

# R309-545 Facility Design and Operation: Drinking Water Storage Tanks

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## **R309-545. Facility Design and Operation: Drinking Water Storage Tanks.**

### ***R309-545-1. Purpose.***

The purpose of this rule is to provide specific requirements for public drinking water storage tanks. It is intended to be applied in conjunction with other rules, specifically R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that facilities are reliably capable of supplying water in adequate quantities, which consistently meeting applicable drinking water quality requirements and not posing a threat to general public health.

### ***R309-545-2. Authority.***

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code, and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

### ***R309-545-3. Definitions.***

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

### ***R309-545-4. General.***

Storage for drinking water shall be provided as an integral part of each public drinking water system unless an exception to the rule is approved by the Director. Pipeline volume in transmission or distribution lines shall not be considered part of any storage volumes.

### ***R309-545-5. Size of Tank(s).***

Storage tanks shall be sized in accordance with the required minimums of R309-510.

### ***R309-545-6. Tank Material and Structural Adequacy.***

#### **(1) Materials.**

The materials used in drinking water storage tanks shall provide stability and durability as well as protect the quality of the stored water. Steel tanks shall be constructed from new, previously unused plates and designed in accordance with AWWA Standard D100-11.

#### **(2) Structural Design.**

The structural design of drinking water storage tanks shall be sufficient for the

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environment in which they are located.

*Guidance: Division review of plans and specifications for storage tanks does not include an evaluation of structural suitability. Certification of structural adequacy may be requested from the design engineer before approval is granted.*

## **R309-545-7. Location of Tanks.**

### **(1) Pressure Considerations.**

The location of the tank and the design of the water system shall be such that the minimum working pressure in the distribution system shall meet the minimum pressures as required in R309-105-9.

*Guidance: The expected water level variation in the tank should be taken into account when considering minimum and maximum distribution system pressures. The maximum variation between high and low water levels in storage tanks that provide pressure to a distribution system should not exceed 30 feet.*

### **(2) Connections.**

Tanks shall be located at an elevation where present and anticipated connections can be adequately served. System connections shall be placed at elevations such that minimum pressures, as required in R309-105-9, will be continuously maintained.

### **(3) Sewer Proximity.**

Sewers, and similar sources of possible contamination shall be kept at least 50 horizontal feet from the tank.

### **(4) Standing Surface Water.**

The area surrounding a ground-level or buried drinking water storage tank shall be graded in a manner that will prevent surface water from standing within 50 horizontal feet of the tank.

### **(5) Ability to Isolate.**

Drinking water storage tanks shall be designed and located so that they can be isolated from the distribution system. Storage tanks shall be capable of being drained for cleaning or maintenance. Where possible, tanks shall be designed with the ability to be isolated without loss of pressure or service in the distribution system.

### **(6) Earthquake and Landslide Risks.**

Potential geologic hazards shall be taken into account in selecting a tank location. Earthquake and landslide risks shall be evaluated.

*Guidance: The design may include special shut-off or isolation valves designed to react*

*in the event of an earthquake.*

## **(7) Security.**

The site location and design of a drinking water storage tank shall take into consideration security issues and potential for vandalism.

*Guidance: Fencing is advisable where the tank is highly accessible to the public or livestock. Where electricity or telemetry is available, consideration should be given to the installation of electronic security equipment.*

## **R309-545-8. Tank Elevation and Burial.**

### **(1) Flood Elevation.**

The bottom of a ground-level or buried drinking water storage tank shall be located at least 3 feet above the 100-year flood level or the highest known maximum flood elevation, whichever is higher.

### **(2) Ground Water.**

When the bottom of a drinking water storage tank will be placed below the normal ground surface, it shall be placed above the local ground water table.

*Guidance: It is recommended that a french drain system be considered around any buried storage tank, but especially if the ground water table elevation is unknown or may exhibit seasonal variations.*

### **(3) Covered Roof.**

When the roof of a drinking water storage tank will be covered by earth, the roof shall be sloped to drain toward the outside edge of the tank.

## **R309-545-9. Tank Roof and Sidewalls.**

### **(1) Protection From Contamination.**

All drinking water storage tanks shall have suitable watertight roofs and sidewalls that shall also exclude birds, animals, insects, and excessive dust.

