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Successfully Implement an Operator Care Program

Getting an operator to act as an owner of equipment can provide myriad benefits

By Bill Wilder and Joel Levitt, Life Cycle Engineering

SUCCESSFUL OPERATOR care programs improve reliability, quality and safety. They also enhance job satisfaction. By decreasing unexpected breakdowns, downtime and maintenance costs, operator care programs also boost financial performance.

Such programs aim to have operators act as owners of their equipment. They become full partners with maintenance, engineering and management to ensure equipment reaches operational goals every day. Successful operator care programs:

- improve production;
- provide individual professional development;
- promote reliability and safety;
- reduce waste; and
- decrease training and downtime.

Operator care has four elements, illustrated in Figure 1, that create a hybrid operator who is comfortable in the operations, maintenance and engineering worlds:

KYMP — Know Your Machine and Process. Operators increase their knowledge of their process and their machines. This may go well beyond current knowledge requirements.

P^2 — Prevent or Postpone Failure. Activities to avoid failure include lubricating equipment, hands-on cleaning, tightening bolts and making minor adjustments. We consider this to be basic maintenance work.

D^3R — Detect Defects, Diagnose and Report. Inspections directly resulting from the hands-on cleaning activity identify any deterioration or defects.

CI — Continuous Improvement. The operator always is involved in thinking about how to make the equipment work better. Potential improvements may come from reduced downtime, increased

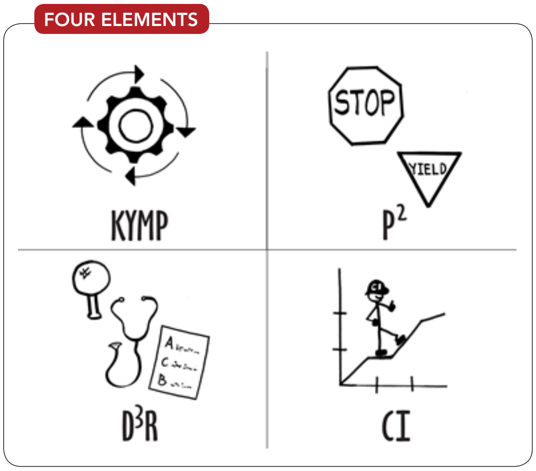

Figure 1. Operator care involves four distinct but complementary aspects.

Figure 2. This proven model involves three stages.

yields and lower utility usage. CI is an adjunctive engineering activity.

IMPLEMENTATION CHALLENGES

You will encounter resistance when launching an operator care program. Success demands proactive steps to address resistance as well as a well-designed learning process. Organizations that simply announce a new expectation and schedule a class but do little intentionally and proactively to manage natural resistance or reinforce the desired change in behavior rarely achieve satisfactory results.

The groups typically involved or impacted by the operator care program are: management; operations; maintenance; sales and marketing; and supply chain vendors. People in each of these stakeholder groups will be required to change their behavior.

The stakeholder group most resistant to changes is management, particularly the direct supervisor. This individual also has the most influence over resistance from the operators and other people who must change.

To alter operator behavior to produce the desired results requires integrating the science of change management and learning. This can be achieved by leveraging established models within each discipline. An example is the integration of Prosci's ADKAR model with our 3A learning process.

ADKAR is a model for the five phases or stages all individuals progress through when they change:

1. awareness of the need for change (why);
2. desire to support and participate in the change (our choice);
3. knowledge about how to change (the learning process);
4. ability to implement the change (turning knowledge into action); and
5. reinforcement to sustain the change (celebrating success).

The Life Cycle Engineering (LCE) 3A Learning process (Figure 2) has three elements — align, assimilate and apply.

ACHIEVING AWARENESS AND DESIRE

In the first phase of the LCE 3A learning process, we gain alignment by creating a direct line of sight from individual behavior to organizational goals. This is done through an intentional campaign to establish awareness of the business need for change and a desire to alter behavior. Senior leadership most influences awareness while direct supervisors most influence desire. The supervisors should work with an impact

map that connects the desired individual behavior to organizational goals. This learning impact map can be a simple table that has columns for organizational goals, learning objectives, individual behaviors and individual results. The objective is to engage the operators' manager in the discussion and setting of expectations for behavior change following the class. More information on how to implement a learning impact map is given at LCE.com.

