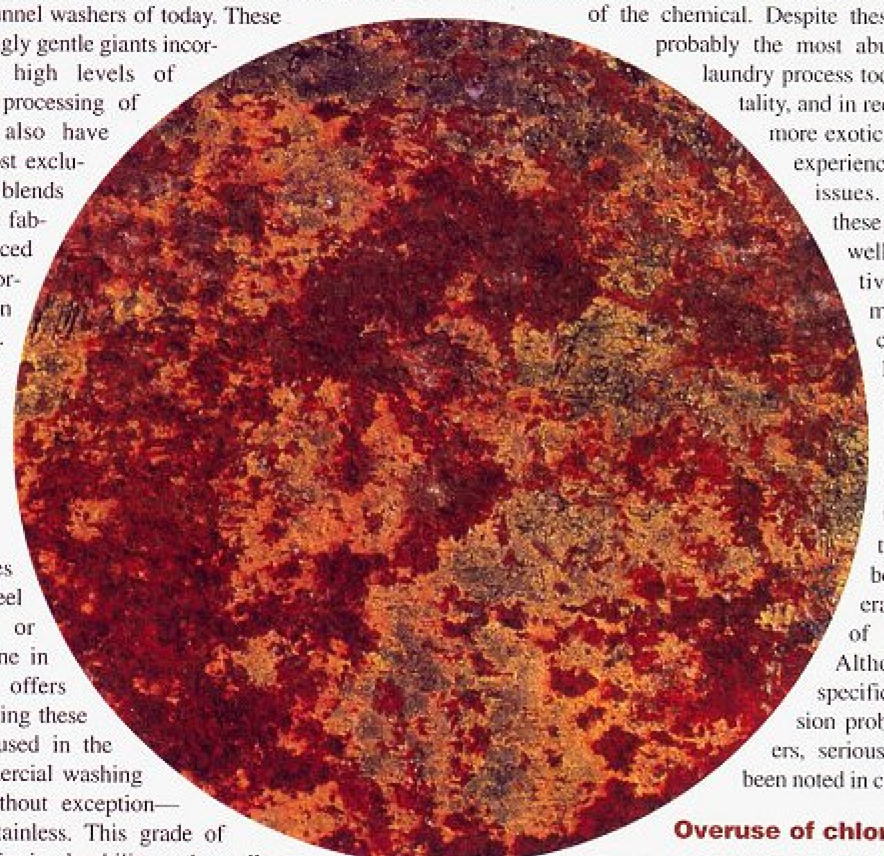
Rust Never Sleeps

Control chlorine use to safeguard tunnel washers



The laundry industry has evolved from the wooden wash wheels with peddle drains in the '20s, to the high-production, computer-controlled, stainless steel tunnel washers of today. These seemingly gentle giants incorporate high levels of sophistication in the processing of fabric. The fabrics also have evolved from an almost exclusive use of cotton, to blends and complex synthetic fabrics. Nothing has replaced water as the most important chemical used in the washing process. These changes have brought with them their own set of problems.

Protect your equipment

This article addresses damage to stainless steel from the improper or overuse use of chlorine in tunnel washers, and offers some direction in solving these problems. The steel used in the manufacture of commercial washing machines—almost without exception—has been type 304 stainless. This grade of stainless was chosen for its durability and excellent corrosion-resistant qualities; the key word here being "resistant."

Product serviceability issues have historically, but erroneously, called for high concentrations of chlorine bleach as the panacea for all quality problems. TRSA has done an excellent job of publicizing the proper levels of chlorine to be used in any application, and the Association has produced studies to show that overuse is a waste of the chemical. Despite these efforts, chlorine is probably the most abused chemical in the laundry process today. Heavy soil hospitality, and in recent years some of the more exotic synthetic fibers, have experienced serious soil-release issues. Attempts to solve these problems have placed well-meaning representatives from the fabric manufacturers, chemical companies and laundries in the position of having to get the stuff clean at all costs. Unfortunately the physical properties of the washers themselves have not been taken into consideration when high levels of chlorine are used. Although this article specifically addresses corrosion problems in tunnel washers, serious problems also have been noted in conventional machines.

Overuse of chlorine common

Tunnel washers are high-production water misers. Most tunnel washers incorporate a water counter-flow system that creates downstream flow of water as the goods flow upstream. Using this method, the typical tunnel washer will use as little as .8

By Samuel Garofalo

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gallons of water per lb. of fabric processed. The water-saving counter-flow systems features of a tunnel washer incorporate levels of chemical concentration in a fluid stream. The chemicals, although concentrated in particular zones, are not exclusive to that specific zone. The intermingling of the chemistry in the fluid stream can benefit the wash process only if the water counter-flow system is operating correctly.

