

# Chemigation

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# Regulations

- Administrative Rules of the Texas Department of Licensing and Regulation (TDLR): Chapter 76 – Water Well Drillers and Pump Installers
- Texas Natural Resource Conservation Commission (TNRCC):
  - Chapter 290 – Public Drinking Water
  - Chapter 344 – Landscape Irrigation
- Local Ordinances

# **TDLR Chapter 76.1007**

## **Water Well Drillers and Pump Installers**

**Section 76.1007. Technical Requirements  
- Chemical Injection, Chemigation, and  
Foreign Substance Systems**

# TDLR Chapter 76.1007

All irrigation distribution systems ... into which any type of chemical ... or other foreign substances will be injected into the water pumped from wells shall be equipped with an in-line, automatic quick-closing check valve capable of preventing pollution of the ground water.

# Check Valve

- Body constructed of:
  - Cast iron
  - Stainless steel
  - Cast aluminum
  - Cast steel
  - Material and design of sturdy integrity
- Materials should be corrosion resistant or coated to prevent corrosion

# Check Valve

- Valve working pressure rating shall exceed the highest pressure to which the valve will be subjected
- Valve shall be installed between the pump discharge and the point of chemical/foreign substance injection

# Other Required Devices

Installed between the pump discharge  
and the check valve

- Vacuum-relief device
- Automatic low pressure drain
  - At least  $\frac{3}{4}$  inch in diameter
  - Flush with inside surface of pipe bottom
  - Outside opening be at least 2 inches above grade
- Inspection port
  - Minimum of 4 inch diameter orifice

# TNRCC – Chapter 290

## Public Drinking Water

Appendix I: Assessment of  
Hazards and Selection of  
Assemblies



# Irrigation With Chemical Additives

- Health hazard
- Required assembly
  - Reduced-pressure principle backflow prevention assembly (RPBA)

# Irrigation Without Chemical Additives

- Non-health hazard
- Required assembly\*
  - Double check valve backflow prevention assembly (DCVA)
  - Atmospheric vacuum breaker (AVB)
  - Pressure vacuum breaker (PVB)

\*Where greater hazards exist reduced-pressure principle backflow prevention assembly is required.

# **TNRCC – Chapter 344**

## **Landscape Irrigation**

### **Proposed Revision**

**An irrigation system which adds any chemical with any kind of injection device associated with it has a potential for introducing toxic substances into the water supply and is, therefore, considered to be a "high health hazard" installation.**

# Proposed Revision

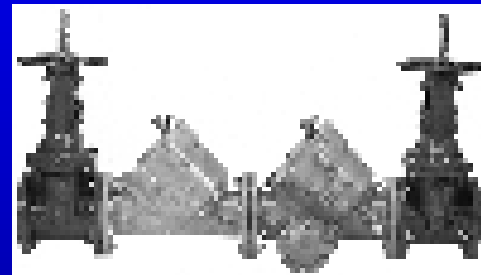
Such an irrigation system must not be connected to any potable water supply except through an industry-approved "high health hazard" backflow prevention device, such as an appropriate pressure-type vacuum breaker backflow preventor or a reduced pressure principle backflow prevention assembly.

# Proposed Revision

The backflow prevention assembly must be tested upon installation and, at least, annually, thereafter, in accordance with §290.44(h)(4) of this title (relating to Water Distribution).

# Reduced-Pressure Principle Backflow Prevention Assembly

- RPBA
- RPZ
- RP



# RPBA

- Protects against back-siphonage & back-pressure
- Can be under constant pressure
- Must be 12 inches above grade
- Must be tested upon installation and annually if in high hazard applications

# RPBA

- Installed horizontally
- 4 test cocks
- 2 shut off valves
- At least 2 (psi) zone pressure difference
- Double seated relief valve



# Chemigation

The process of injecting an approved chemical into irrigation water and applying it through the irrigation system to a crop or field.

# Chemigation

- Fertigation
- Insectigation
- Fungigation
- Nematigation

# Advantages of Chemigation

- Uniformity of application
- Precise application
- Economics
- Timeliness
- Reduced soil compaction and crop damage
- Operator safety

