How Many Antennas Are Too Many?

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Introduction

Multiple provider antenna systems on the same tank is commonplace today.

How can a tank owner know before there are too many antennas?

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Most existing water tanks were not designed to support antenna equipment. At some point, too many antennas can overload the tank or make it unsafe.
AWWA D100 Provisions for Antennas

- General
- Health and Safety
- Workmanship
AWWA D100 Provisions for Antennas

General

- Assess structural condition
- Distribute loads to prevent structural distress
- Limit application of epoxy & stud welding
- Mount antenna cables properly
- Installation must comply with FAA requirements
- Installation details must prevent corrosion damage
AWWA D100 Provisions for Antennas

Health and Safety

- Radio frequency exposure of personnel
- Proper disinfection if entry to tank is required
- Check for hazardous materials in coatings
- Access to antennas must satisfy OSHA regulations
- Antenna equipment must not obstruct ladders, access openings, or vents
AWWA D100 Provisions for Antennas

General Workmanship

- Antenna equipment must not obstruct ladders, access openings, or vents
- Holes cut must be properly reinforced
- Multiple penetrations should be done one at a time
- Adequate clearance must be provided for welder access
Other Antenna Equipment Standards

TIA/EIA-222-G, “Structural Standards for Steel Antenna Towers and Supporting Structures”

- Intended for structures that are dedicated to antenna and communications equipment support
- Uses same or equivalent engineering codes and standards as tank standards (AWWA, API, e.g.) for loads and design methods
Structural Considerations

- What is the structural condition of the tank and foundation?
- What are the effects of the existing and proposed new antenna equipment loads on the tank and foundation?
- Acceptance criteria for antenna equipment loading should be based on current tank standards.

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Structural Condition of Tank/Foundation
Structural Considerations

- Amount of antenna equipment a tank will support is limited by design/construction of tank and foundation.
- Additional antenna equipment may result in localized overstress, distortion, or general instability of the tank – or any combination of these.
Cumulative Effects of Antenna Equipment

- BARE TANK
- 1st ANTENNA INSTALLATION
- 2nd ANTENNA INSTALLATION

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Wind Loads

- Multiple Antenna Systems
  - Greater increase in loads
  - Stress on anchorage system
  - Cumulative effect
Effects on Structural Integrity of Tank

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Effects on Structural Integrity of Tank
When Are There Too Many Antennas?

- When structural modifications are necessary to reduce stress to acceptable levels.
- When antenna weight and wind loads cause distortion of tank components.
- When overturning stability exceeds acceptance criteria of current industry standards.
When Are There Too Many Antennas?

- When cumulative amount of antenna equipment, including cables, prevents:
  - Safe access to ladders, access openings, etc.
  - Proper maintenance of tank interior and exterior coatings
Effects on Access for Maintenance

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Effects on Access for Coating

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What Should a Tank Owner Expect?

- A functional, reliable installation that is easy to maintain and does not interfere with the operation or maintenance of components of the tank on which the antenna equipment is mounted
- Proper planning, execution, and verification of the antenna installation is performed
Planning

- Perform structural evaluation to determine the condition of the tank and foundation & assess any deterioration
- Will antenna equipment installation overload the tank or foundation?
- Will antenna equipment installation interfere with operation or maintenance of the tank?
- Structural evaluation & design review should be performed by 3rd party professional engineer (P.E.)
Antenna service provider must provide detailed plans & specifications for all proposed new antenna equipment.

All existing antenna equipment must also be considered.
Detailed Plans & Specifications

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Information Required for Analysis

- Drawings from Proposed Installer
  - Layout and dimensions
  - Weight of equipment
- Site Evaluation
  - Measurements of existing equipment locations
  - Photographs
  - Datasheets of installed equipment
Execution

- Antenna equipment installation should not commence until structural, safety, and maintenance issues have been resolved.
- Installation should be performed by qualified contractors.
- Installation should be in strict accordance with final plans and specifications certified by P.E.
Verification

- Installation work should be verified by 3\textsuperscript{rd} party inspection company or P.E. to ensure compliance with final plans & specifications
- Any non-compliance should be corrected to satisfaction of tank owner and 3\textsuperscript{rd} party P.E.
Structural Inspection/Field Verification

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Summary

Careful planning, execution, and verification of antenna equipment installations will enable the tank owner to maximize the amount of antenna equipment a tank can support without harmful effects on the structural integrity, safety, and maintenance.
Questions or Comments?