Senior leadership will communicate the business reasons for the change. The message should outline the current business environment, including competitor and customer influences. It also should describe the risk of not changing. This communication should make operators and other impacted stakeholders aware of the business drivers for the operator care program.

The supervisor will introduce operator care concepts, pointing out the benefits for the operators' jobs and lives. Operators will prefer to hear from their supervisor about how the change will impact them personally. The supervisor's responsibility includes significant activities that require strong communication, planning and leadership skills to accomplish the following steps in rolling out an operator care program:

- conducting the initial education and pitch for the operator care program (to all hands);
- selecting future leaders for deeper training;
- setting up committees and choosing the pilot area;
- establishing targets for the pilot area;
- creating plans for machines and areas;
- organizing the opening ceremony;
- starting training and implementation in the pilot area; and
- implementing techniques, including reporting, incentives, and external and internal support, to sustain the program.

The supervisor's actions and communications can make or break your program. First, supervisors tend to be the most resistant to change. So, make a conscious effort to include them in the design and deployment of the program. This will improve their willingness to try operator care and act as advocates for the program. Second, supervisors are the most influential people in overcoming resistance and creating desire among the operators. During this align phase of the 3A process, you want to achieve awareness and desire for the operator care program.

CREATING KNOWLEDGE AND ABILITY

The assimilate phase is where the capabilities to implement the change are created. This is achieved by delivering learning events (classes) that:

Assess and access prior experience. Every person comes to the class with unique individual experiences. The facilitator should be able leverage or mitigate these inputs. Failure to do so will lead to disengagement and disruption during the learning event.

Engage participants in activities at least 75% of the time. The event should allow attendees to work with and practice the knowledge introduced. Active participation means the learner is reading, speaking, writing or, in some other way, engaging with the content, not passively listening and watching a slide presentation or video.

Provide relevant application experience. Learn-

ing should directly relate to helping the attendees do their jobs or reach a goal. Use examples from the workplace, not textbook case studies.

Offer self-direction in the learning process. Adult learners want to be able to choose how they learn. So, let attendees make decisions about what, how and when they will learn. There obviously are some constraints on this. However, never do for learners what they can do for themselves. Seek out ways to let the participants make decisions.

Typically, such sessions should involve no more than 15 operators.

INSTRUCTORS VERSUS FACILITATORS

INSTRUCTORS	FACILITATORS
Content resource (Sage on the stage)	Process manager (Guide by the side)
Share knowledge through writing and lectures	Use knowledge of how people learn to create an active environment
Passive participants	Engaged participants
Control what is taught and when	Access and assess prior experience to encourage sharing of knowledge among participants
It is up to the participant to adapt to learn new skills and knowledge	Learners share and take charge of their learning, benefitting from their unique learning style

Figure 3. The leader of operator care training sessions requires a good balance of skills.

Even with the best course, the particular class leader makes a big difference. That person should provide a good balance between instructor skills and facilitator skills (Figure 3).

The assimilate phase should include engaging the operators in beginning the operator care process for their equipment. The following exemplifies one approach you could apply. It relies on the 5S process (sort, set in order, shine, standardize and sustain).

1. Observe, interview and evaluate by walking down the area, then audit and score.
2. Obtain any current check sheets, preventive maintenance to-do lists, etc. and scrutinize as a team. Review the maintenance logs for history of chronic failure.
3. Take "before" photos.
4. Establish a quarantine area.
5. Initiate a "red tag" process to identify items that potentially don't demand attention, and sort.
6. Review the red tag log with area team members.
7. Assess what to do with as many red tag items as possible.
8. Determine resources needed.
9. Using the process worksheets, record issues and opportunities.
10. Regroup and discuss what you observed and recorded for improvement. What tasks must be performed? What supplies do we need to do them? Do we need cross-functional support from other work streams?
11. Develop a plan and assign tasks. Obtain supporting documentation for tasks.
12. Review the plan with necessary area workers.
13. Start 5S activities. Simplify. Sweep and clean.
14. Conduct another observation and repeat the audit.
15. Develop the 5S area map with help from the area owner.
16. Implement the 5S board and populate it with help from the area owner.

