

3-1-2002

# Chemigation Safety: Equipment Selection and Installation

Cooperative Extension Service  
*South Dakota State University*

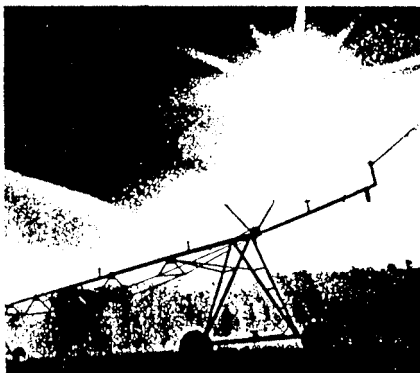
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## Recommended Citation

Extension Service, Cooperative, "Chemigation Safety: Equipment Selection and Installation" (2002). *Fact Sheets*. Paper 43.  
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# IRRIGATION FACTS

FS 860

Cooperative  
Extension  
Service  
South Dakota  
State University

## Chemigation Safety

### Equipment Selection and Installation

#### System Management

Chemigation is the application of an agricultural chemical with irrigation water. Many agricultural producers use their irrigation systems to apply fertilizer, herbicides, insecticides, fungicides, nematicides, and growth regulators. Liquid nitrogen fertilizer is the chemical most commonly applied in irrigation water.

#### Protecting the Water Supply

Chemigation is a safe, effective, low-cost way to apply agricultural chemicals on irrigated land provided precautions are taken to prevent contamination of the water source.

#### Three ways the water supply can be contaminated during chemigation:

- 1 The chemical mixture could flow from the supply tank to the water supply when the irrigation pump shuts off. (Figures 1 and 2.)
- 2 The injection pump could shut off while the irrigation pump continues to operate and water could backflow through the injection system and overflow the supply tank. (Figure 3.)
- 3 The chemical and water mixture in the irrigation pipeline could be siphoned back into the water supply. (Figure 4.)

To protect the water supply, start by installing the proper chemigation equipment. Then inspect and maintain the equipment to insure that it's working properly. Finally, manage the chemigation system for safe and effective chemical application.

#### Chemigation Safely Equipment Required by Law

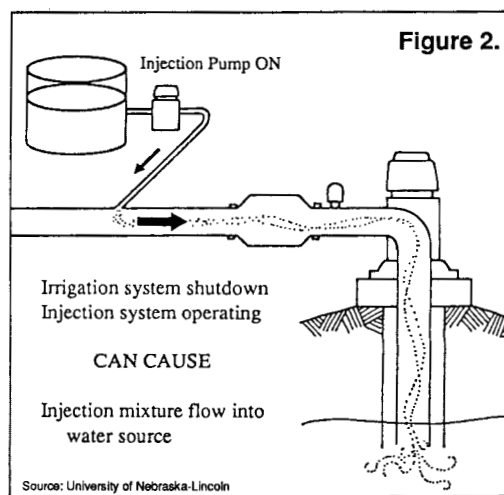
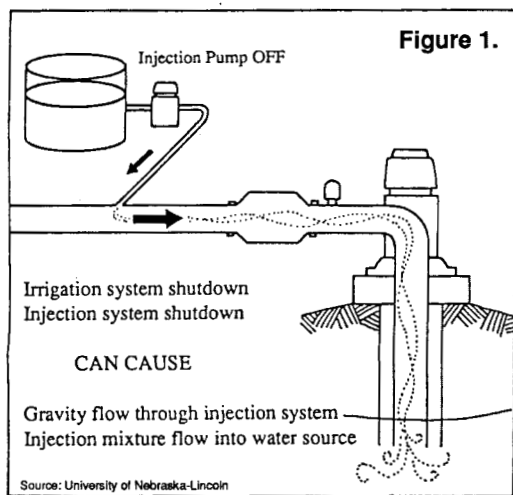
South Dakota law requires certain anti-pollution equipment with chemigation to minimize contamination risk to the water supply:

- Interlocking of irrigation and injection pumps,
- Irrigation pipeline check valve,
- Irrigation pipeline vacuum relief valve,
- Irrigation pipeline Tow pressure drain,
- Irrigation pipeline inspection port, and
- Injection line check valve.