# Disadvantages of Chemigation

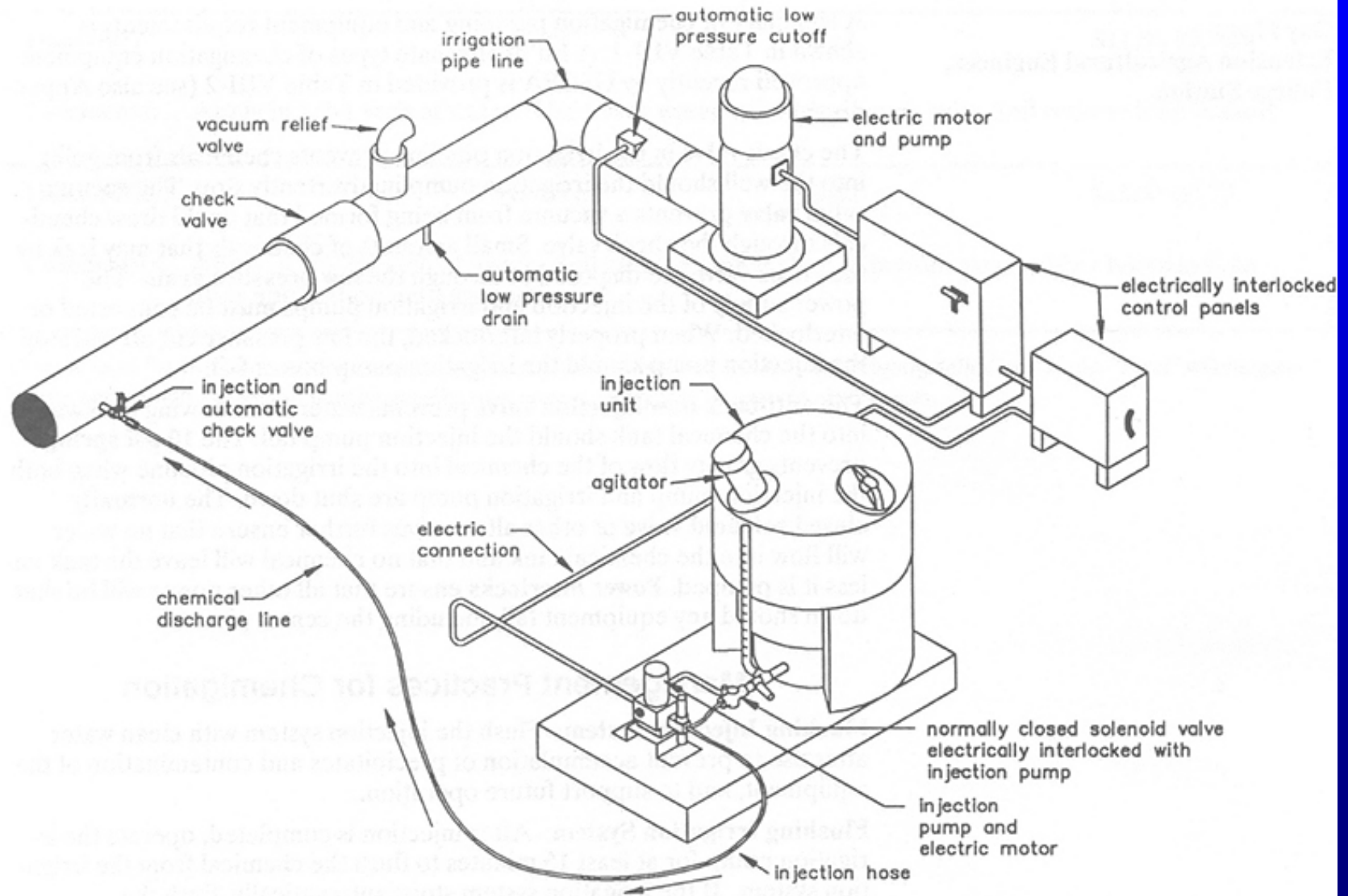
- High management
- Additional equipment

# The US EPA's Label Improvement Program (LIP)

- Effective April 1988
- Labels must state whether product is approved to be applied through the irrigation system
- Application instructions are provided
- Requires use of specific safety equipment and devices designed to prevent accidental spills

# Example Labels

# CHEMICAL INJECTION SAFETY CONNECTIONS



# Summary of Chemigation Equipment Requirements



# 1. Irrigation Pipeline

- Check valve between well and injection points\*
- Vacuum relief valve between check valve and well
- Low pressure cut off
- Low pressure drain\*

\*Alternative safety equipment may be substituted approved by EPA, March 1989.

## 2. Injection Hose

- Anti-back flow injection valve – 10 psi
- Normally closed solenoid valve between injection pump and chemical tank\*
- A metering type injection pump\*

\*Alternative safety equipment may be substituted approved by EPA, March 1989.

## 3. Power Interlock

- Interlock injection pump and water pump power
- Interlock normally closed solenoid valve and injection pump power

# Management Practices for Chemigation

- Flushing injection system
- Flushing irrigation system
- Monitoring
- Calibration check
- Chemical compatibility
- Prevent runoff
- Prevent application to surface water

# Chemigation Pumps

- Mechanical
  - Piston (positive displacement) pumps
  - Diaphragm pumps
- Venturi meters

# Piston/Positive Displacement Pumps

Discharge flow rate will not change as the irrigation pipeline pressure varies

- Flow rates cannot be adjusted while operating
- Used to inject fertilizer
- Not easily adjusted for insecticides, fungicides and herbicides

# Diaphragm Pumps

Discharge flow rate not constant with significantly varying discharge pressure

- Easy to adjust flow rate while operating
- Zero leakage

# Venturi Meters

Variations in flow rate from the water supply will change the rate of injection

- Reduced diameter throat tube
- Velocity changes in throat create vacuum to pull chemical into stream
- Requires additional hardware for injection



# Important Characteristics Chemigation Pumps & Components

- Accuracy to within + or – 0.5 percent
- Calibration tube
- Adjustable while running
- Durable – stainless steel valve balls  
– Niton seals
- Agitation capability
- Accessibility of repairs
- Appropriate size chemical tank/tanks

# Calibration of Equipment

- Small differences in injection rates make large differences in total amount of chemical applied
  - Results in insufficient or excessive application

450 gallons/minute = 1 acre-inch/hour

27,000 gallons = 1 acre-inch

# Example Calibration

# Precipitation Rate

- Amount of water applied per unit time
- Meter method
- Area flow method
- Catch can method

# Example of Precipitation Rate

# Distribution Uniformity

- Provides an analysis of water application over area irrigated
- Expressed in percent
- 70 to 80% is considered good

# Distribution Uniformity (DU) (%)

- Ratio: dry vs. wet areas
- Based on irrigation system hardware
- Easy to measure using catch devices
- Limiting factor when producing good schedules
- **Limiting factor for good chemigation application**

# The Eight Steps of an Audit

Site Selection Step 1: Obtain site data

Step 2: Rank the sites

Field Work Step 3: Inspect the site

Step 4: Prepare for the irrigation  
system tests

Step 5: Perform irrigation system tests

Step 6: Calculate base irrigation  
schedule

Follow-up Step 7: Prepare reports, adjust  
schedule

Step 8: Review performance





**Landscape Irrigation Auditing  
and Management (LIAM)  
Short Course**

<http://irrigation.tamu.edu>