17. Review and train the area owner on the 5S board responsibilities.
18. Conduct an audit with the area leader, teaching that person what to look for in the audit.
19. Develop an operator-care rounds process per flow and step definitions.
20. Establish or revise operator instructions for the operator round.
21. Review with area workers and adjust as needed.
22. Train steps 19 through 21.
23. Develop coaching cards.

REINFORCING NEW BEHAVIORS

The apply phase is when people begin to attain success. Achieving sustained change in behavior requires reinforcing the new behaviors. When people learn new processes, knowledge and skills, they go through a process that can be divided into three types of learning.

1. *The classroom or formal learning event.* This often is a live facilitator-led session or self-paced learning exercise given during the assimilate phase. However, the reality is that it amounts to only about 10% of the learning process.
2. It is through *coaching and peer support* that operators begin to apply what they have learned. During this application process, they pick the brains of their peers or ask a coach, often the same facilitator who led their classroom session. This learning from peers and coaching represents about 20% of the learning process.
3. The most significant stage of learning is *doing*. Performing actions and learning by trial and error represents 70% of how people learn.

   Most people gain proficiency in their job by doing it. Yes, formal "book" learning is important, as is the support of peers, coaches and bosses. However, it's the application of the new skills and knowledge learned in the actual work environment that makes the learning stick.

Do not leave this to chance. Ensure the application phase includes all three types of learning. Design specific, challenging tasks that must be completed and documented.

Early success is critical — this spurs people to use what they have learned and make changes. Management support and coaching are crucial for achieving early wins. Managers can run interference and ensure processes and resources are in place to adapt systems and structures. Coaches can provide the mentoring and feedback to help operators apply what they have learned to the work environment. People are naturally resistant to change but coaching and encouragement can help them to adapt. Management and coaching support are important factors in learning retention, as is the individual's commitment to put new knowledge and skills into practice.

To make the new operator-care behaviors "stick," it's a good idea to establish project targets and publish progress on a dashboard. Figure 4 shows suggested components of such a dashboard.

A strong apply phase ensures participants:

- keep goals top of mind;
- celebrate success;
- plan and track progress;
- learn from others;
- receive coaching and mentoring;

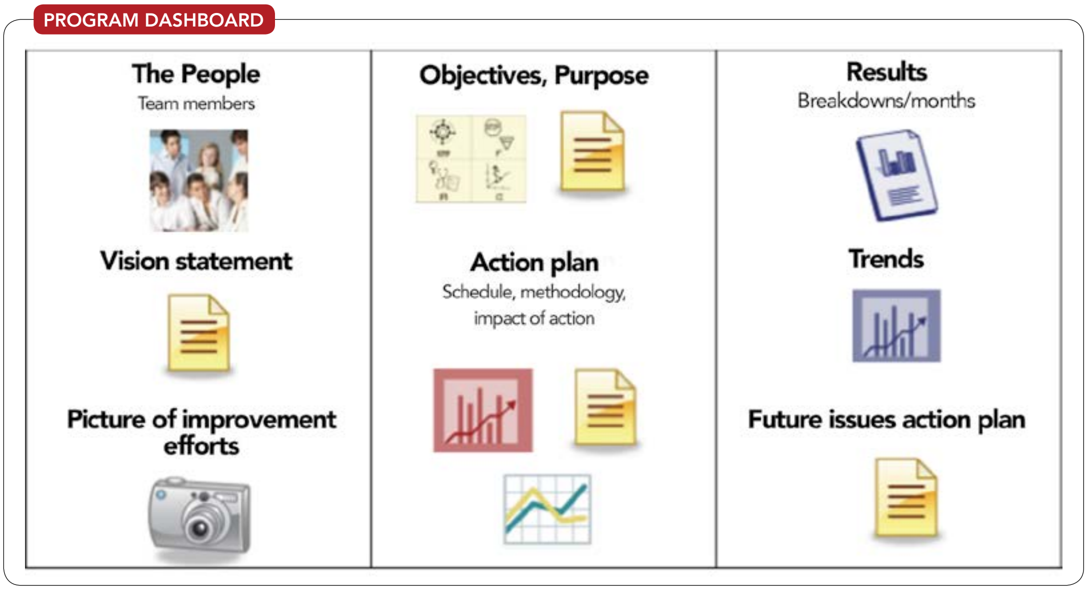

Figure 4. A visual mechanism to show targets and progress can help sustain the program.

