

Robotic Blast Cleaning — Performance Observations

Contributing Authors: Atul Sumra and Russell Clark

The equipment may look like something out of *Star Wars*, or the remote-controlled lawn mower in *Honey I Shrunk the Kids*. However, robotic blast cleaning of steel structures is a technology that has come of age. It is one of several options being developed in response to environmental and worker-safety concerns.

TANK INDUSTRY CONSULTANTS has been involved in several robotic blasting projects in the past few years. Technical data and product brochures are available to anyone considering using or specifying the use of this new technology. However, we thought that the experiences of the TIC field personnel who have been resident technicians on robotic blasting projects might offer a practical view. The following is a summary of two recent projects.

Atul Sumra

My project called for abrasive blast cleaning on the interior and exterior of a 10,000,000 gallon ground storage water tank. The system I observed consisted of a hoist system, hanger assembly, blast module, cyclone separator, and a dust collector cart. This system provided a spot, sweep, commercial, near-white, or white-metal blast. The blast module oscillated horizontally producing a 6-foot wide cleaning path. The horizontal and vertical movement of the blast module was controlled remotely. The remote operator also controlled the module speed, hoist speed, shot flow rate, and abrasive charge. A vacuum hose carried the coating debris and dust to the dust collector. The dust collector cart also housed the electrical panel and air cooler which provided dry compressed air for the oscillation system and for cleaning the dust filters. The blast media was propelled by a centrifugal wheel.

On the vertical shell of the tank, the robot blaster was unable to clean approximately the top and bottom three feet. To clean these areas, the contractor used vacuum blast equipment which slowed the production rate considerably. Areas of rough weld seams were also

a problem and often had to be reblasted. To achieve an acceptable near-white metal blast, the operator had to overlap the blast pattern.

The project specifications called for a commercial blast cleaning on the exterior, and a near-white blast cleaning on the interior. It took about 20 minutes to achieve a near-white blast on an area approximately 6 feet wide by 40 feet tall on the interior.

This device was held to the surface with a vacuum produced within the gasketed (sealed) blast area. Using grit instead of shot caused the gasket to wear quickly. Therefore, the ground around the tank had to be covered to collect any steel grit and coating debris that escaped the unit when the seal was broken. On the positive side, on this lead abatement project, the workers' personal air monitors showed exposure to lead levels of less than 30 micrograms per cubic meter, much lower levels than would be expected if blast cleaning in containment.

Russell Clark was resident technician on the repair and repainting of an 8,000,000 gallon ground storage tank. This project also utilized robot blasters.

The blast achieved by the robot blaster on the exterior of this tank was in accordance with an SSPC SP-6 Commercial Blast Clean as specified. The equipment was able to do a section approximately 50 feet by 70 feet in about an hour and forty minutes.

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Robotic blast cleaning on the exterior of a water storage tank.

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Chairman's Corner

By: E. Crone Knoy, P.E., CEO, TANK INDUSTRY CONSULTANTS

After receiving so many favorable responses to TANK TALK 28's "driving nails and planting corn" Chairman's Corner, I have been searching for a follow-up worthy of printing. I don't think I have found it, but here go some ramblings.

One develops one's outlook on life by synthesizing all of life's experiences, and pretty soon, one cannot separate what are original thoughts and what is being plagiarized. Our data banks are filled with everything we have sensed since birth (and some say before). I would like to share with you several samples of sage advice from my mentors and see if they make any sense to you. Don't get me wrong—I am not saying that I practice all I'm preaching, but I wish I did.

❖ I suppose we all remember our mothers telling us to always wear clean underwear, just in case we are in an accident. I guess this rule still holds.

❖ Then there is the Golden Rule—*Do unto others as you would have them do unto you.* This rule still holds, but Stephen Covey of Seven Habits fame has redefined what is "equal" by making us aware that what one individual perceives as something great happening to him (or her), could be perceived by someone else as a horrible incident.

❖ Proverbs 22:6: *Train up a child in the way he should go: and when he is old he will not depart from it,* is great, except that none of us parents seem to know how to train our children, let alone know what to train them. As I was apologizing to one of my sons for not being there at the right times or doing the right things when he was growing up, his response was, "Relax Pops, this is the first time you ever had the job of being a dad."

