

Exploring the Secrets of CIP

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To succeed today, food and beverage producers know they must meet four objectives: 1) produce safe, high-quality products, 2) operate efficiently, 3) increase profitability, and 4) reduce water, energy, and waste.

They also know that to achieve these objectives, they can't overlook **clean in place** (CIP). If CIP is not done well, producers risk contaminated products, production downtime, higher costs, and increased natural resource consumption. Further, poor quality and product recalls can damage brand reputation, lead to litigation and undermine hard-earned customer, consumer, and shareholder trust.

However, the challenge with CIP is evaluating how—and how well—it cleans at each wash. It's like an old friend who, after years of friendly give and take, still holds tight to his secrets.

The industry has certainly tried to peer beneath the surface to learn what's really going on during the CIP process. Periodic manual evaluations have provided helpful snapshots of CIP performance, but they could not be used to validate effectiveness across all washes. Increasing the frequency of manual evaluations to truly meaningful levels has simply not been practical.

In addition, when Programmable Logic Controllers (PLC) coupled with field instrumentation, advanced Human Machine Interfaces, and electronic Historian Databases became the standard of control within CIP operations, the industry expected greater insight into CIP performance. These technologies did generate reams of data. But developing platforms that could translate it into actionable insights required special expertise and considerable expense. In the end, the data offered limited practical value for understanding CIP performance.

With no good way to assess each clean, QA and plant operations teams have taken it largely on faith that CIP activities are being performed as intended. When Ecolab, which has partnered with fluid flow processors to enhance this **sanitation** technology for over 55 years, asks customers what percentage of the time they believe their CIP washes are done correctly, they usually answer "around 100 percent."

Such assumptions can be risky. For instance, when Ecolab installed an **automated CIP monitoring system** at several customer locations, only 30 to 50 percent of washes were



running optimally. So far, the absolute best rate of conforming washes the company found has been between 60 and 70 percent. Non-conforming washes suggest trouble on one of two fronts: either resources are being wasted (too much water and/or chemical) or food safety is at risk (too little water and/or chemical.) Of the two, the impact on quality has been far and away customers' top concern. Resource use and associated costs have been a distant second.

Recently, the quest for effective, comprehensive CIP monitoring has taken a promising turn, thanks in large part to the **Internet of Things** and **big data**. The marriage of these two thoroughly modern inventions has led to systems capable of monitoring CIP washes 24/7 and providing specific insights into current and emerging CIP performance problems.

These advanced automated monitoring systems collect real-time CIP process data from the customer's industrial network (PLC and/or Historian Database), encrypt it, and transmit it to data centers where the data is aggregated. Sophisticated algorithms then scour the data for patterns and deviations that indicate compliance or non-compliance with prescribed wash protocols. Importantly, these algorithms are designed to translate the data in a CIP context to help ensure the relevance of the output.

Data analytics experts provide further interpretation of the data to discern problems that need immediate attention—and opportunities for future improvement. Ultimately, the analysis separates the “critical” from the merely “interesting.” With such clarity, recommendations can be developed to address immediate and long-term challenges.

Armed with actionable recommendations, internal and external technical teams can waste no time getting to the most urgent issues. In fact, for greatest impact, all data analysis should lead to action plans that can be incorporated in the plant's service platform.

From Transparency Comes Impact

Food and beverage producers who have implemented these 24/7 automated CIP monitoring systems report positive impact on quality and operational metrics, as seen in the following examples.

Over 12 months, the Kemps fresh milk plant, Rochester, Minn., using **Ecolab's 3D TRASAR** for CIP Technology, reported improvements in the following:

- Product quality as monthly variability in percent passing decreased by 55 percent from 2013 to 2014 and average percent passing end of code increased by 1.1 percent from 2013 to 2014;
- 1,295 hours of cleaning time saved;
- 963,750 gallons of water used for cleaning conserved;
- 1215 kWh electricity saved and 1,847 pounds of carbon dioxide emissions avoided (Calculated from www.epa.gov/cleanenergy/energy-resources/calculator.html); and

- 3,000 gallons of CIP chemical usage reduced.