- involve their managers; and
- document results.

Some typical mistakes to avoid include:

- not considering both how people learn and how people best adapt to change;
- focusing only on the learning and, therefore, not getting sustained behavior change;
- trying to change behaviors without teaching operators how; and
- training without reinforcement.

TAKE CARE WITH OPERATOR CARE

Achieving success with an operator care program depends as much upon behavior change as new processes and tools. By keeping Prosci's ADKAR model for individual change and LCE's 3A Learning process in mind, you can engage people's willingness and ability to make the change. The end result will be an operator care program that gives operators more satisfaction with their jobs and delivers improved reliability, quality and safety.

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Discover Savings in an Unexpected Place

Reduce costs and optimize CIP procedures using rotary impingement technology

By Jessica Letscher, VP of Marketing, Alfa Laval Tank Equipment Inc.

TANK CLEANING has always been viewed as a necessary evil for manufacturers. During the cleaning process, a significant amount of resources (time, chemicals, water, electric and labor) is required between batches to ensure a reliable, uncontaminated, quality batch is produced. Although these repeating expenditures have a significant effect on the bottom line, many chemical manufacturers continue to rely on outdated processing for cleaning, not realizing the potential opportunity for substantial cost reductions and revenue recovery through clean-in-place (CIP) optimization.

To understand how to optimize a cleaning process, one must first understand the basics of cleaning. Herbert Sinner, a former chemical engineer for Henkel, first summarized the basic principles of cleaning in 1959. His summary, now referred to as the Sinner's Circle (Figure 1), describes the four factors that can be manipulated in any cleaning scenario: temperature, chemical action, time and mechanical force.

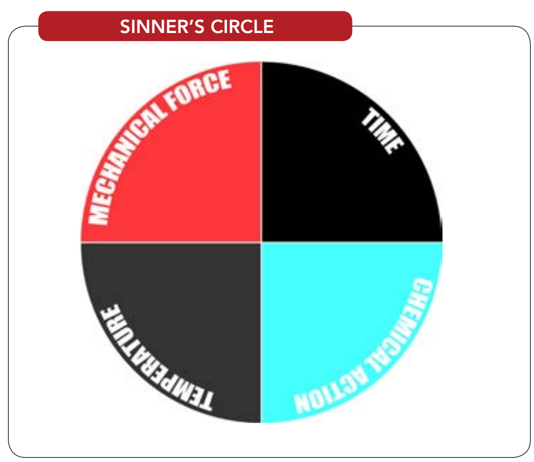

Figure 1. Four factors — temperature, chemical action, time and mechanical force — can be manipulated in any cleaning scenario.

When the effectiveness of any factor is increased, a decrease can occur in one or multiple other factors, without affecting the quality of the clean. Washing dishes is an effective example of how the four factors interact. Hot water (temperature) is going to remove stuck on food better than cold. Adding soap (chemical action) makes the process even easier, and you can either soak a dish overnight (time) or scrub the dish clean (mechanical force).

When cleaning tanks, it is imperative to examine not only the effectiveness of the cleaning process but the efficiency as well, especially in such a competitive marketplace. Sinner's Circle can be easily applied to tank cleaning as a way to compare the efficiency of processes (Figure 2). The most common tank cleaning processes are: wetting (static spray balls), rotary wetting (rotary spray heads), boiling out, manual cleaning and rotary impingement cleaning (rotary jet heads). Rotary wetting and wetting are more easily understood as a "cascading method." By applying massive amounts of cleaning solution to the tank interior, the residue eventually erodes off, which requires significant amount of time and effluent consumption and a minimal reliance on temperature and mechanical