It is common to find the irrigation pipeline check valve, vacuum relief valve, Tow-pressure drain, and inspection port packaged as a combination chemigation check valve. Certain product labels for pesticides also may require additional equipment. Be sure to follow all label instructions for pesticide application using chemigation.

Figures 5 and 6 are example layouts of the antipollution and irrigation equipment used with chemigation.

# Potential sources of water contamination if a chemigation system



## Function, Installation, and Operation of Chemigation Safety Equipment

**INTERLOCKING OF THE IRRIGATION AND INJECTION PUMPS** prevents the chemical injection pump from operating when the water pump shuts down.

The irrigation pump and the chemical injection pump must be interlocked or inter-connected so if the irrigation pump stops, the injection pump also stops. This prevents pumping chemical from the supply tank into the irrigation pipeline after the water flow stops.

Systems with electrically driven irrigation pumps commonly use a small electric motor to power the injection pump. The electrical controls for both motors must be interlocked so the injection pump will be shut off whenever the irrigation pump stops. Wiring must conform to the National Electric Code.

If the irrigation pump is driven by an internal combustion engine, the injection pump often is driven from the irrigation pump drive shaft. Or, it can be driven from an accessory pulley on the engine or from the generator set used to power the irrigation system.

Another type of injection pump utilizes flowing water or pressure to power the pump; when water flow stops, the injection pump stops also. This injection pump would be interlocked simply by the way it operates.

**In all cases, make sure the injection pump stops when the irrigation pumps stops and water is no longer flowing.**

**IRRIGATION PIPELINE CHECK VALVE** prevents chemical solution from flowing back into the water supply.

Locate a check valve between the water supply and the port where chemical is injected into the pipeline. The check valve must be positive closing, ie. spring loaded, to prevent flow back into the water supply. It must have a water-tight seal and should be easy to maintain and repair.

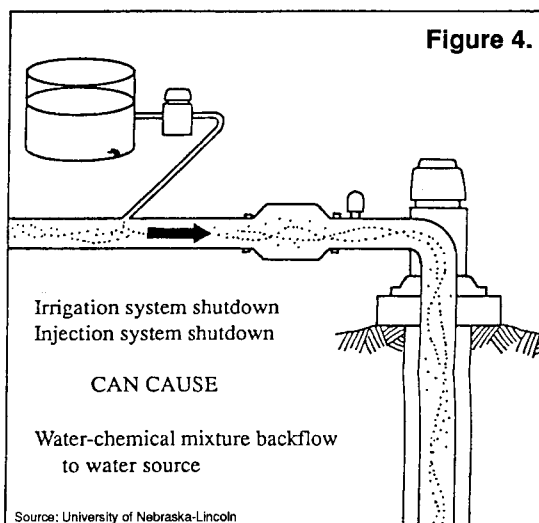
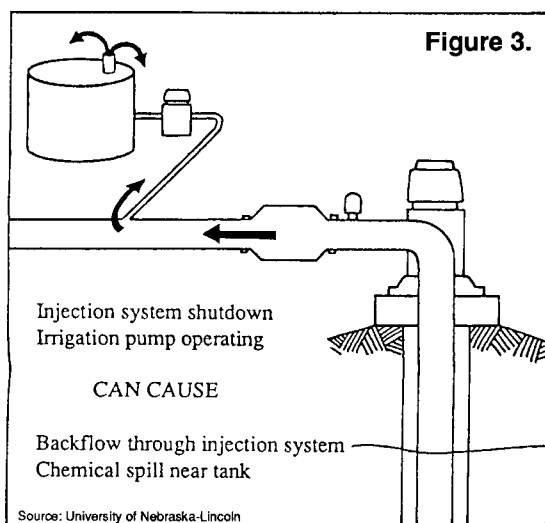
**IRRIGATION PIPELINE VACUUM RELIEF VALVE** prevents a vacuum that could siphon chemical solution into the water supply.

Install a vacuum relief valve between the water supply and the check valve. The valve allows air to enter the pipeline when flow stops and prevents a vacuum that could cause siphoning of water/chemical mixture back into the water supply.

