by Dan Knupp

Antennae mania

Safety and maintenance become renewed issues of concern for utilities as they consider agreements with telecommunications (telecoms) or other companies to site antennae on their water storage tanks. There are significant revenues involved. Although the extra revenues are universally welcome, it's best the utility follow a protocol that ensures no negative impact from antenna installations because there is a right way and many wrong ways to mount any exterior appendage to a facility tank. If done incorrectly, it may end up costing the utility more for maintenance and safety than received from the antenna lease.

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Cities and RWDs should remember that it is their storage tank and not the telecom's company tower. Professional planning input from the utility's point of view is essential to maintaining the integrity of the structure in serving the purpose of safe water storage. Severe problems have resulted from antenna installations that were poorly designed and constructed. Many telecom installers and their engineers view a tank as only a prime location for their antennae – they many times do not integrate what they are doing with the critical functions the tank serves and the purposes of the tank's design and engineering. Problems include:

- Damage to the structure,
- Interior and exterior coating damage resulting in corrosion,
- OSHA violations,
- Liability in accidents,
- Ice and snow loading,
- Sanitary concerns,
- Out-of-service down time,
- Potential for increased lightning strikes,
- Schedule for tank inspection and cleaning (many times the tank will need to be cleaned and disinfected after an installation),
- Separate electrical grounding is needed to prevent corrosion,
- RF exposure to workers,
- Security concerns due to telecom personnel accessing facility,
- Poor access to hatches,
- Access holes and ladders,
- Water supply contamination,
- Confined space safety considerations,
- Obstacles and extra costs to future painting and maintenance, and
- Negative aesthetics.

On the utility's behalf, a qualified engineering firm with antenna and tank experience should review the conceptual plan and conduct a walk through inspection of the site with telecom representatives.

A protocol to sidestep problems

The telecom firm and their engineer should provide fully illustrated conceptual plans of the entire installation including technical descriptions of project details. On the utility's behalf, a qualified engineering firm with antenna and tank experience should review the conceptual plan and conduct a walk through inspection of the site with telecom representatives. The final report from the utility engineer should include welding specs, coating specs and a structural analysis detailing the tank's weight support capacity. The report also should verify that all federal, state, and local laws are being met,

This Kansas tower's sheer number (49) of antennae mounts and cable bundles make maintenance and painting hazardous and costly. Also, the number of RF sources could present a health hazard for workers.

including FAA height restrictions, guidelines and lighting requirements. The utility's engineer should follow the process through revisions and change orders. Every contract and facility plan will be different. Final inspection of completed work for confirmation of adherence to specs is the last step but it is recommended that a one-year anniversary inspection for verification that all work is performing to design specs be included in the contract. The American Water Works Association recommends utilities hire an attorney to write the contract on their behalf instead of using the telecom boilerplate version. Things to include in that contract are clauses to avoid litigation in the areas of liability or water quality should an issue arise.

Engineering fees

The engineering cost of the design review and inspection above should be negotiated into the contract and be paid for by the telecom. This is also good for the telecom because it assures them that everyone understands the importance of each other's equipment or property and that it will be properly installed or respected.

Check with a neighbor

With antenna installations becoming common throughout the state, neighbor systems hosting antennae could be a great resource to check regarding many concerns. These include future painting expenses, exclusivity clauses in the contract, cost-of-living adjustments, liability, access, security, length of contracts and many other legal or financial considerations.

Painting and cables

At regular intervals every tank requires minor painting or complete recoating or some procedure in between. With multiple antennae coaxial cable bundles ascending a structure, taking up space, the painting process becomes even more difficult. From the telecom point of view, valuable equipment needs to be protected and may require wrapping before a sandblasting or paint operation. The tank owner needs full access to ensure long-term maintenance and safety in the facility's operations. These kinds of considerations will increase a system's costs because contractors must factor cable protection, removal and reinstallation into many of their bids. Finding middle ground can be difficult. In some cases, paint repairs can only be completed during periods when water demand is low or they must wait for warmer weather. But now, both will require coordination with the telecom.

Cable routing is not just a problem for tank painting and recoating. Some installers route cables with a goal of making installations easier. This can restrict access to ladders, covers and hatches resulting in OSHA violations for ladder standards and confined space access.

Tank structure penetrations

The agreed upon conceptual plan also should identify the size, location and number of tank penetrations to be made. Placements of penetrations in certain areas of the tank require design considerations in order to ensure structural integrity. Major damage can occur with improper

This photo is of cable routing on the tank shown on the previous page. Cable bundles can give a vandal an easy way up.

reinforcement of penetrations through the base of spherical and fluted column tanks. Steel plate sections in most tank roofs are thinner than the side plates; too much weight can cause them to buckle. To avoid this, the antenna frame must be properly attached and reinforced. Some installation procedures may require draining or partial draining of the tank until completion. Penetrations affecting the tank's condensate ceiling should also be evaluated for a proper seal.