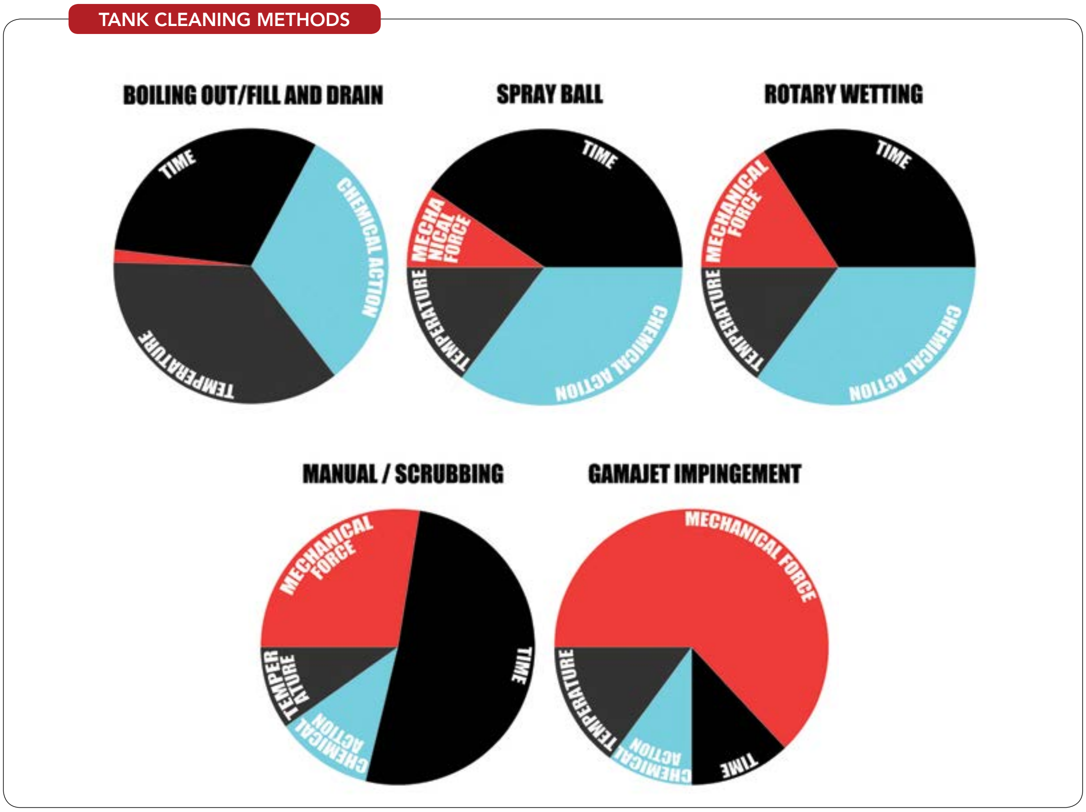

Figure 2. Sinner's Circle can be easily applied to tank cleaning as a way to compare the efficiency of processes.

force. The average force from a spray ball, rotary or static, is less than .1 lbs. The effectiveness of this cleaning process is accurately described as "fair" and often requires additional manual cleaning, which includes scrubbing and scraping. Boiling out offers a similar cleaning at an even slower rate, with even more effluent and temperature, and no mechanical action. Manual cleaning, on the other hand, offers a reasonable amount of mechanical force with minimal effluent but can result ineffective cleaning, based on who is doing the job at any given time. Also with safety in mind, lower temperatures must be utilized to clean the tanks, therefore increasing the time it takes to complete the job. There are numerous other reasons why manual cleaning, particularly confined space entry, is considered unsafe. Rotary impingement cleaning with rotary jet heads utilizes the most mechanical force compared to any other tank cleaning process, therefore reducing time and cleaning solution drastically.

HOW ROTARY IMPINGEMENT WORKS

Rotary impingement tank cleaning devices combine pressure and flow to create high impact cleaning jets. Cleaning occurs at the point at which the concentrated stream impacts the surface. It is this impact and the tangential force that radiates from that point which blasts contaminants from the surface, scouring the tank interior.

