By Scott Bryan and Julie Holmquist

How Is Your Boiler Layup Faring This Summer?

June has rolled around, which means you have probably already shut down any of your boilers used for winter facility heating and moved on to other tasks. The question that remains is, how is your boiler faring right now, and how will you know if your seasonal boiler layup technique was successful by the time fall arrives? Since seasonal boiler layup procedures can range anywhere from turning off the boiler and leaving it full of water, to draining and adding desiccant, or implementing a full-fledged nitrogen purge, it is good to be aware of how your specific processes are impacting your boiler system and if they are worth the apparent return on investment.

The issue at stake is corrosion, which may or may not develop depending on your layup procedure and other circumstantial factors. Although discovering corrosion at the end of layup will not allow you to reverse the effects of what is happening in your boiler right now, it will provide the next best option: evaluating the results and becoming wiser for the future so you can take a new route to boiler layup next year if necessary.

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Fall Boiler Startup: The Moment of Truth

When fall and cool weather return, it will be time to bring the boiler back online. This is the moment of truth when you will discover if corrosion protection was effective or deficient during layup. *(Note: For proper evaluation, it is good to apply a blend of oxygen scavengers and metal passivators to minimize the potential for pitting corrosion from high dissolved oxygen content levels in the unheated makeup water during startup itself. This levels the playing field to better isolate the true results of the layup itself, rather than introducing additional corrosion.)*

The main indicator of corrosion is out of balance water chemistry, e.g., high iron levels. High iron levels signal that corrosion is taking place somewhere in the boiler—whether in the steam line, condensate line, feedwater tank, or boiler proper. This represents a loss of integrity in the steam system and also throws off the water chemistry, circulating iron contaminants throughout the boiler. Additional indicators include clogging of the system with corrosion products or, in serious circumstances, leakage. All these issues require extra time and labor to solve the problems.

If the boiler does show signs of corrosion after layup, it would be wise to reconsider the layup method and look for a more effective option next time. If results prove to be tolerable, it can still be beneficial to reevaluate traditional methods of layup for the sake of greater convenience, if not greater effectiveness.

Disadvantages of Common Layup Methods

There are several common methods of seasonal boiler layup. The easiest is to do nothing and hope for the best. Other options include applying quick lime or silica gel to absorb moisture, using a positive dry air flow to prevent moisture accumulation, or performing a nitrogen purge to maintain an inert environment with zero oxygen. These methods and their pros and cons are outlined in the chart below.

Factors to Consider	Quick Lime	Silica Gel	Positive Dry Air Flow	Nitrogen Blanket	Doing Nothing
Method of Protection	Moisture absorption	Moisture absorption	Preventing moisture accumulation	Maintaining inert environment	Chance
Thorough Drying Required?	Yes	Yes	Yes	Yes	No
Maintenance Required?	Yes	Yes	Yes	Yes	No
Convenient to Apply?	No	No	No	No	Yes
Easy to Apply?	No	No	No	No	Yes
Subject to Failure?	Yes	Yes	Yes	Yes	Yes
Removal Required?	Yes	Yes (typically)	Yes	Yes	No
Health & Safety Concerns?	No	No	No	Yes	No

New boiler tubes (shiny) alongside old tubes damaged from corrosion that could be the result of a non-existent or inadequate preservation program. Cortec® image.

One of the first challenges is achieving a perfectly dry environment. This in-and-of-itself is a major hurdle given the intricacies of a boiler and the many places for residual water to collect after the boiler has been drained. Another nuisance is the periodic maintenance required for each active method of protection. For example, since silica gel absorbs moisture, it needs to be checked periodically and replaced if the desiccant is spent. Otherwise, damp silica gel could itself be the cause of corrosion. Positive dry airflow and nitrogen blanketing require special equipment and must be maintained for the duration of layup to be effective. In the case of nitrogen blanketing, if the system depressurizes and the nitrogen leaks out, the costly procedure will have to be done all over again. Leaking nitrogen poses health and safety hazards, as well. Each active method also requires labor for removal when layup is over. In some cases, such as desiccant use, failure to take the material out of the boiler before refilling it can be worse than doing nothing because of the problems it causes and the headaches that come from having to clean the desiccant out of the boiler once it has been dispersed in the water. In the end, even if the costliest precautions have been taken, the layup may still be ineffective and result in corrosion.

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Time to Take a New Layup Route?

Vapor corrosion inhibitor (VCI) layup technologies offer alternatives to other methods that show themselves to be ineffective or inconvenient. VCI technology has been applied successfully to the water treatment industry for several decades and is now available in an increasing array of formats to adapt to various boiler sizes or layup methods (e.g., wet, dry, or wet-dry).