### **(2) Openings.**

Openings in the roof and sidewalls shall be kept to a minimum and shall comply with the following:

- (a) Any pipes running through the roof or sidewall of a metal drinking water storage tank shall be welded, or properly gasketed. In new concrete tanks, these pipes shall be connected to standard wall castings with seepage rings that have been poured in place. Vent pipes, in addition to seepage rings, shall have raised

concrete curbs that direct water away from the vent pipe and are formed as a single pour with the roof deck. Roof drains or any other pipes, which may contain water of lesser quality than drinking water, shall not penetrate the roof, walls, or floor of a drinking water storage tank.

(b) Openings in a storage tank roof or top, designated to accommodate control apparatus or pump columns, shall be welded, gasketed, or curbed and sleeved as above, and shall have additional proper shielding to prevent vandalism.

***Guidance: Valves and controls should be located outside the storage tank so that the valve stems and similar projections will not pass through the roof or top of the tank.***

### **(3) Adjacent Compartments.**

Drinking water shall not be stored or conveyed in a compartment adjacent to wastewater when the two compartments are separated by a single wall.

### **(4) Roof Drainage.**

The roof of all storage tanks shall be designed for drainage to eliminate water ponding. Parapets, or similar structures, which would tend to hold water and snow, shall not be allowed/permitted unless adequate waterproofing and drainage are provided. Downspout or roof drain pipes shall not enter or pass through the tank.

## ***R309-545-10. Internal Features.***

The following shall apply to internal features of drinking water storage tanks:

### **(1) Drains.**

- (a) A means shall be provided for the draining of drinking water storage tanks.
- (b) Where possible, the drain shall be separate from the outlet pipeline. If a tank drain line is provided, it shall be sloped for complete drainage.
- (c) The drain shall not discharge to a sanitary sewer.
- (d) If local authority allows discharge to a storm drain, the drain discharge shall have a physical clearance of at least 12 inches between the discharge end of the pipe and the overflow rim of the receiving basin.

***Guidance: A “means” to drain the storage tank can include a separate drain line, the ability to drain through a downstream hydrant or at a location with a significant elevation difference from the tank floor, or pumping out the water. It is recommended that the drain line be screened with No. 4 screen.***

## **(2) Internal Catwalks.**

Internal catwalks, if provided and located over the drinking water, shall have a solid floor with raised edges. The edges and floor shall be designed so that shoe scrapings or dirt will not fall into the drinking water.

## **(3) Inlet and Outlet.**

(a) To minimize potential sediment in the flow from the tank, the outlet pipes from all tanks shall be located in a manner to provide a silt trap prior to discharge into the distribution system.

(b) Inlet and outlet pipes shall be configured to provide mixing and circulation.

*Guidance: Internal baffling, special spray nozzles, bends, or mixing valves may also be needed in order to minimize the possibility of short circuiting through the tank depending on the size and shape of the tank and the flow.*

## **(4) Tank Floor.**

The floor of the storage tank shall be sloped to permit complete drainage of the structure.

### ***R309-545-11. Internal Surfaces and Coatings***

#### **(1) ANSI/NSF Standard 61 Certification.**

All interior surfaces and coatings shall comply with ANSI/NSF Standard 61 or other standards approved by the Director. This requirement applies to any pipes and fittings, protective materials (e.g., paints, coatings, concrete admixtures, concrete release agents, or concrete sealers), joining and sealing materials (e.g., adhesives, caulks, gaskets, primers and sealants) and mechanical devices (e.g., electrical wire, switches, sensors, valves, or submersible pumps) that may come into contact with the drinking water.

#### **(2) Curing Procedures and Volatile Organic Compounds.**

(a) Proper curing procedures shall be followed per manufacturer's directions, including curing time, temperature, and forced air ventilation. Drinking water shall not be introduced into the tank until proper curing has occurred.

(b) It shall be the responsibility of the water system to assure that no tastes, odors, toxins, or contaminants that result in MCL exceedances, are imparted to the water as a result of tank coating or repair.

(c) Prior to placing a drinking water storage tank in service, cleaning, disinfection, and flushing procedures shall be completed.