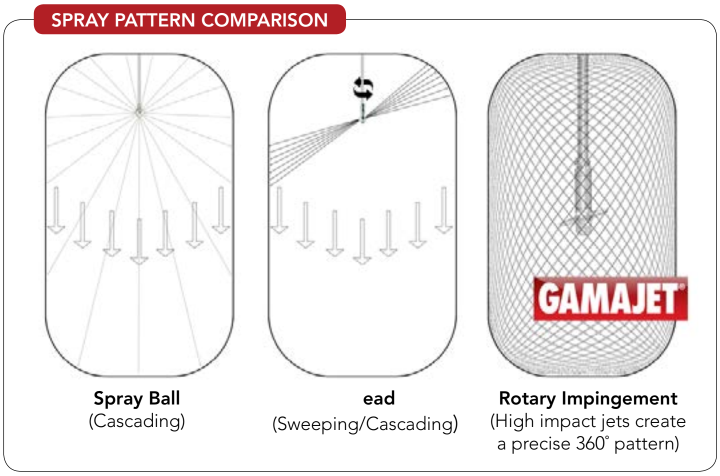

Figure 3. Rotary impingement provides a full-coverage, indexing pattern that ensures the entire tank interior is cleaned.

In conjunction with this impact, these machines are engineered to rotate in a precise, repeatable and reliable, 360° pattern (Figure 3). This full-coverage, indexing pattern ensures the entire tank interior is cleaned, every time. This combination of impact in a controlled indexing manner results in an economic homerun, because impact is a one-time investment; chemicals, temperature and time are continual, never-ending expenditures.

REAL WORLD APPLICATIONS

Below are a series of incidences in which rotary impingement tank cleaning was used to optimize an outdated cleaning solution.

Example 1: Rotary Impingement vs. Boil Out. In an effort to become a more efficient and sustainable business, an Australian specialty chemical company decided to audit their process tanks' CIP process in search for cost savings through time and water usage reductions. The CIP process they utilized was a fill and drain method. As a 24-hour facility, running 7 days a week they were able to make nearly 197 batches per year. Each batch took approximately 44 hours, from start to finish. Of that time, 3.65 hours were dedicated to cleaning. The total process utilized 5,800 gallons of water with a caustic concentrate, per batch, totaling nearly 1.5 million gallons per year.

The filling process with hot water and caustic was taking entirely too long for the company to keep up with growing demand. The water usage was also a major concern because of drought conditions, as well as the expense of disposal. An oily residue remained within the internal coils of the reactors after the boil out, requiring additional cleaning.

The primary concerns being time and sustainability, the company introduced a mobile CIP system and a rotary impingement tank cleaning device to the process. The CIP was needed to increase the pressure as well as better utilize the heating element.

TIME AND WATER USAGE

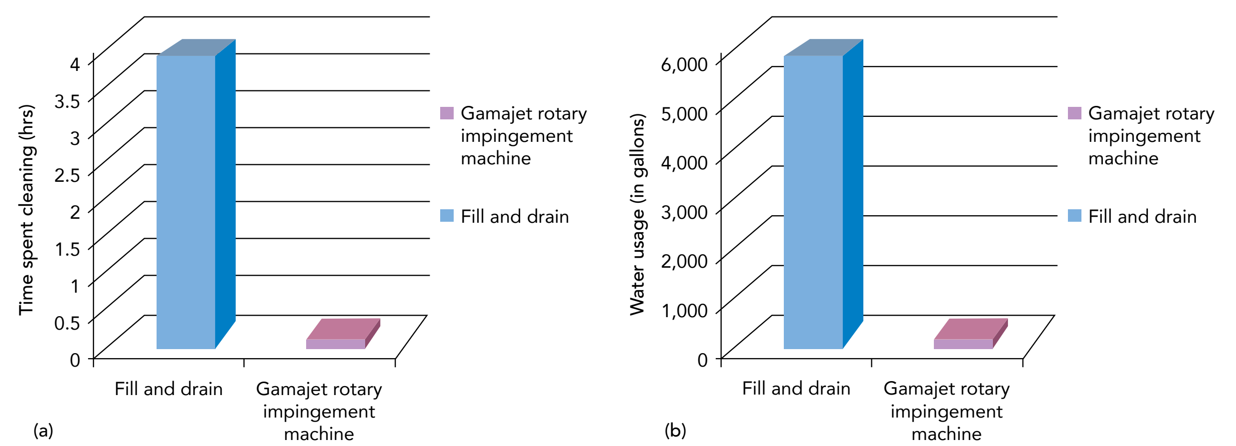

Figure 4. Using the rotary impingement cleaner reduced overall time spent cleaning (a) nearly 95% and water usage (b) 96% compared to previous CIP fill and drain method.