**IRRIGATION PIPELINE LOW PRESSURE DRAIN** discharges any leakage past the check valve away from the water supply.

Install an automatic low pressure drain in the bottom of the lowest point of the irrigation pipeline between the pump and the irrigation pipeline check valve. The drain must open automatically whenever the pump stops to prevent any water/chemical solution from entering the water source if the check valve might leak. If necessary, use a hose to carry any drainage solution at

## fails during operation



least 20 feet away from the water supply. Make sure any drainage solution is contained so that it cannot enter the water source.

**IRRIGATION PIPELINE INSPECTION PORT is used to inspect the pipeline between the pump and check valve to make sure no chemical is getting into the water supply.**

An inspection port must be located between the water supply and the check valve to permit inspection of the check valve for leaks or malfunction. Inspect prior to each chemigation. The connector for the vacuum relief valve often can serve as the inspection port.

**INJECTION LINE CHECK VALVE prevents flow of irrigation water into chemical storage tank and siphoning or gravity flow of chemical into the irrigation pipeline.**

### Other ways to Comply with the Law

Certain situations do not require the installation of the anti-pollution equipment described.

Open discharge systems with an air gap between the water supply and the point of chemical injection require that the water supply pump discharge water into a tank or holding reservoir which then serves as a secondary water source for the irrigation system. The water supply pipe must discharge at least one inch above the water level in the holding tank or reservoir.

A double, check-valve system is required on the chemical injection line to prevent irrigation water from flowing back through the line and overflowing the chemical supply tank. (Figure 3.)

Locate one check valve on the chemical injection line as close as possible to the point of injection into the irrigation pipe line.

If the injection pump does not have an internal check valve, install a second check valve on the injection line. Remember to locate the injection port downstream from the irrigation line check valve.

The injection line check valve should have a minimum opening (cracking) pressure of at least 10 psi (pounds per square inch). This will prevent siphoning or gravity flow of chemical into the irrigation line when the injection equipment is not operating.

A vacuum relief valve installed in the highest part of the pipeline—higher than all downstream sections of the irrigation system—will create an air gap and prevent any siphoning back to the water supply. The chemical injection must be downstream from the high point in the pipeline.

If an irrigation system has been designed using other equipment to prevent potential contamination of the water supply, consult the regulating agency. It may grant a variance for the installation.

# Antipollution devices

Minimum requirements and arrangement of equipment for applying chemicals through the irrigation system.