❖ What really caused me to think was a response from my grandson, then about four years old, who was telling me in a very authoritative way how using cigarettes and drugs was bad for you. I asked him where he learned this, expecting a response such as pre-school, mother, or church. His reply astounded me. "I just know." At first I thought,

"What a wise guy response!" But, as I thought of it more, it saddened me to consider how many four year olds might grow up "just knowing" that smoking, drugs, violence, abuse, and so forth are acceptable modes of behavior. Can we ever erase these troublesome "I just knows" from those unfortunate children exposed to such distorted teachings since birth?

Some of my other favorites:

❖ *If you want the oats that have already been through the horse, they come a lot cheaper.* (Anonymous.)

❖ *Engineers document, attorneys shred.* (Gosh knows where this one comes from!)

❖ *Man may criticize, but only God can pass judgment.*

❖ *Each night when you go to bed, be a better person than you were when you awoke in the morning.* Let's look at how our day flows, too. Let's be a better person when we leave the workplace than we were when we arrived. (Source, I don't know. Hopefully, it's an "I just know it.")

❖ I thought I had an original philosophy of *Know what you don't know.* My bubble was burst while reading an article published in a state P.E. newsletter. There it was, staring me in the face. Well, maybe they stole it from me.

❖ *It is better to have character than be a character, but if you can accomplish both at the same time, why not?* (Maybe an original.)

❖ While attending the Illinois Section AWWA meeting in March, a friend who had attended a seismic presentation I gave 10 or 12 years ago reminded me of another Cronyism I used in that presentation. At that time, being about 50, I said, "I wish I were only one-half as smart as I thought I was when I was 25 years old." He said that his two daughters who recently graduated from engineering school had really brought that point home.

❖ Finally, although I have used pi for

over 50 years, I just read the *Indianapolis Star* that March 14—precisely at 1:59 p.m. (i.e. 3 14 159)—is celebrated as "Pi Day." I was also reminded in the article that pi is an irrational number. Dealing with round tanks most of my life, I have "just known" that a pretty close approximation to pi is 3.14159. Does that make me an irrational person?

Enough ramblings. This issue of TANK TALK contains a very important announcement concerning a very esteemed colleague joining the TIC team. What company's motto is "Making the best better"? We at TIC would like permission to use it.

Crone knoy@tankindustry.com

Chip Stein Young Engineer of the Year



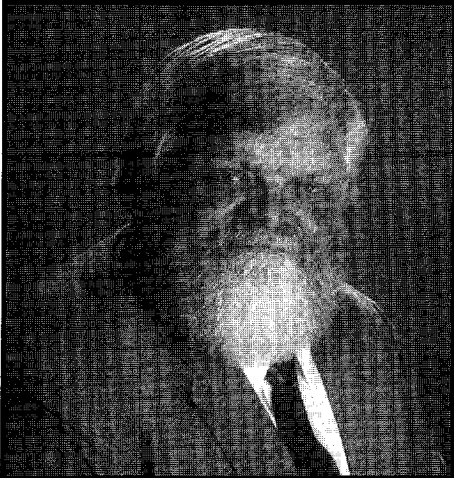
Gregory R. "Chip" Stein, Vice President Operations, TANK INDUSTRY CONSULTANTS, was named 1998 Young Engineer of the Year by the Indiana Society of Professional Engineers. His nomination will now be forwarded to the National Society of Professional Engineers for the nationwide award.

Candidates for the Young Engineer award are chosen based on professional achievements and civic and humanitarian activities.

Congratulations, Chip!

Please Join Us in Welcoming...

In TANK TALK 28 I explained that much of TIC's success has been achieved by concentrating on what we do best. Recently we were paid one of the highest compliments we could have received. **Stephen W. Meier, P.E., S.E.**, one of



Stephen W. Meier, P.E., S.E.
Vice President Engineering & Technology

the most highly regarded storage tank structural engineers in the world, has joined TIC. Steve comes to us after more than 22 years with CBI (Chicago Bridge & Iron Company). He is active on committees and is a member of the International Conference of Building Officials, the Structural Engineering Association of Illinois, the American Water Works Association, the Steel Plate Fabricators Association, the American Concrete Institute Committee on Concrete Pedestal Tanks, and the National Earthquake Hazards Reduction Program. Not only does Steve know and write the standards; he also possesses the ability to communicate very technical things in an understandable manner. His past several years have been spent in constantly upgrading seismic design standards for steel and concrete non-building structures. Having the industry "guru" in-house, available for a wide variety of projects, will be of great value to our clients and the industry as a whole.