This heat, a necessary component for such residues, coupled with the same concentrate of caustic and significant impact, exceeded all expectations.

The solution: The Alfa Laval Gamajet rotary jet head required 45 gallons per minute at 100 psi. The nozzle and stator assembly was selected to optimize this cleaning solution, obtaining 15 lbs. of force at a 15-ft. distance. Coupled with hot water and caustic, the 12-minute cycle time proved to be highly effective. All areas around the coils and behind were thoroughly cleaned, with 205 gallons of re-circulated fluid. Overall, the impingement cleaner reduced time and water savings by 95% (Figure 4). The company was then able to increase production by 12.3%, an additional 16 batches. With the pumps running at much less time, energy usage decreased by 277,800 kWh per year, reducing greenhouse gasses by 45,400 kg per year.

Example 2: Rotary Impingement vs. Manual Cleaning. Manual cleaning is a very common method of tank cleaning; however, the method is beginning to lose some steam. Although nearly every other process is automated, many companies still rely on manual cleaning as an effective way, not only to clean, but to validate the cleaning process as well. Human error aside, no manual clean can ever be absolutely replicated. In addition, margins for error are non-existent, the dangers of confined space entry and the potential damage to the tank is high. A facility in San Francisco, Calif., was utilizing manual cleaning to its fullest extent. The company manufactures a wide range of products and was experiencing revenue loss due to their inefficient tank cleaning procedures, and they were under significant pressure to provide a

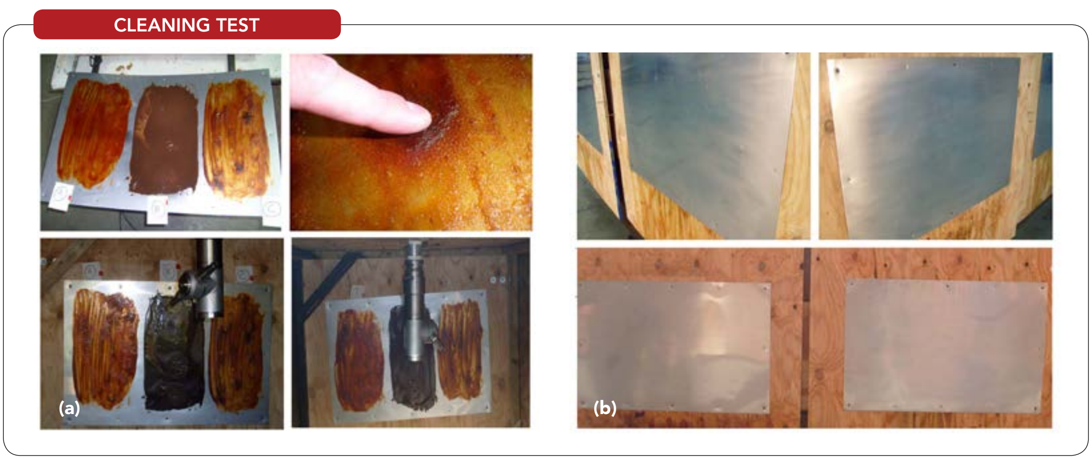

Figure 5. Baked on products, on a stainless steel plate, placed five feet from the impingement cleaner (a) are cleaned to reveal stainless steel plates after one half cycle at exact operating conditions (b).

more validatable clean and eliminate confined space entry. Their process included jacketed tanks with dual agitators and the products were burnt onto the tanks. As a result, their cleaning process included 2 hours of manual cleaning every day. The manual cleaning included confined space entry, scraping and scrubbing, and a significant amount of tank downtime and water usage. Tank downtime was 2,920 hours per year due to cleaning and the water usage was 3,504,000 gallons per year, which was costing them a total of $16,293 per year.