Tunnel washers that incorporate counter-flow systems redistribute the rinse water into the flush and washing process. If the water flow is not distributed properly in the fluid stream, the counter-flow system will stall, causing the high concentrations to be pumped into other areas where the blending will cause potentially damaging chemical reactions. Quality can suffer as this problem compromises the desired chemical curve. Chemical technicians under fire are forced to respond—sometimes out of desperation—by slowing the tunnel down, increasing temperatures and programming ever-higher levels of chlorine that border on insanity.

Eye-opening cases

During a plant visit in late December 2000, I noticed that a tunnel counter-flow system was seriously compromised causing the chemical curve to stall. The pungent odor of oxidizing chlorine filled the air. There were visible signs of corrosion in the flush tank, splitter and weirs. The chemical company technicians had tried everything to achieve the required quality and used temperature and chlorine as their corrective procedures of choice. Most of the chlorine from the bleach zone was being pumped into the flush module along with sour from the water-extraction devices. This tainted water was heated in the wash zone of the tunnel to 180°F. The chemical reaction is scary enough without considering that the quantities of 1.25% chlorine being injected were calculated in the area of 45 quarts per 100 lbs. of fabric. In January 2001, less than one month later, I was shown photographs of a hole in the top of the tunnel where one of the maintenance employees walked through the top of the corroded, crystallized shell. The tunnel was turned off at the time so fortunately there were no personnel injuries. However, the damage to the machine was extensive and costly.

Staff at another plant were complaining that they had a problem with "chloroform" in their effluent. The water department was adding a hefty service charge to the water bill and had warned them that regardless of the service charge, the levels were above any acceptable limits. The problem needed to be corrected within 90 days. The plant was involved in the manufacture of rags and was using chlorine as a scouring agent. I was unable to determine the actual parts per million of chlorine in the process; however the washman poured six five-gallon buckets of raw chlorine bleach into a 400-lb. machine.

These two plants were obviously using unacceptably high levels of chlorine. They show how things can get out of hand. The overuse of chlorine is now approaching epidemic proportions in an ever-increasing number of laundry facilities. It's not unusual to see levels in excess of 20 quarts per 100 lbs. of 1.25% chlorine. Corrosion can be seen in areas of excessive heat and/or areas where commingling of chemicals occurs in these machines.

Avoid damage

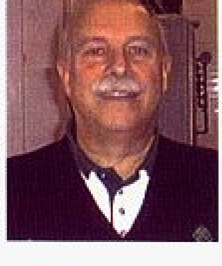
As frustrating as this problem is, we can have our cake and eat it too! The most important issue is protecting the equipment, building and employees from the destructive effects of chlorine abuse. With that in mind, contact the equipment manufacturer—not the distributor, not the chemical company, not the linen company—for information on this issue. The reason is simple. The engineers that design, build and warranty your machines are with the manufacturer. The manufacturer can verify that the counter-flow systems are working within the specifications for their equipment. Each manufacturer also has guidelines for the distribution of water in the reuse system. The proper setting and operation of the counter-flow system of a tunnel washer is critical for quality and production issues.

Second, take the gallons of chlorine used per week and multiply that figure by four, then multiply that figure by 10. The result is the amount of quarts of 1.25% chlorine bleach that you use in your facility weekly. Do not depend on programming data for this number; use your weekly inventory. Calculate your lbs. produced weekly separating percentages of light, medium and heavy soil products that you process. The proper concentrations of chlorine have been well documented for decades.

Regardless of your soil factor, your chlorine inventory use should *never*, under any circumstances, exceed eight quarts of 1.25% per 100 lbs. To complicate matters, a seemingly innocuous injection of two quarts per 100 lbs. in a tunnel can yield twice the PPM of chlorine desired if the counter-flow system has been compromised or manipulated. In other words, you can inject the proper quarts per 100 lbs. and still have a potential corrosion problem.

The wash pie is one of the few common factors regarding conventional and tunnel washing systems. The chemical contact time, temperature and mechanical action requirements need to be met in either case. Wash quality problems can be addressed by taking the fabric manufacturers' wash formulas and adapting them to a tunnel washer. If the fabric manufacturer requires a 10-minute wash chemical bath, you must be able to fill the required time in the bath liqueur. The same is true for the bleach bath. This may require slowing the transfer rate, or elongating the chemical zones by installing more injection points, but using lower amounts of chemical.

