

Chemigation Practices for Wyoming

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This bulletin is one of two covering the subject of chemigation. Companion bulletin B-1023 covers chemigation equipment and calibration procedures. It should be noted the following management practices are not official Wyoming Best Management Practices (BMP). These have yet to be developed and approved by the Wyoming Department of Environmental Quality's (WDEQ) Nonpoint Source Task Force (NPSTF).

Irrigation systems today are being used not only to apply water to crops, but also fertilizers, insecticides, herbicides, fungicides, nematicides, and plant growth regulators (PGR). The process of applying chemicals to crops through irrigation water has been termed chemigation.

The purpose of this bulletin is to provide information needed to chemigate safely and effectively. Its intent is to supplement operator's manuals for irrigation and chemical injection systems. This bulletin will focus on procedures for center-pivot sprinkle systems. Center-pivot sprinkler systems and self-propelled linear systems lend themselves well to chemigation. When correctly designed, calibrated, and operated, they allow for a high level of uniformity and precision in the application of water and chemicals to crops.

Regulatory Concerns

State Law and Regulations

Wyoming currently has no laws governing application of chemicals through irrigation water. However, groundwater wells used for chemigation may need to be permitted in the near future under the Wyoming Environmental Quality Act. Be certain you are in full compliance with all applicable rules and regulations by checking periodically with the WDEQ, which monitors the use of agricultural chemicals, the Wyoming Department of Agriculture (WDA), and your local county extension office.

In accordance with paragraph 35-11-301 of the Wyoming Environmental Quality Act:

No person, **except when authorized by a WDEQ permit** issued pursuant to the provisions of [this] act, shall:

- i. Cause, threaten, or allow the discharge of any pollution into the waters of the state;
- ii. Alter the physical, chemical, radiological, biological, or bacteriological, properties of any waters of the state;
- iii. Construct, install, modify, or operate any... system or... facility capable of causing or contributing to pollution.

At this time, WDEQ does not have a formal rule developed to issue a permit for the construction and operation of chemigation wells. WDEQ anticipates development of a chemigation permitting rule in mid- to late-1995. The intent of this rule will



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be to prevent pollution of groundwater and surface water by ensuring that all *new* chemigation wells are designed, constructed, and operated according to minimum standards and specifications.

As a minimum, all of the anti-pollution devices identified in companion bulletin B-1023 will be required because U.S. Environmental Protection Agency (EPA) regulations will always be minimum design standards. Wyoming may require more controls and devices. It is likely that an operation and maintenance manual, describing a plan and schedule to inspect and maintain these devices to ensure proper operation, will also be required for a permit.

Until WDEQ/WQD develops its own regulations, producers in Wyoming must follow all rules and regulations of the EPA. Under the EPA Label Improvement Program (LIP), certain chemigation safety equipment is required. Some alternative equipment has been approved for use by the EPA. Refer to bulletin B-1023 for a complete listing of the necessary equipment. A brief summary of federal laws follows.

Federal Laws and Regulations

Federal Insecticides, Fungicide, and Rodenticide Act

All pesticide applications, including those made through an irrigation system, are subject to provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as amended. FIFRA provisions that will affect an applicator include requirements to:

1. Use pesticides only as directed by the label.
2. Be a certified pesticide applicator or be supervised by a certified applicator if you plan to purchase or use any pesticide classified "For Restricted Use Only."

Pesticide Labels

The label of a pesticide (the document affixed to the pesticide container along with any supplemental labeling that may be provided) constitutes a legal document. It has the same force as federal law. Using any pesticide in a manner inconsistent with its labeling is a violation of FIFRA and can result in legal actions against you. Before buying or using any pesticide, it is important that you first read completely and fully understand the product label.

A pesticide not intended for chemigation will have the following statement on the label: "Do not apply this product through any type of irrigation system."

Under the same law, if a pesticide is allowed to be applied via chemigation, all of the following statement will appear on the product label:

1. "Apply this product only through [a specific type (or types) of irrigation system]. Do not apply this product through any other type of irrigation system."
2. "Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water."
3. "If you have questions about calibration, contact state extension service specialists, equipment manufacturers, or other experts."
4. "Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place."
5. A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise."

FIFRA Exemptions

In general, a producer may apply a pesticide by any method not specifically forbidden by the label. The site (crop) on which you wish to apply a pesticide must appear on the label. It is violation of FIFRA to use a pesticide if the crop is not listed on the label. A pesticide may be applied against any pest occurring on any crop, animal, or site specified on the label unless use of the pesticide is limited only to those pests specified on the labeling.

Applying more pesticide than the label specifies also violates FIFRA. To be certain you are using the proper rate, it will be necessary to calibrate your chemigation system. Procedures for doing this are described in bulletin B-1023. It is permissible to apply a pesticide at any dosage, concentration, or frequency *less* than that specified on the labeling.