The solution included two Alfa Laval Gamajet PF rotary impingement tank cleaning devices. These machines were operating at 90 psi and 40 gpm per machine. Cleaning included a 5-minute pre-rinse, 10-minute recirculated wash and a final 5-minute rinse. Total cleaning time per tank was 20 minutes. The rotary jet head was able to give this facility a repeatable and reliable pattern that satisfied the quality assurance manager, and it resulted in the elimination of confined space entry, meeting OSHA requirements. This facility able to save 2,434 hours total in tank downtime per year and was also able to lower the usage of water to 2,336,000 gallons per year saving them $10,862 per year.

Figure 5 shows a few photos from testing.

Example 3: Rotary Impingement vs. Spray Balls. A quick history into spray balls and other "cascading" devices: Spray balls and rotary spray devices are the most commonly used tank cleaning devices. Static spray balls were introduced in the 1950s with the development of CIP. They work in a way that the wash fluid is discharged from numerous holes. This diffuses the energy of the fluid and, therefore, impact is minimal, less than .1 lbs. The cleaning action thus results from sheeting or cascading action with minimal impact from the turbulence as the cleaning solution (chemicals) cascades down the tank walls over long duration (Figure 6).

Rotary wetting, on the other hand, is often a rotating spray device with nozzles or open orifices. The effluent is typically split four or more ways and,

depending on the manufacturer, high body leakage reduces flow to each nozzle. As a result impact per nozzle is not optimal. In comparison to spray balls, the randomness of this wetting is limited resulting in a slightly more exact cleaning pattern, which still relies significantly on time, temperature and chemicals. Prior to the development of impingement cleaners such devices were readily accepted, mostly because there were no alternatives, they were easy to install and inspect.

A chemical manufacturer based in Mason, Ohio decided to establish a more efficient and effective tank cleaning method because they could no longer meet

SPRAYBALL CASCADING

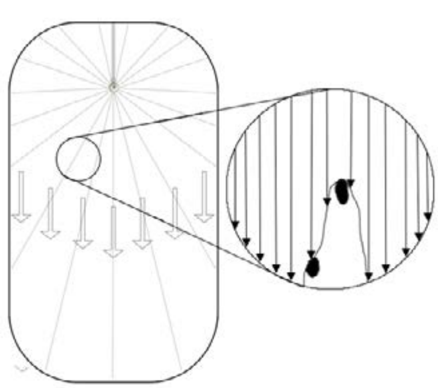

Figure 6. Spray balls provide minimal impact as the cleaning solution cascades down the tank walls over a long duration.

the demands of their consumers using their existing methods. The company operated four continuous production lines, each with three tanks. Each day the tanks were shut down for cleaning, which took a minimum of one hour. In many cases cleaning took longer because of the frequent clogging of the spray balls. There was also additional manual cleaning needed from time to time when the spray balls could not remove the built-up residue. The company turned to rotary impingement tank cleaning, and the results were much more beneficial than expected. The solution was an Alfa Laval Gamajet A6 rotary jet head operating at 115 psi and 15 gpm. Cleaning began with a 2-minute pre-rinse to remove the bulk of the residue followed by a five-minute re-circulated wash with caustic and a final two-minute rinse. The total cleaning time was 9 minutes, which was 91% faster than the previous method. The design of the machine, coupled with a filter, allowed for the debris to pass through or be caught, resulting in no clogging. The facility was able to utilize the saved cleaning time and increase production by 71%, producing 1,042 batches more a year. In addition the facility reduced its water and chemical usage by 85%.

The above cases are not extreme situations. The evolution of tank cleaning devices has resulted in exponential learning and understanding of cleaning in general. Plant managers, corporate leaders, sanitarians, and engineers worldwide have begun not only to recognize the benefits of rotary impingement tank cleaning, but also to implement them companywide.

For more information or a free consultation please contact Alfa Laval Tank Equipment. With over 70 years of tank cleaning experience, Alfa Laval Tank Equipment is dedicated to providing customers worldwide with the most efficient and effective tank cleaning solutions, offering everything from rotary impingement tank cleaning machines to mobile state-of-the-art CIP systems, all at an economical price.

Located in Exton, Pa, **ALFA LAVAL TANK EQUIPMENT** provides the most comprehensive line of tank cleaning equipment. Visit www.gamajet.com for more information.