Regardless, we should be able to get the production and quality we need without destroying our washrooms. **TR**



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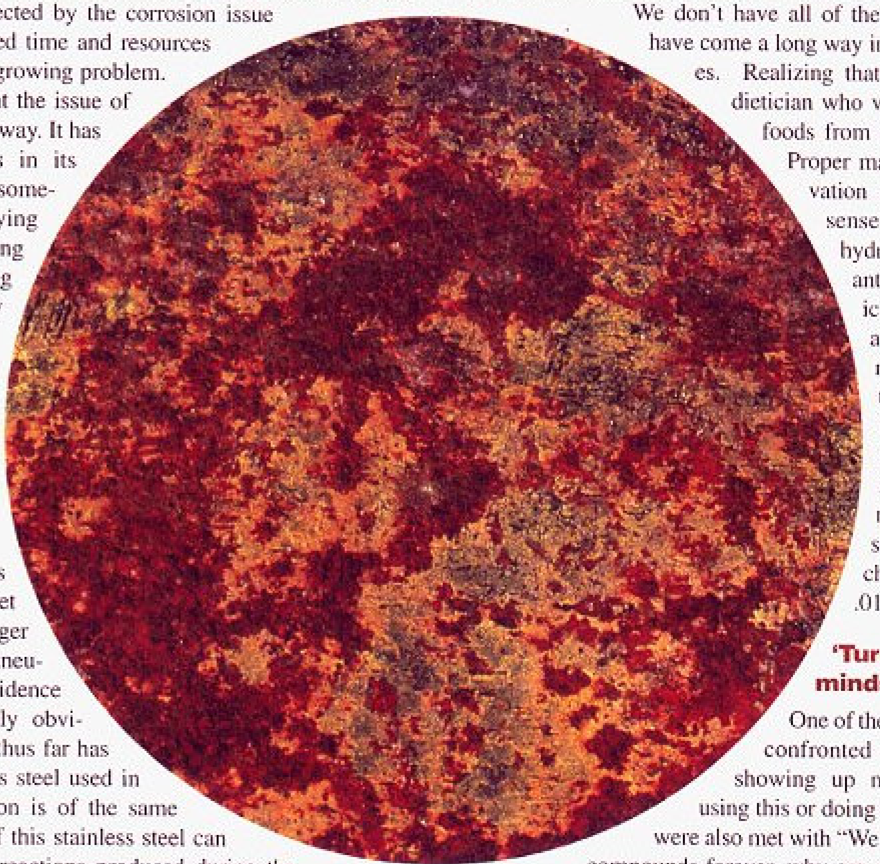
Rust Never Sleeps: Part II

Field-tested techniques aimed at reducing the threat of corrosion in today's batch tunnel washers

By Samuel Garofalo

In the February 2002 edition of *Textile Rental* we studied the effects of chlorine damage to the stainless steel construction of batch tunnel washers. Since that time, TRSA and others affected by the corrosion issue have contributed time and resources regarding this growing problem. You can be assured that the issue of corrosion is not going away. It has been almost insidious in its effects on machinery—sometimes literally destroying one tunnel, and leaving the sister tunnel sitting right next to it virtually untouched. On a positive note, we are in a much better position to implement corrective procedures.



Cost-effective treatment

The original revelations as to causation were met with strong denial, finger pointing and legal maneuvering, before the evidence became overwhelmingly obvious. The investigation thus far has shown that the stainless steel used in most tunnel construction is of the same grade. The corrosion of this stainless steel can be traced to chemical reactions produced during the washing process, aggressive chemical compounds and or chemical delivery issues. Identified causes are excessive chlorine, fluoride-based sours and malfunctioning chemical-injection systems. Contributing causes that we are now aware of range from poor counter-flow, high iron content in the water supply and bleaching at too low a pH. The jury is still out on sodium thiosulfate antichlor forming corrosive gaseous acids when contacting other compounds.

We don't have all of the answers yet, but we have come a long way in identifying the causes. Realizing that this sounds like the dietician who virtually eliminates all foods from your diet, take heart! Proper maintenance and observation procedures, common sense in using chlorine, hydrogen peroxide as an anti-chlor and phosphoric acid as a sour will almost guarantee corrosion-free tunnel systems. How much is this going to cost, you ask? The chemistry involved, if implemented properly, should only increase chemical costs around .01 per 100 lbs.

