

# TankTalk

## Antenna Installation on Water Tanks

By: Jeffrey S. Marlett, P.E.

Have you been contacted yet by one of the cellular phone carriers in your area? No, not trying to sell you cellular phone service--but trying to lease space on your water tower to install their antennas. If you haven't been contacted yet--don't worry--it's most likely just a matter of time before they'll be in touch.



Antenna installations can be concealed as on the roof of this multi-column tank. Photo courtesy of Stealth Network Technologies.

Chances are you may already have some type of communication antenna on your tank. If you do, this could be good--or it could be bad. Cellular antennas on water towers can be a great source of revenue for you, the local water utility. TIC is aware of cellular phone companies who are currently paying anywhere from \$2,400 to \$36,000 per year for the privilege of renting space on water towers. On the other hand, if the antenna is not properly designed and installed, the operation and maintenance of your water tank can be severely hampered.

While the advantage to the water utility of having antennas installed on a water tank is primarily financial, cellular companies have several reasons for wanting to rent space on your water tower. With increasing NIMBY (Not In My Back Yard!!) concerns, cellular carriers are looking for existing structures to attach antennas to rather than building their own towers. This option also saves them money in land acquisition and tower construction costs, as well as future maintenance costs. Some utilities are constructing new

tanks with the intent of providing access and points of attachment for initial or future antenna installation and service. However, as with everything else in life, there is a right way and a wrong way to do it, and a poor cellular antenna installation can create problems for the tank owner which can easily outweigh the potential financial advantages.

At TIC, we evaluate hundreds of tanks each year, and some of the typical problems we encounter when antennas have been installed improperly include:

- Openings cut in the roof compromise the sanitary integrity of the tank contents.
- Cables improperly mounted to ladders, across access openings, or on platforms create OSHA and safety-related deficiencies.
- Cables, mounting devices, antenna brackets, and the antennas themselves can hamper access to vents and manholes.

In addition to the sanitary and safety deficiencies caused by improper antenna installation, there are also problems created which can impede or prevent future maintenance of the tank.

- Improper (or unperformed) touch-up painting after the antenna is installed can lead to premature coating failure on the interior and exterior of the tank.
- Cables, antennas, and mounting devices placed too close to the tank and appurtenances can make it difficult, if not impossible, to clean and paint behind them.

There are also structural problems that can be caused by antenna installation.

- Improper cable penetrations can cause damage to your tank.

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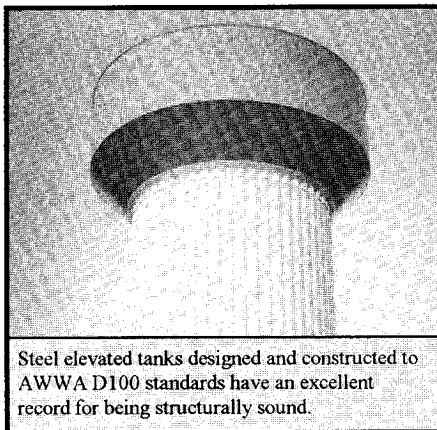
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## Chairman's Corner

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

When I began my water tank engineering career in 1960, the American Water Works Association (AWWA) Standard D100, "Steel Tanks-Standpipes, Reservoirs, and Elevated Tanks for Water Storage," was only 25-years old, yet it was the bible for steel tank design criteria. As a young engineer, D100 appeared to me to rather thoroughly set forth the necessary design criteria for standpipes, reservoirs, and tower-supported tanks. However, some questions left unanswered by the standard were the connections of the tower posts to the tank, and the distribution of the loadings to the container through the use of an exterior balcony or an interior or exterior girder.

As I designed single-pedestal elevated tanks, I thought that the standard was pretty definite about applying the Board-



Steel elevated tanks designed and constructed to AWWA D100 standards have an excellent record for being structurally sound.

man formula (a tabulation of which was in Table 8 of the D100 Standard) to design conical and double-curved supporting tubular members. My assumptions were confirmed by comparing my designs with those of competing firms. Although there were no dimensional tolerances given in the AWWA standard, I have heard of no failures of tanks designed using the Table 8 criteria for cones. My presumption is that this excellent track record was due to the very conservative nature of the design criteria.

In the late 1970's, research done by NASA concerning cones in compression came to light and some designers attempted to incorporate these findings into

elevated tank designs, paying little attention to the fact that the NASA research was done assuming "nearly perfect" cones, that is, little deviation from the intended contour of the cones. I continued to design cones in compression like cylinders in compression, and had no failures or even near misses in my design career. In the middle 60's, I had occasion to see a new tank constructed by a competitor with little regard for the local buckling criteria set forth in the D100 Standard. The tank survived the initial filling; but later, after painting, the tank failed, falling across the home and grocery store of the town board president. As late as in the 1990's, we saw cones on single pedestal tanks fail that were designed from textbook theory alone.

