. Frenzel, Ph.D.

An example of medium to heavy flash rust after water cleaning using a "mower" without vacuum recovery. The rust bloom formed as the water on the horizontal surface dried. This rust is "clean" with respect to salts, but it is loose and dusty, so it is not a paintable surface.

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Flash rust quickly changes the appearance of the surface. Any steel surface except stainless steel can show flash rust within as little as a half hour after water cleaning.

In June, we had about 20 inches of rain in our part of Texas, so our grass kept growing. We were barely able to keep up with the lawn mowing. When it didn't rain, the temperature hit the mid 90's and it felt like a sauna bath. Every place in which there is the tiniest bit of unprotected steel, every lawn chair, every table, every plant hanger, every rod that holds the landscaping railroad ties in place—RUSTS. It is quick-forming "flash rust."

You might wonder why anyone is concerned about flash rust. After all, when you wash down something that has unprotected steel or iron in it, it

will certainly tend to rust. Rusting is a natural process. Fast, slow, whatever you want to call it, the usual process is iron metal reacting with oxygen in the air to become iron oxide. Pure iron doesn't exist in nature, but iron oxides or iron hydroxides (fancy names for rust) are plentiful. I can easily find six different compounds that are "rust" in the Handbook of Chemistry and Physics. Dr. Tricou at Pennsylvania State University estimates that in a single shipyard \$230,000 per year could be saved if rust-back or flash rust was eliminated.

If making rust from iron is so common, what's the big deal? You might have to pressure wash brick, stucco, or wood on a house. Your cleaning job is perfect, but in a short time, rust stains from nail heads, staples, or wire mesh have run down the side and mar the finish.

If pressure washing removes a protective layer—it could be paint,

it could be dirt, it could be the rust layer itself—and adds moisture, the reaction now has a pathway to take off. In the process of cleaning the structure, you could open the path to new rust.

Flash rust quickly changes the appearance of the surface. Any steel surface except stainless steel can show flash rust within as little as a half hour after water cleaning. The color of the flash rust can vary depending on the age and composition of the steel and the time-of-wetness. With time, the flash rust changes from a yellow-brown, well adherent, ("tight") light rust to a red-brown, loosely adherent, heavy rust. Flash rust can be reduced or eliminated by physical or chemical methods.

Historically, flash rust was associated with the drying of water on a surface. Once the coatings industry said they could paint over flash rust from water cleaning, the

Definitions of Flash Rust

Flash rust or water bloom is a light oxidation of the steel that occurs as wetted carbon steel dries. (NACE NO. 5- SSPC SP-12)

Flash rusting—Rusting that occurs on metal within minutes after exposure to moisture. ("Good Painting Practice," Steel Structures Painting Manual, Vol. 1, SSPC, 1982)

Flash rusting is a form of corrosion that occurs during the drying process of a water-based coating. Water-soluble corrosion products migrate to the surface of a coating and appear as a stain. ("Coatings Encyclopedia Dictionary," ed. by Stanley LeSota, FSCT, 1995)

Previous *Cleaner Times* Articles about Flash Rust

- *Cleaner Times*, April, 2001, John Tanner, "Dealing with Flash Rust"
- *Cleaner Times*, May, 2001, Lydia Frenzel, "Flash Rust: Color"
- *Cleaner Times*, June, 2001, Lydia Frenzel, "Flash Rust: Amount"

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dry abrasive industry wanted to adopt rapid rusting as part of their acceptable surface. Thus, the Society for Protective Coatings (SSPC) adopted a definition that includes flash rust as rapid rust-back during wet or dry blasting. I don't agree with including rapid rusting during dry blasting as acceptable flash rust.

Many millions of square feet with light to moderate flash rust from waterjetting have been painted successfully. The smart contractor and owner know it is not the rust itself that is the problem. It is the amount and what is causing the rust on the surface that is the problem.

In 1996, Dr. John Kelly of International Paint said, "There is more than one kind of rust." He went on to say, "Flash rust formed after preparing surfaces by waterjetting using potable water consists of pure iron oxide. General atmospheric rusting or rusting in immersed service is contaminated with chemicals from the environment to which the metal has been exposed."

In industrial painting, rust is a big, big issue. I personally think it is unwise to paint over flash rust or rust-back that has formed quickly on a dry blast project. I think it is also unwise to paint over flash rust that forms in a few days. In a conventional dry blast project, the speed of the reaction indicates that there is likely unseen chemical contamination left on the surface. While the initial job looks good, the paint may start to fail from underlying contaminants.

John Tanner (*CleanerTimes*, 2001) related that tight rust makes an acceptable surface. Coatings manufacturers want the paint to contact a stable surface, not "dust" on the surface. Loose rust is dust. Heavy, obscuring layers of loose rust are not acceptable surfaces.

In two *Journal of Protective Coatings and Linings (JPCL)* articles published in November, 2002, and January, 2003, a group of French authors

reported on evaluation of paint performance over flash rust that was developed by exposure from April 2001 to June 2001, a period of 60 to 90 days. The French group reported poor performance of paint systems over this flash rust.

I would say that the rust in this evaluation was actually due to a combination of both flash and atmospheric rusting processes and is most likely not the same as flash rust generated as water is drying during a cleaning process. This rust is a condition of long-term exposure. I am not surprised at the results and different opinion from a study commissioned by the Navy Sea Systems Command.

The Navy Sea Systems Command said the following in a 2002 SSPC report on performance of waterjet-prepared test panels:

"In most instances, pull-off adhesion measurements did not experience failure at the substrate. Where failure was observed at the substrate, the pull-off adhesion

measured was quite high; over 1,000 psi in all cases, indicating that flash rust does not significantly affect pull-off adhesion.

"Cathodic disbondment testing gives an indication of coating adhesion to substrate and coating performance when used in conjunction with cathodic protection. The scribe cutback results showed that coating systems applied over light and medium levels of flash rusting had good adhesion compared to the SP-10 control panels, whereas coatings applied over heavy flash rusting had poor adhesion. This suggests that heavy flash rusting may compromise coating adhesion.

"The results and conclusions based on this testing are valid for specific equipment, operating parameters, and coating systems. Any change in these factors may produce different results."

I agree completely with the working philosophy that one should not paint over longer term rust-back as compared to very quick flash rust.

As I look at my back yard and ponder painting the rusty spots, I remember what John Kelly says, "There is more than one kind of rust."

Lydia M. Frenzel, Ph.D. is executive director of the Advisory Council. She is an industry resource and works as a proactive advocate for emerging technology. She shares her knowledge and experience through custom courses, educational modules, and presentations.

References:

- Fred Berry (Navy Sea Systems Command), Brad Shaw and Wayne MCGaulley, *Flash Rusting: Characterization and Effect on Coating Performance*, paper Presented at SSPC Annual Conference, 2002.
- Philippe le Calvé, Jean Marc Lacam, and Philippe Meunier, *Quantification of the Products of Corrosion after UHP Waterjetting*, JPCL, November 2002.
- John Kelly, "There is more than one kind of rust," *MarineLog*, May, 1996, p. 18.
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