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The Changing Science of Process Cleaning & CIP

The science of process cleaning is changing. Considerations for process cleaning and CIP now include much more than they did just a few years ago. Energy efficiency, water usage, waste reduction, and solids recovery have all begun to affect the design of process cleaning systems.

For any products that go into or on our bodies, the hygienic integrity of the product is naturally a concern. Because the science of food safety has evolved in the past century, the demand for adequate and consistent hygiene has never been higher. As scrutiny on hygiene continues to increase, other demands are placed on our cleaning processes far beyond time, temperature, titration, or turbulence.

This CIP system was designed and manufactured by CSI.



In recent years, interest in reducing resources has increased dramatically, and cleaning is a major consumer of facility resources. Labor, electricity, steam, water, raw ingredients, finished product, and chemicals are consumable resources that should be considered in any process

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or cleaning system design. Every resource has a cost to procure, a cost to maintain, and a cost to dispose. With adequate and proper cleaning as an immutable part of the system design, considerations for resource optimization and sustainability become the focus for the future of cleaning.

Reducing Solids to Optimize Resources

If you reduce your solids load prior to cleaning, you can shorten your cleaning cycle times, which reduces labor, chemicals, water, electricity, and steam. A food manufacturing facility commonly has many sources of solid waste, and not all sources are easily identified or recovered. In traditional thinking, only

major waste streams were worth recovering, and over time there have been many advancements in effectively treating process waste. With financial ramifications as a primary concern, there has been no real value to pursue recovery of these non-primary streams of solid waste.

Likewise, the environmental impact of solid and chemical wastes has been a concern for some time. Most facilities monitor and modify the biological oxygen demand (BOD) and chemical oxygen demand (COD) of their waste streams by adding more water or chemicals to bring the waste stream to acceptable levels. The acceptable levels are dictated by the local municipality or sewage treatment plant. Some facilities create waste streams so significant or burdened with solids and chemicals that they have invested in their own pre-treatment facilities. Regardless of where sewage is treated, unexpected loads on the system or discharge of fats, oils or grease can create significant issues and significant cost.

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Since the facility cleaning system—CIP or otherwise—is a major contributor to solids and chemical-affected effluent, process cleaning becomes a primary focus area for improvement.

Benjamin Franklin was quoted as saying, “An ounce of prevention is worth a pound of cure.” In the case of resource optimization in a cleaning system, this could not be more true. The more solids remaining in a system before cleaning, the more water, chemicals, energy, and time required to clean it, and the more waste to treat.

Product Recovery as a Method for Resource Optimization

The primary purpose of a cleaning system is to reduce the total solids in a process system. In many processes the primary solids reduction device is a primary water flush, often to drain. Product recovery systems are utilized widely—although sometimes as an afterthought—for recovery of usable product.



This product recovery system, designed by CSI, consists of a launcher, a projectile (or pig) and a catcher.

Cleaning effectiveness is a base element in all process designs; however, effective recovery of product is not. Most process valves and equipment do not accommodate an effective product recovery system. Also, processes are not designed to optimize product recovery technology. Recovering product with compressed gas or an air blow system can be partially effective but can create other cleaning issues.

If we effectively reduce the solids present at the start of a cleaning process, we gain resource optimization in many ways:

- The solids we recover are not diluted, so they can be reused or sold for alternative purposes like livestock feed, fertilizer or sources of alternative energy.
- Since there are fewer solids to remove, cleaning and rinsing cycles take less time.

- Shorter cycle times equal less water usage, less electricity and steam required, lengthened equipment life for both process and CIP equipment, and even labor savings.

- Since the time required to clean equipment is time that could be spent producing product, shorter cleaning time directly increases productivity.

- Fewer solids also mean fewer cleaning chemicals required. In many countries the elimination of cleaning chemicals altogether is increasingly encouraged.

Many pieces of process equipment cannot be cleaned using product recovery techniques. Tanks, vessels, heat exchangers, pumps, and valves are each areas of concern for cleaning that are not aided by current product recovery techniques.

In the case of tanks and vessels, the use of dynamic spray devices can drastically in-

crease cleaning effectiveness and reduce time and water usage. Utilizing impingement forces of water or cleaning solutions distributed across the interior surfaces, rotating spray devices remove soil from tank surfaces more efficiently and more effectively than typical static spraying devices. In fact, the mechanical impingement forces are so effective at releasing soils that they could reduce or eliminate the need for chemical reactions that perform the same duty.

Likewise, heat exchangers—particularly plate and frame style—can be areas of concern that must be addressed in cleaning systems. The issue is not the design of a sanitary heat exchanger, but the flow required to effectively clean it, which is typically much higher than that required for the process lines to which it is connected.