'Turn up the heat' mindset

One of the big questions that we confronted was, "Why is this showing up now? We have been using this or doing that for 20 years." We were also met with "We have been using these compounds forever, why are we having these problems now?" In order to answer this question, we must first admit the obvious! We are putting more demands on equipment manufacturers, chemical companies and ourselves to be more productive at the least possible cost. The need to comply with these industry demands creates the atmosphere of rushing to react. This need for speed and new linen products that are literally unaffected by chemistry tend to allow the practice of the "just add more bleach" or a "turn up the heat" mindset. An endless quest for faster cycles, cheaper chemical costs, cost caps, excessive use of cheaper chemicals, etc., coupled with the recent revelations make the corrosion issue perfectly understandable. As with everything in nature, something has to give!

Collaborative investigation

In Part II of *Rust Never Sleeps*, we will review the circumstances regarding damage to four tunnels of different manufacturers, and seemingly totally different causes. This type of corrosion is a progressive and exponential process in its quest to destroy your equipment. A small insignificant spot can literally grow to huge damaging proportions, especially if the original causes are not addressed, and immediate action isn't taken to restore the integrity of the metal through a process called "passivation." In this process, the metal is treated with a solution of nitric and hydrofluoric acid. The hydrofluoric acid loosens surface rust and the nitric acid penetrates and resurfaces the metal in a process similar to galvanizing. This is a process commonly used in the metal manufacturing industry.

It is important to remember that this article was written in the spirit of disseminating information that could prevent damage to expensive washroom equipment. My observations and opinions in this article are based on personal visits to the sites, metallurgical reports and the cooperation of several industry chemical engineers. The plant owners, machinery manufacturers and chemical companies involved are really irrelevant, and will not be revealed mostly because of the spirit of cooperation seen in the identifying process. None of the damage in any of these cases was intentional, nor were they the result of blatant irresponsibility. Hopefully, a heightened awareness of the possible causes of the corrosion will encourage managers to implement corrective procedures to prevent more damage. Operators and chemical technicians should check machines for any signs of corrosion, especially in the bleach and sour zones and in the faces of the press equipment.

Please note that the analysis of machine damage is based on evidence discovery, cooperation of involved parties and the experiential opinion of the writer.

Corrosion case findings

Photo #1 This image shows the face of a tunnel, which along with the press, was heavily damaged by corrosion. As the corrosive pattern rose from the mouth of the machine, it was apparent that the damage was caused by a gas and was not consistent with contacting liquid or splashing. Examination of weirs, and the sides of the machine verified that only a gas could have created the damage seen. The material safety data sheets (MSDS) of the chemicals being used, injection sites and titrations, etc., were observed to determine the source of the damage. The cause of this corrosion appeared to be high concentrations of chlorine bleach, too low pH and chlorine mixing with a fluoride-based sour.

Photo #2 This tunnel had significant face plate and clean end cylinder rust damage. Ironically, a new tunnel of the same manufacture was installed right next to the old one. At the time of the installation of the new tunnel, the chemical company switched from a fluoride-based sour to a phosphoric-based sour. After several years of operation, the new tunnel, which utilized phosphoric sour, had no corrosion. The older tunnel that had previously used fluoride-based sour exhibited no increase in corrosion. In some cases, we have seen a reduction in the corrosion process when the change to phosphoric acid was made. Note: the corrosion seen on this tunnel should be cleaned, and the metal should be repassivated.

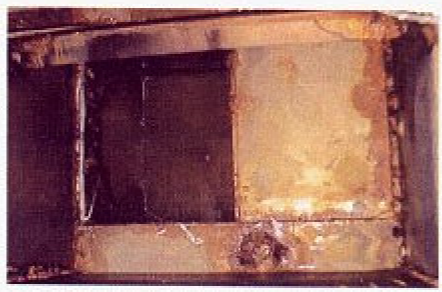


Photo #3 This image shows the bottom of a weir box where chlorine was inadvertently siphoned into the tunnel from a stock tank through an air-operated diaphragm pump. The siphoning occurred in the evening when the plant and machinery was shut down. The liquid seen at the bottom of the weir tested at 11% sodium hypochlorite.

Photo #4 I did not see this machine, however, the damage was limited to the clean end of the tunnel. The sour bath injection port corroded away, reportedly causing extensive damage to the support system. This damage can be seen to the right side of the picture. The subsequent leakage of the fluoride-based sour from the port caused the chemicals to spray onto the stainless steel cylinder. **TR**

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