After Steve had made his decision to join us at TIC, I asked him to tell me why he had made such a significant career

change after so many years with one company, when he was at the absolute peak of his profession. To this question, Steve wrote the following:

From a business viewpoint, I am excited about the potential of TIC to provide an increasingly valuable service to the community and industry through our ability to be closer to the clients' problems and developing practical, cost-effective solutions.

As a professional engineer, I am excited about the opportunity to apply my engineering expertise to help a broader range of owners, consultants, and contractors, especially as the problems relate to the special challenges found in the storage tank industry. Of particular concern to me personally are the difficulties facing many municipalities and owners when upgrading their non-building structures and storage tanks to meet the newly developing national seismic rules. I intend to continue to play a leadership role in developing these national and international standards to produce practical, cost-effective performance criteria.

Finally, and perhaps most importantly, I believe in the fundamental values that TIC was founded upon; to provide valued services to the public and our customers, and to continue to advance the principle of employee ownership. I consider these values to be essential ingredients to a successful endeavor.

To say that we at TIC are enormously pleased to have Steve with us would be very inadequate. With Steve's added expertise, our eyes have been opened to a wide variety of services we can expertly provide our clients. It is the dawning of a new day, a new era, at TIC. And all of us here are excited to reach out and embrace each new opportunity. Welcome, Steve, and thank you!

Crone Knoy

Steve Meier can be reached at
630/226-0745 - Chicago
317/271-3100 - Headquarters
meier@tankindustry.com

Concrete Tank Maintenance

Unfortunately, there is no "perfect" tank. While each type of tank has its own advantages and disadvantages, all tanks, whether constructed of welded steel, bolted steel, or concrete, require maintenance. If properly constructed, a concrete tank may require significantly less maintenance than a welded steel tank. However, without proper initial construction and routine maintenance, a concrete tank may require significant structural repairs or replacement prior to the end of its anticipated life.

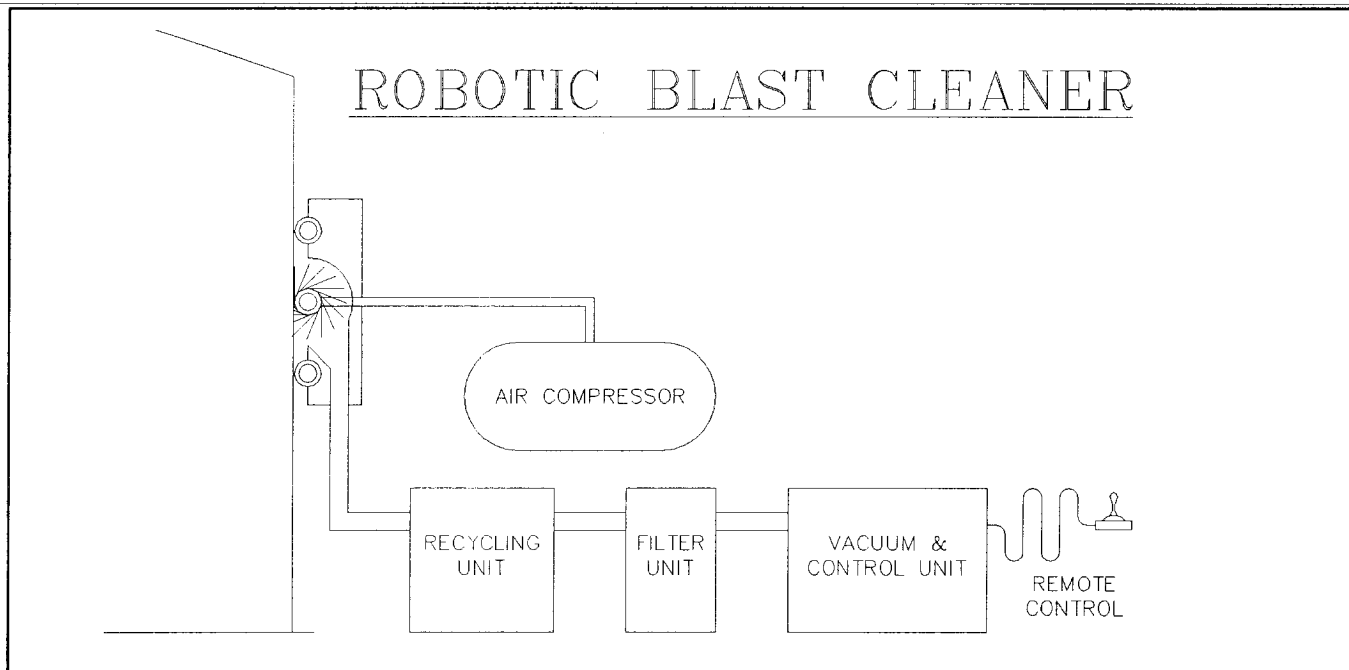
Routine Evaluations: The AWWA Standard D110 for concrete tank construction recommends routine evaluations of concrete tanks. These evaluations should, at a minimum, include a review of the concrete tank's exterior. This exterior evaluation should focus on any changes from previous evaluations.