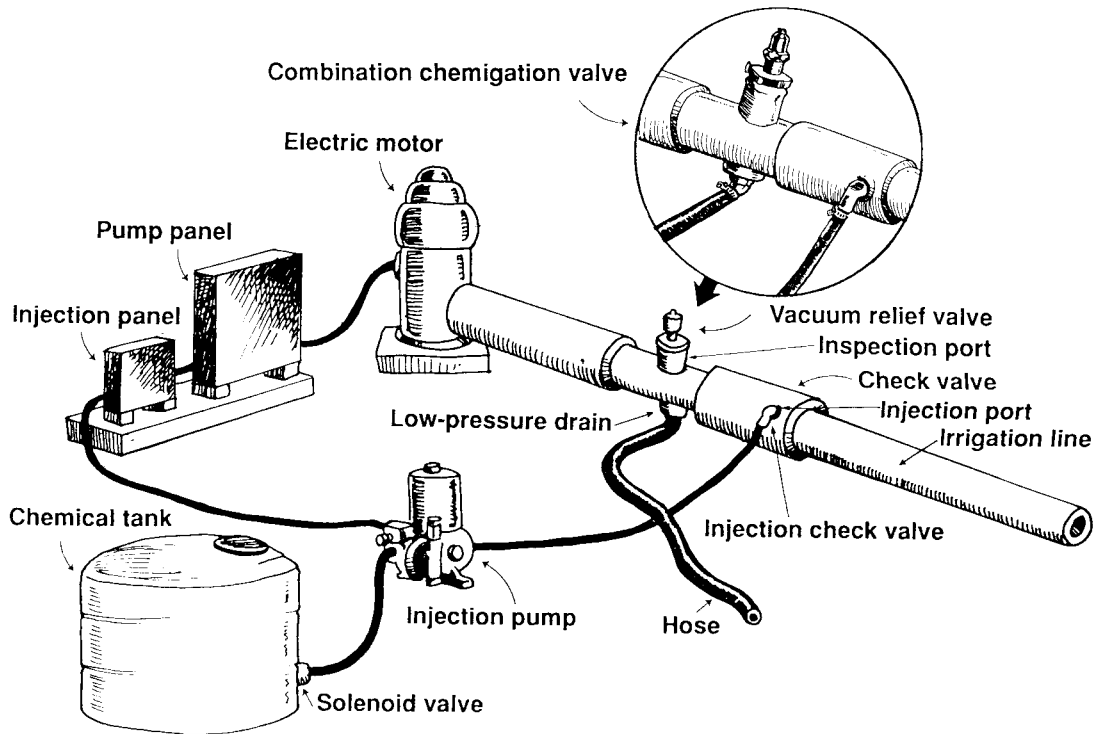


Figure 5. Motor drive

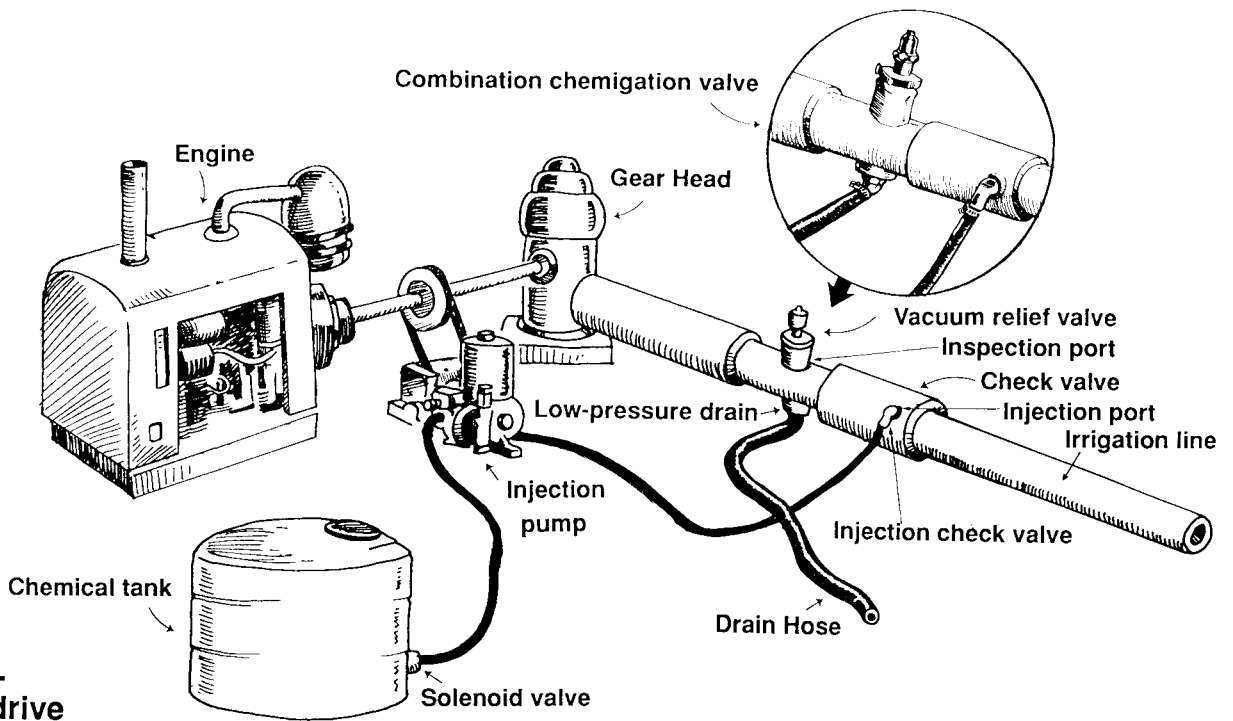


Figure 6. Engine drive

## Other Chemigation Equipment

Select equipment that will resist chemical corrosion and stand up to exposure to the environment.

### **SUPPLY TANK holds the chemical or chemical solution.**

Choose a chemical tank or tanks made of materials that will stand up to the chemicals being used. The most common materials are fiberglass, polyethylene, and stainless steel. Provide a method of agitation for chemicals that require it.