Fortunately, techniques exist that allow for increased flow at the heat exchanger while reducing the total water and energy consumption of the system.



Toffejorg's TJ 20G rotary jet head provides a 360° cleaning pattern inside a vessel.

Resource and Energy Management

As we think about our processes and how they are cleaned, we should con-

sider the resource balance. Cleaning processes—including pre-cleaning product recovery—utilize many forms of energy: electricity for flow and pressure; steam for heat; chemicals and water as a resource; and, traditional cleaning uses. All of these are used in various combinations. Traditional thinking might say, “Water is abundant—use all you need;” and, some might consider the cost of a device rather than its effectiveness.

However, in most areas of the world, those luxuries no longer exist. Engineers must consider cleaning options that trade one resource for another in effort to increase the sustainability of the system. Increasing product recoverability is one part of the equation, but it is not the only consideration. Increasing cleaning equipment capacity—only to decrease time without thought of other ramifications—would be an error.

As with every other aspect of process system cleaning, no single answer solves every possible problem. Study, consideration and cooperation of the engineers, designers, system operators, and facility management are required to decide what solutions best fit their specific needs. To take the first step, contact a CSI representative at **800.654.5635**, or visit us online at www.csidesigns.com.

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Why Do My AL-6XN Welds Look So Bad?

We've grown accustomed to judging the quality of a weld by its appearance. A good weld is shiny, smooth, and uniform in color, right? That may be the case when welding 304 or 316 stainless steel, but the rule doesn't always apply when welding higher nickel alloys, such as AL-6XN.

A typical AL-6XN alloy weld will have non-uniform freeze lines and slag islands in the weld bead. These slag islands are dull or blue-gray in color and adhere to the surface. The appearance of "light" and "dark" spots on both the inside and outside of the weld is common. The heat-affected zone can also have discoloration and is generally a little darker than conventional 316L stainless steel welds.

This is an example of a weld made with AL-6XN electropolished tubing.

It's a Bad Weld, Right?

Actually, no. Metallurgical lab tests were used to identify the composition of slag islands, discoloration, and the impact of such on the integrity of AL-6XN welds. The evaluation process employed the following analytical techniques:



- Scanning electron microscopy (SEM) to determine what the surface "looks like" and to determine areas for evaluation with microprobe analysis.
- Energy dispersive spectroscopy (EDS), sometimes called microprobe analysis, to determine the approximate composition of any areas in question.
- X-ray photoelectron spectroscopy to determine the molecular composition of areas or compounds present and to provide light element detection.
- Accelerated corrosion testing in a modified ASTM G48 solution to identify areas of potential corrosion attack.

Summary of the Weld Test and Analysis

- The weld discoloration does not appear to have an effect on the corrosion resistance of the weld, and removal of the discoloration does not seem to be a requirement for good field performance.
- Most of the discoloration observed in the weld originates from inclusions in the steel that are melted during welding and concentrated as slag on the weld. They can originate in the steel-making process or enter as tramp elements from the scrap used to make up the alloy.
- It appears that little, if anything, can be done during the welding operation to eliminate the discoloration since it comes from the steel itself.
- The white or silver areas on both surfaces of the weld are areas free from oxides or nitrides. They represent clean surfaces.
- The dark areas are composed of a mixture of oxides, silicates and nitrides. They seem to come from the inclusions in the steel and possibly from the partial decomposition of the oxides in the slag. They appear to be stable and not attacked by the very aggressive corrosion test.

To learn more about AL-6XN alloy properties, specifications, applications, and corrosion studies, visit www.al6xn.com. Or, contact **Eric Bruning**, our alloy specialist, at **800.654.5635 extension 132**.

New Rep Serving Iowa, Nebraska & Kansas City



Michael Louck may be new to the state of Iowa, but he is not new to serving CSI's customers.

"My focus has always been on the customer and their needs," says Michael about his changing role at CSI. His previous experience working as a customer service representative taught him the importance of responding promptly to requests, communicating clearly with the customer, and identifying the next step together. He also learned about CSI's products, their applications, and what materials work with best different products.

In June of 2009 Michael moved into a new role as a technical consultant. In his new position, he specializes in solving processing problems. He enjoys visiting plants to see their application first-hand, then identifying the best solution to meet that customer's need. When an off-the-shelf product won't do, Michael works with CSI's design and engineering team to create a customized solution.

In July of 2010, Michael relocated to Des Moines, IA in order to better serve his customers in Iowa, Nebraska and the Kansas City area. His customer base includes processors and mechanical contractors in the food, dairy, beverage, and pharmaceutical industries.

When Michael isn't occupied at work, he enjoys spending time with his wife and four children, ages 8 months through 6 years.

The next time you have a problem that needs a creative solution, give Michael a call at **800.654.5635 extension 182**.



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