Leaks in the tank should be located by visually assessing any cracking. Efflorescence (sometimes called calcium deposits) should be identified, and if there is significant cracking with efflorescence or spalling found, tank repairs may be needed. Also, check the ground around the tank for standing water or any evidence that the foundation backfill is being washed out. If any signs of leakage are noted, additional evaluation, including professional assistance, is needed.

If the person performing the routine evaluation can safely climb the tank, the evaluation should include a review of the tank roof. Proper operation of the vent should be verified and the screens checked for deterioration. The roof manhole should be evaluated for deterioration, and it should be confirmed that any access openings in the roof are securely locked. Overflow pipes, shell vents, ladders, and other tank appurtenances should also be evaluated for deterioration.

5 Year Evaluations: In addition to the routine evaluations, every 5 years—or more frequently if warranted—concrete tanks should be thoroughly evaluated. This more detailed evaluation should include evaluating the tank interior. Once again, one of the most important aspects

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The equipment required only one person to operate it. Emissions were kept to a minimum, and the equipment was very quiet and performed well on smooth surfaces. In order to use the robot blasting equipment on the interior of the tank, holes were cut in the roof to support the steel I-beams required for the unit. The surface to be blast cleaned had to be relatively clean in order for the magnets that hold the unit to the steel to adhere properly. Pack rust, grease, and other foreign substances had to be removed from the steel before using the robot blast equipment. Large and uneven vertical or horizontal welds also created problems for the magnets which held the device to the steel.

The reports from these technicians contain some of the negative aspects of these two variations on robotic abrasive blasting; however, the advantages far outweighed the problems encountered. Both projects were completed without budget, environmental, or worker-safety problems. TIC plans to continue to specify this and other innovative technologies as the contractor base continues to develop sufficient capabilities in their utilization. We will continue to update you on viable new technology as it becomes available.

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of this evaluation should be the review of any changes from previous evaluations, or any cracking or spalling found. In conjunction with the interior evaluation, the tank should be washed out to remove all sediment and other deposits that may have accumulated since the last tank washout. At the completion of the evaluation, the tank should be disinfected and the water tested in accordance with AWWA standards and state requirements prior to placing the tank back on line.

Typical areas of deterioration: Areas which typically show deterioration are the exterior shell-to-roof connection; the interior floor-to-shell connection where the water stop is located; and the interior roof. These areas should be closely evaluated for signs of deterioration or leakage. Our observations indicate that the reinforcing in

concrete corrodes when exposed to the chlorine vapors present in most water tanks.

What should be done if problems are found? Determining whether the cracking is superficial or structural requires significant expertise. There are substantially different repairs for each type of problem. Associated with each of these different repairs is a wide variety of costs. Therefore, specifying and designing the appropriate repairs is imperative for not only the success of the project, but also for the assurance that project costs are appropriate.

Concrete tanks can provide decades of service to your waterworks system. However, like tanks constructed of other materials, these tanks do require maintenance in order to fulfill their anticipated service life.

daugherty@tankindustry.com

Antenna Installation

We've received a large number of phone calls concerning our Summer 1997 *Tank Talk* feature article, "Antenna Installation on Water Tanks." It seems that more and more cellular companies are looking at tanks as a way to solve their land acquisition problems—and more tank owners are considering leasing space on their tanks due to the potential financial gain.

Many of the "pros" and "cons" of antenna installation on tanks were discussed in the article. Since then, we have gathered still more data on all aspects of antenna installation and have developed a "negotiation checklist" to assist our clients in developing contracts with cellular companies.

For more information about antenna installation, contact Bill Daugherty at:

317/271-3100

or via e-mail

daugherty@tankindustry.com.