Over three months of 24/7 CIP monitoring, another large beverage producer found a flow imbalance during the cleaning of its fillers. After making needed improvements identified by monitoring one line, the plant reported annualized efficiency benefits, including:

- 200 hours reduced cleaning time;
- 875,000 gallons reduced water consumption for cleaning;
- \$8,000 cost avoidance through reduced pump and valve maintenance; and
- \$369,000 total estimated benefit gained from identifying problems with 24/7 monitoring.

In addition, over a three-month period in which just 20 percent of its CIP activity was monitored, a large food producer identified opportunities to realize savings valued at \$230,000. More important, round-the-clock monitoring found ineffective sanitizing methods occurring at a rate that could have negatively impacted the quality of approximately 1,800 production batches each year.

What to Expect of Automated CIP Monitoring

Automated CIP monitoring systems should answer three simple questions: 1) Did you clean everything you were supposed to clean? 2) Did you clean everything the way it was supposed to be cleaned? 3) Did you clean optimally?

If the technology can't respond with clear answers, it's probably not for lack of data. Rather it's likely due to the system's inability to distill the data to a level that is useful. Too

much information with too little interpretation is more frustrating than no information at all.

To assure that "yes" is the answer to the three questions day after day, a three-phase approach is recommended once an automated monitoring system is installed.

- **Standardize.** During this phase, the aim is to make needed adjustments to CIP protocols to achieve at least 90 percent of washes done correctly (as mentioned before, the best Ecolab has seen is 60 to 70 percent). Creating consistency around CIP operations has an immediate, tangible impact on quality while also improving efficiency. Once washes are standardized to perform correctly and consistently, it's time for Phase 2.
- **Optimize.** In this phase, the goal is to identify savings opportunities to further optimize washes. Ultimately, the focus should be to drive wash conformance rate upward to 100 percent.



Image Credit: Ecolab

- **Sustain.** With CIP, many things can, and do, change as wash recipes are added and adjusted. Automated CIP monitoring should be an ongoing and well integrated component of operations to ensure sustained wash conformance—as well as consistent product quality and safety for the long term. Continuous monitoring also enables organizational learning as it yields insights and best practices that can be shared.

Of course, easy access to the results of 24/7 CIP monitoring is essential. Advanced systems feature online dashboards with scheduled and exception-based reporting, as well as access to comparative analysis (historical, relative, and best-case). They use phone, email, and text to alert you—and your service and support teams—to the need for action when immediate problems arise.

Having CIP performance data at your fingertips provides another important benefit: It helps you prepare for compliance with the Food Safety and Modernization Act (**FSMA**). FSMA requires extensive documentation and recordkeeping related to QA and control processes. Companies that cannot readily produce the required documentation could face inspections, fines, and even recalls. CIP monitoring reports will help avoid these and other regulatory pitfalls.

Constant Assurance

CIP has long been a tight-lipped introvert. But with automated CIP monitoring systems, it's becoming a babbling extrovert, pointing to problems that need quick action and suggesting opportunities to improve metrics or avoid catastrophe.

The transformation is astonishing, and it is not yet complete. As monitoring technologies continue to advance, look for CIP to become smarter, perhaps even intelligent.

Today, CIP is prescriptive. It takes direction on when and how to wash—and then it does the job. In the coming years, CIP will take direction on when and how to wash based on production. Further in the future as digital technologies provide an even more comprehensive view of production and cleaning performance, expect CIP to become “predictive,” cleaning only when, and as much as, needed. These leaps forward will make CIP an even better partner in product quality and food safety.

Before you think about tomorrow, though, it's important to appreciate where CIP is today. Automated CIP monitoring is taking much of the guesswork, and worry, out of quality and food safety by providing constant assurance that every wash is confirmed and validated. The advantages are unmistakable:

- Anomalies are found immediately, and action can be taken to mitigate food safety impact;
- Risks are more apparent and better understood;

- Processes and applications can be optimized;
- Operational choices, and how they affect one another, can be evaluated; and
- Outcomes can be improved.

More than ever, food and beverage producers can be proactive in preventing risks. And more than ever, they can be assured that CIP is supporting, not undermining, their quality, safety, profitability, efficiency, and sustainability objectives.

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Food Quality & Safety - <http://www.foodqualityandsafety.com/article/exploring-secrets-cip/>

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