(d) Prior to placing a drinking water storage tank in service, an analysis for

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volatile organic compounds from water contained therein may be required to verify compliance with drinking water maximum contaminants levels.

*Guidance: If any volatile organic compounds are detectable, increased monitoring may be required in accordance with R309-205-6(2)(j)*

### **R309-545-12. Steel Tanks.**

#### **(1) Paints.**

Proper protection shall be given to all metal surfaces, both internal and external, by paints or other protective coatings. Internal coatings shall comply with R309-545-11.

#### **(2) Cathodic Protection.**

If installed, internal cathodic protection shall be designed, installed and maintained by personnel trained in corrosion engineering.

*Guidance: Cathodic protection should be considered if an external structure, such as a communication tower, is added to the tank.*

### **R309-545-13. Tank Overflow.**

All water storage tanks shall be provided with an overflow that discharges at an elevation between 12 and 24 inches above the ground surface or the rim of the receiving basin. The discharge shall be directed away from the tank and shall not cause erosion.

#### **(1) Diameter.**

Overflow pipes shall be of sufficient capacity to permit waste of water in excess of the filling rate.

#### **(2) Slope.**

Overflow pipes shall be sloped for complete drainage.

#### **(3) Screen.**

Overflow pipes shall be screened with No. 4 mesh non-corrodible screen installed at a location least susceptible to damage by vandalism.

#### **(4) Visible Discharge.**

Overflow pipes shall be located so that any discharge is visible.

#### **(5) Cross Connections.**

Overflow pipes shall not be connected to, or discharge into, any sanitary sewer system.

## **R309-545-14. Access Openings.**

Drinking water storage tanks shall be designed with reasonably convenient access to the interior for cleaning and maintenance.

*Guidance: When considering what is reasonably convenient, it may be necessary for one individual to open the access. The access should be hinged at one side, and counter-weighted if the lid is in excess of 60 pounds. The safety of the operator should be considered when designing and locating access openings. Factors to be considered should include the placement of the locking mechanism, the location of the hinges for the hatch, etc.*

### **(1) Height.**

There shall be at least one opening above the level of the overflow, which shall be framed at least 4 inches above the surface of the roof at the opening; or if on a buried tank, shall be elevated at least 18 inches above any earthen cover over the tank. The frame shall be securely fastened and sealed to the tank roof to prevent any liquid contaminant entering the tank. Concrete drinking water storage tanks shall have raised curbs around access openings, formed and poured continuous with the pouring of the roof, and sloped to direct water away from the frame.

*Guidance: It is preferable that access openings are framed higher than the 4 inches required above, and more if located in areas subject to heavy snow.*

### **(2) Shoebox Lid.**

The frame of any access opening shall be provided with a close-fitting, solid shoebox-type cover that extends down around the frame at least 2 inches and is furnished with a gasket(s) between the lid and frame. The horizontal surface of the tank lid shall not have any openings, cracks, or penetrations, such as a lock, key hole, or bolted handle that would allow contaminants to enter the tank.

*Guidance: Those wishing to utilize pre-manufactured roof hatches as access lids for drinking water storage tanks should contact the distributor of such and make clear that any penetrations through the lid is not acceptable.*

### **(3) Locking Device.**

The lid to any access opening shall have a locking device.

## **R309-545-15. Venting.**

Drinking water storage tanks shall be vented. The air venting capacity shall exceed the water inflow and the water outflow of the tank. Overflows shall not be considered or used as vents.

Vents provided on drinking water storage tanks shall:

### **(1) Inverted Vent.**

Be downturned a minimum of 2 inches below any opening and shielded to prevent the entrance of contaminants.

### **(2) Open Venting.**

On buried structures, the end of the vent discharge shall be a minimum of 24 inches above the earthen covering.

*Guidance: In areas of heavy snowfall, it is recommended that the vent discharge be raised.*

### **(3) Blockage.**

Be located and sized to avoid blockage during winter conditions.

### **(4) Screen.**

Be fitted with No. 14 mesh or finer non-corrodible screen.

### **(5) Screen Protector.**

Vents that are 6-inch diameter or greater shall be fitted with additional heavy gage screen or substantial covering, which will protect the No. 14 mesh screen against vandalism or damage.