The recently released revision of the D100 Standard (D100-96) clarifies the intent of the standard and allows for the use of higher stress levels (thinner plates), but also requires that certain dimensional tolerances be held. Presently, the draft of AWWA D170, "Standard for Composite Tanks for Water Storage," includes the D100-96 design criteria plus options for partial and more complete pressure stabilization of those cones and double-curved members in compression. This concept will likely be utilized in a future update of the D100 Standard; however, it appears that some fabricators are presently designing water-filled cones using this proposed D170 (Composite Elevated Tanks) criteria. Utilizing these thinner plates will necessitate even more measurement and testing than with the recently introduced D100-96 buckling standard design criteria. (A more detailed article concerning the changes in D100-96 will be featured in the next issue of Tank Talk.)

AWWA has always supported the philosophy of utilizing the best available technology to provide clean, safe drinking water to the public. I believe that the intent of AWWA standards is to also consider the safety and welfare of those living near water utility infrastructure such as storage tanks. When weighing the value of human life, should we opt to build

tanks of less than maximum safety at a savings of a few thousand dollars? I do believe that the approach the D100 Task Force has taken is good, and I can agree with the proposed wording in D170 for the next update of D100. I do, however, think that the tank specifier should look at the ramifications of new design techniques and recognize that if they are used, we must be aware of the increased need for adequate quality control in order to construct the tank to the tolerances required to meet the less conservative design criteria.

My hat is off to the dedicated members of the D100 Welded Steel Tank Revision Task Force and the members of the Steel Elevated Tanks, Standpipes & Reservoirs Committee who have worked tirelessly to see that a workable, safe standard has been developed and maintained. These design criteria are not based solely on research, theory, or computer simulation—but are confirmed by real-world, full-scale model testing conducted by the companies employing these task force and committee members. And as a result of their efforts, steel elevated tanks designed to these standards are extremely safe and have an excellent record for safely providing water for the communities they serve. My hopes are that other welded steel tank standards developed by AWWA will have the same common-sense approach used in their development.

*Crone*

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Tank Talk® is published as an informational service to Owners and Engineers of storage tanks by

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Penni Snodgrass, Technical Editor

## Water Tank Design & Maintenance Seminars

"Good mix of information."

"Great job. Very thorough and organized. Information essential to anyone involved with water utilities."

"Real world examples made for an informative and interesting seminar."

"I received a significant amount of new guidance and some old guidance revised and updated and reinforced."

Comments like these are the reason TANK INDUSTRY CONSULTANTS continues to host water tank seminars throughout the United States. City engineers, engineer associates, project managers, design engineers, consultants, tank owners, operations engineers, maintenance personnel, utility managers, rural water circuit riders, and utility regulators are but a few of the hundreds of people in the water tank industry who have attended past TIC seminars.

We are now into our 13th year of presenting tank-related seminars. The first year we hosted 3 two-day seminars at our headquarters office in Indiana. The next year we expanded the program to include additional regional sites—and this year we will host a total of nine seminars in nine different cities. This year's seminars are literally coast-to-coast and border-to-border.

Through the years we have explored many seminar formats and topics, but it appears that our current one-day "Water Tank Design & Maintenance Seminar" is the most popular yet. Covering all of the information included in this seminar in just one day is a challenge for both the TIC presentation staff and the attendees, but we have found that most attendees prefer this intense program over the loss of work time and increased cost of being away from the office for an additional day.

### Up-Coming Seminar Schedule

After completing five very successful seminars in Tennessee, Texas, Indiana, New Jersey, and North Carolina this past January and February, this summer, we will be presenting seminars at four all-new sites:

Las Vegas, NV  
Las Vegas Crowne Plaza  
Monday, July 28th

Seattle, WA  
Seattle Marriott Sea-Tac Airport  
Wednesday, July 30th

Columbus, OH  
Radisson Hotel Columbus North  
Tuesday, August 12th

Albany, NY  
Albany Marriott  
Thursday, August 14th

The fee for this seminar is \$295. This fee includes the seminar binder and outline, the new AWWA D100-96 Standard, lunch, and breaks. Registrant check-in begins at 8:00 a.m. the day of the seminar, the seminar starts at 8:30 a.m., and it concludes by 5:00 p.m. The seminar schedule includes ample opportunity to network with fellow attendees and the TIC teaching staff. Your comments and questions are encouraged throughout the seminar--both in the seminar classroom and during breaks.

For more information about the upcoming seminars, contact

TIC Seminar Coordinator,  
Linda Withner,  
1-800-TANK SEM  
info@tankindustry.com

## Tank Tips

Warm summer evenings--perfect for enjoying an outdoor concert, catching fireflies, playing hide-and-seek with your kids...or checking the lighting on your water tank and site.

Make it a part of your summer tank maintenance program to verify the proper operation of any obstruction lighting on your tank and all site security lighting. Don't forget the lighting on the interior dry portion of your tank. Replace burned-out or broken bulbs, verify that fixture safety guards or globes (where required) are in place, and check to make sure that all electrical wiring is intact and properly encased in conduit. If you do not have a photoelectric cell on your obstruction lighting, make plans to have one installed to help reduce the cost of bulb replacement and electrical usage.