Federal Water Pollution Control Act

Amendments to the federal Water Pollution Control Act generally provide to the federal government authority only over surface waters. If surface waters (streams, rivers, lakes, etc.) are used as an irrigation water source, any pollutant discharge (such as pesticides or fertilizers) incident to chemigation operations may subject the violator to federal prosecution. In most states, regulation of pollutant discharges into ground water is provided through state programs approved under the Water Pollution Control Act.

Federal Safe Drinking Water Act

There may be cases in which the irrigation well is situated in close proximity to the municipal water well. Any backflow of water and/or chemical that enters an aquifer that is or could be used as a public drinking water source is a violation of the Federal Safe Drinking Water Act. Laws in some states may prohibit chemical injections into irrigation systems if the irrigation water is drawn from a well within a given distance of a public drinking water source. If your irrigation system is connected to a public drinking water source, special equipment may be required such as a reduced-pressure principle backflow prevention assembly.

Resource Conservation and Recovery Act

Disposal of pesticides or pesticide-contaminated materials such as containers and rinsate is subject, under some conditions, to the requirements of the Resource Conservation and Recovery Act. Be sure to follow label directions carefully when disposing of such materials.

Advantages of Chemigation

Uniformity of application – With a properly designed sprinkler irrigation system, water and chemicals can be uniformly applied, resulting in excellent distribution of the water-chemical mixture.

Precision application – Chemicals can be applied where they are needed and in the correct concentrations.

Incorporation and activation – Materials requiring incorporation and water for activation can be applied to the desired depth and activated immediately.

Economics – Applying chemicals through chemigation is often less expensive than conventional application methods. Also, the amount of chemicals needed can be reduced. The more chemical treatment an operator applies, the more cost-effective chemigation becomes.

Timeliness – Chemicals can still be applied when other methods cannot be used due to wetness, excessive wind, applicator availability, or other factors.

Reduced soil compaction and crop damage—Conventional in-field spray equipment is not needed, often resulting in less crop damage and less soil compaction from tractor wheels.

Operator safety – Because the operator is not continuously in the field during application, there is reduced human contact with the chemicals from drift, frequent tank fillings, and other exposures.

Nitrogen fertilizer application – Chemigation allows for more frequent and lighter applications of fertilizers. Using proper water management practices, chemigating nitrogen fertilizer reduces the potential for nitrate leaching into the groundwater. Considerable leaching will occur, however, if correct timing or irrigation amounts are not used.

Effectiveness – The effectiveness of fertilizers, herbicides, insecticides, fungicides, nematicides, and PGRs when applied through chemigation has been proven over several years of research.

Disadvantages of Chemigation

Potential for ground water and surface water pollution – Ground water pollution can occur in one of two ways. Water can backflow through the chemical injection system and cause an overflow from the chemical supply tank. Or a power failure can occur, which would allow the chemical solution to flow backward and pollute the well. Both can be avoided if proper equipment is incorporated into the pumping plant.

Additional pollution problems – Chemical-laden water could drift or run onto non-targeted areas or be inadvertently applied to open surface water in a field.

High management – Chemical application always requires the safe use of chemicals, skill in calibration, knowledge of the irrigation and chemigation equip-

ment, and an understanding of irrigation scheduling concepts.

Additional equipment—Proper injection and safety devices are essential. Legal equipment requirements have been established and must be used. Refer to bulletin B-1023 for a complete discussion of equipment requirements.

The most significant risk is potential contamination of the irrigation water supply. To minimize risks related to chemigation, an irrigation system must be properly equipped and operated. Antipollution equipment must be added to the system and procedures must be followed to ensure operator and environmental safety as well as desired results of the chemical application. Refer to bulletin B-1023.

Deciding to Chemigate

Because extra equipment is needed to chemigate, time should be taken to consider all the possibilities before investing. Is irrigation necessary for production? Is there already a center pivot system being used to irrigate? How often do you/would you chemigate each year? Is there a crop being grown that would benefit from chemical application of one type or another? Is the chemical that is normally used or intended for use able to be applied via chemigation? Several additional factors also should be considered:

Cost-effectiveness

If application is made only once a year, chemigation may only be cost-effective for chemicals that require incorporation. But as application rates increase to two or more times per year, chemigation becomes more cost-effective.

Irrigation System Location

Proximity of an irrigation system in relation to occupied buildings or dwellings, surface water sources, neighboring crops and roadways must be carefully considered. Person, wild and domestic animal life, and other non-target sites must not be endangered.

Soil Type

Soils can differ considerably over relatively short distances. Therefore, it is not uncommon to find dif-

ferent types of soils within a single field. The rate at which water and/or agricultural chemical(s) enter the soil (infiltration rate) differs according to soil type. It follows that variations in soil type will influence irrigation system management and chemigation operations. Consult soil survey maps published by Natural Resources Conservation Service (NRCS) (formally the Soil Conservation Service) for specific soil characteristics. NRCS and extension personnel can help with irrigation management.