## ***R309-545-16. Freezing Prevention.***

All drinking water storage tanks and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing, which may interfere with proper functioning.

## ***R309-545-17. Level Controls.***

Adequate level control devices shall be provided to maintain water levels in storage tanks.

*Guidance: Some tanks should have automatic flow control devices because of the size and complexity of the system, while other smaller systems may monitor the tank levels manually. Level controls should be adequate to assure that the distribution system and tank will not run out of water.*

## ***R309-545-18. Safety.***

### **(1) Utah OSHA.**

The safety of employees shall be considered in the design of the storage tanks. Ladders, ladder guards, platform railings, and safely located entrance hatches shall be provided where applicable. As a minimum, safety practices shall conform to pertinent laws and

regulations of the Utah Occupational Safety and Health Division.

## **(2) Ladders.**

Ladders having an unbroken length in excess of 20 feet shall be provided with appropriate safety features, such as a safety cage, a safety harness, platforms, etc.

## **(3) Requirements for Elevated Tanks.**

Elevated tanks shall have railings or handholds provided to access the water compartment safely.

### ***R309-545-19. Disinfection.***

Drinking water storage tanks shall be disinfected before being put into service for the first time and after being entered. The tank shall be cleaned of all refuse and shall then be washed with drinking water prior to adding the disinfectant. AWWA Standard C652-11 shall be followed for tank disinfection.

Upon completing any of the three methods for storage tank chlorination, as outlined in AWWA C652-11, the water system must properly dispose of residual super-chlorinated waters in the outlet pipes. Other super-chlorinated waters, which are not to be ultimately diluted and delivered into the distribution system, shall also be properly disposed. Chlorinated water discharged from the storage tank shall be disposed of in conformance with R317 of the Utah Administrative Code.

### ***R309-545-20. Tank Standards.***

The plans and specifications shall incorporate the applicable portions of the following standards:

#### **(1) AWWA Standards.**

- (a) C652-11, Disinfection of Water- Storage Facilities.
- (b) D100-11, Welded Carbon Steel Tanks for Water Storage.
- (c) D102-11, Coating Steel Water-Storage Tanks.
- (d) D103-09, Factory-Coated Bolted Carbon Steel Tanks for Water Storage.
- (e) D104-11, Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Tanks.
- (f) D110-13, Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks
- (g) D115-06, Tendon-Prestressed Concrete Water Tanks.
- (h) D120-09, Thermosetting Fiberglass-Reinforced Plastic Tanks.
- (i) D130-11, Geomembrane Materials for Potable Water Applications.

## **(2) NSF International Standards.**

- (a) NSF 60, Drinking Water Treatment Chemicals - Health Effects.
- (b) NSF 61, Drinking Water System Components - Health Effects.

## **(3) Utah OSHA.**

Applicable standards of the Utah Occupational Safety and Health Division shall be adhered to.

### ***R309-545-21. Operation and Maintenance of Storage Tanks.***

#### **(1) Inspection and Cleaning.**

Tanks that are entered for inspection or cleaning shall be disinfected in accordance with AWWA Standard C652-11 prior to being returned to service.

#### **(2) Recoating or Repairing.**

Any substance used to recoat or repair the interior of a drinking water storage tank shall be certified to conform to ANSI/NSF Standard 61. If the tank is not drained for recoating or repairing, any substance or material used to repair the interior coatings or cracks shall be suitable for underwater application, as indicated by the manufacturer, as well as comply with both ANSI/NSF Standards 60 and 61. Recoating of the interior of a drinking water tank shall comply with the plan review requirements of R309-500-5(1)(c)(i).

#### **(3) Seasonal Use.**

Water storage tanks, which are operated seasonally, shall be flushed and disinfected in accordance with AWWA Standard C652-11 prior to each season's use. Certification of proper disinfection shall be obtained by the water system and kept on file. During the non-use period, care shall be taken to see that openings to the water storage tank (those which are normally closed and sealed during normal use) are closed and secured.

**KEY: drinking water, storage tanks, access, overflow and drains**

**Date of Enactment or Last Substantive Amendment: November 10, 2014**

**Notice of Continuation: March 13, 2015**

**Authorizing, and Implemented or Interpreted Law: 19-4-104**

*(Reconciled with DAR version 12/6/2017)*