Locate the tank to minimize the possibility of chemicals entering the water supply if a leak develops. There also may be local or state regulations dealing with chemical storage such as secondary containment or minimum distances to the water supply.

### **CHEMICAL INJECTION PUMP pumps the right amount of chemical into the irrigation water.**

Select the chemical injection pump for the intended purpose. It should be accurate, easy to calibrate and maintain, and rugged. Be sure the pump's capacity matches the rate at which chemicals will be applied.

Several types of pumps are available including diaphragm, piston, and water-driven units.

Diaphragm pumps are well suited to most chemical injection needs. They are especially adapted to application of pesticides since they can be set for lower injection rates and can be calibrated more easily while the pump is operating.

Piston and water drive pumps are best for applying liquid fertilizers such as nitrogen. They are more difficult to use with pesticides because of calibration and operation at low injection rates. Piston pumps generally require more maintenance.

### **SOLENOID VALVE adds protection on the chemical injection line.**

A normally-closed solenoid valve can be installed on the inlet side of the injection pump to give positive shutoff of the chemical solution. A good location is at the outlet of the storage tank. Interlock the solenoid electrically with the injection pump controls.

### **CALIBRATION EQUIPMENT checks chemical injection rate.**

Install a calibration tube or other method of calibrating the chemical injection pump as part of the chemigation system, especially for chemicals requiring close calibration such as pesticides. A calibration tube is clear with markings that show liquid volume. Put the calibration tube on the suction side of the injection pump with the necessary valves and fittings so the injection rate can be checked before and during actual application.

### **INJECTION HOSES AND FITTINGS**

Inspect all hoses and fittings before each chemigation and replace any components that are defective. Protect the hoses from damage and replace any damaged hoses or fittings.

### **INJECTION LINE STRAINER**

Install a strainer or screen on the inlet side of the injection pump to remove foreign materials that could plug or damage the injection pump and check valves. Put the strainer on the inlet line at the chemical supply tank.

### **INJECTION PORT LOCATION**

In all cases the injection port where chemical is injected into the irrigation pipeline must be downstream from the irrigation line check valve. If possible, locate the point of chemical injection above the chemical supply tank but below the lowest sprinkler. This will prevent siphoning from the chemical supply tank.

### **TWO-WAY PUMP INTERLOCK**

A two-way pump interlock might assist chemical application management. If either pump stops, the other also stops. This interlock eliminates untreated areas in the field by stopping the irrigation pump and distribution system if the injection pump stops.

### **INJECTION LINE FLOW SENSOR**

An injection line flow sensor is an added safety device that will shut down the injection pump if there is no flow in the injection line. Locate the sensor just upstream from the chemical injection line check valve. Interlock the flow sensor with the injection pump to provide shut down if a hose plugs or breaks, the injection pump stops or loses prime, or the supply tank runs empty.

## Chemigation System Management

The chemigation operator is responsible for management of the chemigation system including maintenance, calibration, and application.

Before chemigation, inform the appropriate regulatory agency of the intent to apply chemicals in the irrigation water. Keep records for reporting purposes about the amount and timing of chemical applications.

Make sure the chemigation equipment is working properly. Inspect the safety equipment before each use and repair or replace any defective components.

Calibrate the injection equipment with the irrigation system to be sure the proper rate of chemical is applied.

Flush the chemigation injection equipment and the irrigation system after each use.

Follow label instruction carefully when applying pesticides. Do not apply any pesticide through an irrigation system unless the label specifically includes chemigation. Some pesticide labels may have additional requirements; for example, a label may require posting of the field or use of additional safety equipment.

As the operator of the chemigation equipment, you also must report any spills, accidents, or other malfunctions that may involve actual or potential contamination of either surface or ground water.

Always check with the appropriate regulatory agency for any new regulations or specific requirements. Make sure local ordinances are followed. Some municipalities and counties may have specific requirements for chemical storage and application.

For a copy of S.D. Chemigation rules or for answers to questions about chemigation write or call:

Water Rights Division  
Joe Foss Building  
523 E. Capitol  
Pierre, SD 57501

(605) 773-3352

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1500 copies printed by CES at a cost of \$.23 each. December 1990; updated March 2002.