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All year long--but especially before summer's annual increase in the insect and bird populations--check the sanitary safeguards on your tank. Overflow pipes should be properly screened and the flap gate hinged cover aligned to close off the pipe completely. All vents should be adequately screened. Roof vents should be designed with pressure and vacuum relief pallets to facilitate tank ventilation during periods of rapid fill or withdrawal if the insect screening is clogged. Cathodic protection hand hole cover plates should be properly positioned to completely seal the opening, and any other roof openings should be screened or seal welded shut. And while you're up on the tank checking the vent, make sure that all roof hatches are securely locked to help prevent your tank from becoming the local teens' favorite swimming hole. Believe it or not--it happens!

**Crone Knoy Elected to Industry Boards:** E. Crone Knoy, founder and Chief Executive Officer of TANK INDUSTRY CONSULTANTS, INC., has been elected to continue as a member of the Board of Governors of SSPC: The Society for Protective Coatings. He will also continue as the SSPC liaison representative to the NACE International Board of Directors. TIC representation on various industry boards, task groups, and committees helps assure our customers that they will have the advantage of the latest information available within the industry. It is hoped that through activities with AWWA, SSPC, and NACE, cooperation on common issues such as standards development and training can be attained.

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- ♦ Improperly mounted brackets or antennas can create a potential liability should high winds, ice loading, seismic activity, or other similar events cause the installation to fail, damaging the tank or surrounding property, or endangering individuals.
- ♦ Brackets screwed directly into tubular columns can cause interior column corrosion.
- ♦ Improperly designed brackets can buckle the tank during high winds.

Most cellular companies have installations designed by their own engineers or consultants. However, our experience is that most designers and installation contractors have little experience with water tank design and maintenance. Therefore, simple items to prolong the life of the coating system or avoid potential sanitary, structural, or safety problems are often overlooked. While we're not suggesting that you take over the design responsibilities, it is prudent to have all plans, designs, and drawings reviewed by someone looking out for your interests and the proper upkeep of the tank. The following list contains some of the more important items which should be checked for in the plans and designs before installation:

- ♦ All work must be properly scheduled. For example, surface preparation and touch-up painting should be performed after installation.
- ♦ Tank penetration and reinforcement requirements must be adhered to.
- ♦ The size and location of cable support and mounting brackets should be reviewed.
- ♦ Welding requirements, procedures, and acceptance criteria should be clearly stated.
- ♦ The location and placement of cables should be verified to prevent sanitary, safety, or personnel hazards.
- ♦ The location and placement of cables and antennas should be designed to reduce interference with future cleaning and painting operations.
- ♦ The procedures for surface preparation and touch-up painting of damaged areas (inside and out) should be established.
- ♦ Pertinent industry standards should be adhered to in completing all work.

Additionally, you should require site visits by the designer of record. Ideally, you would want periodic site visits to verify the work is being properly performed throughout the installation. At a minimum, a final site visit needs to be performed to check the installed product against the plans and drawings.

Allowing cellular antennas to be mounted on your water tower can be a win-win situation, providing the installation is properly performed. You get the benefit of additional revenues, and the cellular companies get a low initial cost, minimal maintenance location to mount their antennas.

Ever since cable TV, satellite communication, emergency communication systems, and microwave dishes became prominent in the late 70's, TIC has played several roles in protecting the interests of the utility owner by reviewing submittals and providing guidelines, designs, and construction observation for antenna and dish installation. The first step in the design process should be to look at the tank and evaluate it for feasibility of the installation proposed. Contact us if you have any questions concerning this "new" use for steel tanks.

*Jeff Marlett is Regional Manager of TIC's office in Dallas, Texas. A graduate of Rose-Hulman Institute of Technology, Jeff is responsible for client liaison activities and project management in the Southwest region of the United States, and is a Registered Professional Engineer and NACE Certified Coating Inspector. Jeff can be reached at: 972/719-2507.*

## Lead Update

For years we have tried to keep you up-to-date on the latest information concerning the presence of lead and other heavy metals in the coatings to be removed from steel structures. The risks and worries concerning lead removal have somewhat settled down due to a better understanding of the regulations, contractor familiarity with new techniques, and the development and availability of new equipment and methods. Some of the products and trends we see as being significant are:

- ♦ Reusable abrasives, the use of which minimizes the amount of hazardous material to be disposed of, and reduces the costs of abrasives.
- ♦ Better abrasive reuse equipment, including mechanical delivery of the abrasive to the steel instead of using air to propel it.
- ♦ Better contractor and operator training.
- ♦ Use of dehumidification equipment to speed up and increase the quality of interior cleaning and coating.
- ♦ Owners recognizing that having lead on their structures is not necessarily a problem which needs to be abated immediately. Leaving the lead-containing coating on the structure can even enhance the life-cycle cost.
- ♦ Increased expertise in containment methods.

Much of the practical lead coating removal and disposal problem solving we've noted can be attributed to the job that SSPC and its publication, *JPCL*, have done disseminating the information and educating structure owners and contractors.

## Did you know?

...that if a person drank two gallons of water a day for eighty years with the maximum amount of lead allowed by the EPA and all the lead was retained in this person's body; that at the end of eighty years the amount of lead in this person's body would weigh less than the little circle removed from punching a hole in a piece of paper?

*Our thanks to the Clifton (CO) Water District newsletter, "Water Line," for this information*