One of the key advantages of VCI technology is its multi-phase corrosion protection action, which translates into a variety of benefits. Because VCI works in the vapor phase, it can be used to protect the internals of an empty boiler or the headspace above the water level without requiring direct application to the metal. Rather, the corrosion inhibiting vapors diffuse through the air and adsorb in a protective molecular layer on all accessible metal surfaces inside the boiler as long as the vapors cannot escape (i.e., boiler openings are closed). VCI also dissolves in the water so that it is able to protect all metal surfaces in contact with the treated water below the waterline. In this way, VCI technology

provides full coverage of boiler internals whether or not the boiler is drained.

VCI technology has benefits in terms of convenience as well. Since VCI protects even in the presence of water, there is no need to ensure that residual water is completely dried out of the boiler before layup. Once the VCI has been applied and the boiler openings closed, no further maintenance is required until startup, other than the good practice of applying and periodically checking corrosion coupons to confirm active corrosion protection. VCI does not typically need to be removed upon startup. Also, the products do not have serious health and safety concerns if basic personal protective equipment is used.

Another benefit of VCI technology is that it is versatile when it comes to different methods of boiler layup—dry, wet, or wet-dry. A classic example of VCI *dry* boiler layup is the annual practice of placing a water-soluble film tube filled with VCI powder into the waterside of a boiler, slitting the film open to release the protective vapors, and closing the boiler openings to keep the VCIs trapped inside the system. When the boiler is refilled at startup, the water-soluble film and VCI powder simply dissolve, eliminating the need for removal.

A classic example of VCI dry layup: VCI powders packaged in a water-soluble tube that dissolves when the boiler is refilled. Cortec® image.

Another *dry* layup method is to apply VCI waterborne fogging fluid. This is suitable for and adaptable to protecting both the smallest and largest (e.g., heat recovery steam generators) of boilers as an excellent cost-effective alternative to nitrogen blanketing. Boilers are then sealed for layup, and there is typically no VCI removal or flushing necessary when the boiler is restarted.

VCIs for *wet* layup are added to the boiler water and circulated, but little maintenance is required other than an occasional check to make sure all remains stable. VCIs protect metals below and above the waterline and do not need to be flushed out when the normal water treatment chemicals are added for the period of operation.

Pitting corrosion on steam drum separators, likely caused by a deficient wet layup. Cortec® image.

A fourth method of VCI layup is the *wet-dry* layup option, where the VCI is added to the water and left to dwell in the boiler for 24 hours before draining. This option has the benefit of not even requiring the boiler operator to open the boiler before layup.

Factors to Consider	VCI Layup Technology
Method of Protection	Surface adsorption
Thorough Drying Required?	No
Maintenance Required?	No
Convenient/Easy to Apply?	Yes
Subject to Failure?	No
Removal Required?	No
Health & Safety Concerns?	No

VCI Layup Precautions

While the various forms of VCI technology available allow users to avoid startup issues by means of safe and convenient application options, it is also important to be aware of specific product precautions. For example, VCI powder used in a boiler exposed to wet and dry cycles over several months can eventually get hard and difficult to remove. In this type of application, the user should take care not to put a water-soluble bag of VCI powder in an area that is prone to getting wet and dry throughout the layup period. Another option is to spray a VCI liquid into the boiler internals to avoid any potential issues with water in the boiler during the layup season.

When properly applied, VCI technology is effective for several months—even years—without having to be replaced. However, for long-term preservation or mothballed equipment, a corrosion monitoring program is always recommended in order to detect a loss of VCI chemistry and replenish the system.

Orange/reddish color in the tube sheet of a firetube boiler suggests some corrosion has occurred in the fireside. Cortec® image.

Make Plans Now to Evaluate Your Boiler Layup Effectiveness This Fall

In the middle of summer, it may seem like the only option left is to sit tight and hope for the best until seasonal boiler layup is over. However, it is a great time to start making plans for evaluating the effectiveness and ease of your current boiler layup method. First, plan to check the condition of your boiler at fall startup time. If, upon examination, the telltale signs of corrosion are present, consider using VCI protection. If all looks well, be thankful, but also consider whether the effort and expense invested in last spring's layup was the best use of resources compared to the convenience of VCI alternatives. WCP

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About the company

***Cortec® Corporation** provides cost-effective, user-friendly integrated solutions for corrosion problems in the packaging, metalworking, construction, electronics, oil and gas, and many other industries. Learn more at https://www.cortecwatertreatment.com/.*