Welding damages coatings

Paint and coating damage result from the heat of the welding process both on exterior and interior surfaces. Although the exterior paint is usually touched up, interior paint which burns just as quickly as exterior, typically is ignored. Severe damage from corrosion occurs on the wet interior if damaged locations are not prepped and repainted with a quick-curing coating. These same coating surfaces are affected from cable bracket clamps, set screws and loose cables that move in the wind wearing away the coating.

Water supply contamination

Poor cable installation procedures if unchecked can leave a utility at risk of water supply contamination. Improperly sealed roof penetrations for routing cables, roof vents used as points of cable entry with vent screens removed for cable routing, and roof hatches left open by telecom workers can all cause water supply contamination.

Aesthetics should be another point of concern for a utility. A very visible image of a utility is the storage tank. If it is visually disrupted with an abundance of antennae mounts and paint blemishes, a utility's image may suffer. If different options are available for mounting designs and locations, operators or board members should review the telecom proposal with the finished project's appearance in mind. Mountings that can be made on the side of the tank less visible should be chosen. Paint that is damaged should be repaired and matched in color. Cable attachments should include guards to prevent access to the tank to keep vandals at bay.

RF exposure to workers

Electromagnetic fields caused by the radiofrequency output or RF from the antenna transmissions, may cause harm to maintenance workers working on the tank. The Federal Communications Commission has investigated RF and maintains that worker exposures are within norms if working around a single antenna. Multiple antennas pose a much higher level of RF and this has experts debating the problem at this time.

This dish antenna mounted on a tower leg could present a structural problem if unreinforced penetrations were made. The mount location however does not present ladder or catwalk access problems.

Including antenna revenue in the bottom line is like any other business consideration. There is no free lunch. Close attention paid to the planning and contracting process touched on by points in this article can help ensure the utility makes instead of loses money—and continues to own a tank that poses no danger to their customer's community water supply.

This article was compiled from publications of the American Water Works Association, the Minnesota Rural Water Association and previous articles from The Kansas Lifeline.

A contractor's observation

by James Brookshire

I recently read a post at the "Watering Hole," on KRWA's Web site message board, regarding placement of telecom equipment on water towers and standpipes. As a water tower contractor, I agree that these items are a nuisance, especially if they are placed or mounted incorrectly. That being said, I am strongly in favor of any city or water district utilizing their towers to generate income. This is an excellent way to pay for maintenance and upkeep on their towers. However the things that most cities or RWDs fail to realize is that if these items are placed at the wrong location or incorrectly attached, they can not only damage or prematurely deteriorate coatings, they can also pose structural or safety hazards to the tank itself. When this happens it adds considerably to the cost of maintaining or renovating the tank, and cities or districts rarely receive proper compensation for allowing these companies to place equipment on their towers. Free Internet service doesn't even come close.

What our company has seen

Recently our company renovated a tower in Arkansas that had numerous antennae, coaxial cables and a remote television camera attached to the exterior. The annual income received by the city was less than $2,000 per year. The cost to renovate the tank with these items attached added more than $35,000 to the cost of renovating a similar tank without them. We have seen this scenario many times before. Although most tanks or towers in Kansas do not have the sheer number of accessories that the Arkansas tower had, one antenna with coaxial cable does add to the cost of maintaining the tank. In most cases, the cost to benefit ratio is usually too high.

Many times we see antennae attached directly to the tank's ladder. This is strictly taboo. For example while working on an elevated tank in Kansas several years ago, a large triangular antenna approximately 30 feet in length was attached to the tank's balcony-to-roof ladder. It completely covered the ladder. The only way to access the roof was to actually climb the antenna. These kinds of incorrect mountings cause the contractor's price to go up.

In the case of a larger antenna, as it moves in the wind, it can "work harden" the ladder support brackets, causing them to break. We have had to repair this problem more than any other, not to mention the fact that any obstruction on a ladder makes it difficult and dangerous to climb. I have also seen antenna damage a tank roof. The steel thickness of a tank roof is generally not sufficient enough to support the constant movement of a windblown antenna.

Poor installation methods

Unrestricted, a telecom company will typically install equipment at the point most easily accessible. On a standpipe, it's the ladder or roof; on an elevated tank, it could be on one or all of the tank ladders, legs or support struts. Other spots are the balcony railing or the roof. Elevated tanks tend to be more attractive to telecom companies because of these multiple locations.

This tank has two antennae. The left is mounted on the rail at the ladder and the other on the catwalk rail making access hazardous. At least it is symmetrical, giving it a pair of ears.

I have seen coaxial cable attached to the tank with nothing more than electrician's tape or coatings removed to bare metal from cables simply hanging freely. On several other occasions we saw multiple cables attached to a ladder that rendered it virtually impossible to climb.

Something else for cities and water districts to consider is that if telecom equipment becomes damaged, who is liable – the equipment owner, the tank owner, or the contractor working on the tank?

Our recommendation

The best advice I could give a utility board or operator is that if a city or water district is approached about placing telecom equipment on the water storage tank, get an independent professional opinion about proper location and placement. A professional engineer can offer some advice, but most have little or no experience in dealing with this type of situation. Almost all tank and tower contractors will offer free advice or assistance. The tank does not belong to the telecommunications company; it is yours! Be sure they are doing things the way that you want them done.

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