Topography

Topography of the field can substantially affect uniformity of application through an irrigation system lacking properly regulated sprinklers. Variations in terrain along the length of the irrigation system will cause differences in pressure at various nozzle outlets. This results in uneven water distribution, especially with low-pressure systems. Uneven water distribution can be corrected by using pressure regulators on each individual sprinkler. If distribution variances are not corrected, your irrigation system may be unsuitable for chemigating.

Management Practices

Management practices should be employed to maintain the existing beneficial uses of water resources and to reduce adverse effects and water quality degradation.

Center Pivot Systems

Center pivots have a high instantaneous rate of water application. If the infiltration rate of the soil is exceeded, runoff of chemical-water solution may occur. Therefore, the center pivot sprinkler package should be selected to minimize runoff potential. Work with the irrigation system dealer, extension or NRCS, and/or your local conservation district to select a sprinkler package to match the field being irrigated. In many situations, the quantity of irrigation water applied will be small enough that runoff will not be a major concern.

The amount of water applied by a center pivot during one irrigation cycle is determined by the irrigation pumping rate and the revolution time of the center pivot system. The minimum irrigation amount will be

applied when the system is operated at the maximum rotation speed. Consult your system operator's manual for specific system information.

Equipment Maintenance and Inspection

All irrigation and injection equipment must be kept in good working order. In addition, instructions on chemical labels must be followed precisely. Most chemical accidents result from careless practices or lack of knowledge about safe handling of chemicals. Time spent taking precautionary safety measures is an investment in the health and safety of yourself, your family, and others, and in protecting the environment. It also helps assure that the desired results are achieved.

Proper equipment maintenance is necessary to ensure safe distribution of chemicals. Consequently, all hoses, clamps, and fittings must be in good repair. Inspect them before each chemigation operation. All components that are in contact with chemical, from the supply tank to the point of injection on the irrigation pipeline, should be constructed of chemically resistant materials.

Periodically monitor the irrigation system and chemical injection equipment to assure proper operation. Before chemigating, inspect your equipment to be certain the following items are functioning properly:

- The irrigation system main pipeline check valve and vacuum relief valve
- The chemical injection line check valve
- The irrigation system and pumping plant main control panel and the chemical injection pump safety interlock
- The low pressure drain
- The injection system including the in-line strainer
- The irrigation pump and power source
- Casings, manifolds, and pipelines are not leaking

Read and comply with product label

If you plan to apply a pesticide, always read the product label before starting to chemigate and comply with all directions given. Be certain that:

- The product is labeled for application by chemigation

- The crop on which you plan to apply the pesticide is listed on the label
- The rate at which the product is applied does not exceed the quantity or frequency specified
- All items of safety clothing and equipment specified are used
- Empty pesticide containers are triple rinsed and disposed of as directed

Drive units

High-speed center pivot drive units are desirable with some chemicals so that lighter applications of water can be made.

Chemical compatibility

Check compatibility of the chemical with the water supply. Avoid chemicals that may form a precipitate that could clog nozzles on the system.

Monitoring

During any chemical application, periodically monitor the irrigation system and chemical injection equipment to be certain both are operating properly.

Plug first nozzle on center pivots

To facilitate monitoring of the chemigation operation, the main control panel, water pump, chemical supply tank, chemical injection pump, and the area around them must be kept free of chemical contamination. Plugging the nozzle outlets in the immediate area of this equipment will significantly reduce the possibility of inadvertent exposure to chemical contamination.

Wind speed

Wind distorts the irrigation application pattern, causing non-uniform distribution. Disruption of the sprinkler irrigation pattern is least with continually moving systems and greatest with solid-set systems. Wind increases evaporation and can increase the loss of volatile chemicals. Pesticides and PGRs should not be applied in sprinkler irrigation systems if wind speed exceeds 10 miles per hour for continually moving systems and 7 miles per hour for solid-set systems.

Calibration

Accurate calibration of the application system is critical. Unless the system is calibrated, there is no way to determine whether the amount of chemical applied is too much, too little or – by chance – just right. Over-application is needlessly expensive. Under-application frequently does not provide the effect needed. Refer to bulletin B-1023 for calibration procedures.

Accidental spills

Pesticide spills must be managed according to WDEQ/WQD Chapter IV, Section 4, rules and regulations. Regardless of the size of a chemical spill, take steps to avoid personal contamination and to keep the potential spill damage to a minimum. Do not let children or other people near the spill area. Do not let the chemical (especially pesticides) get on your skin, clothing, or shoes.

Confine the spill if possible. If it starts to spread, dike it with soil or sand. Avoid letting the chemical flow away from the spill site into any surface water source. Special precautions, such as removing the contaminated soil, may be necessary to prevent ground water contamination.

Regulatory officials need to be notified in the event of a spill. If water contamination is suspected, notify state health and water quality officials. Information such as the type, quantity, and location of the spill, and the response, containment, and cleanup actions that will be/have been taken is required. These officials may have suggestions and/or requirements for cleaning up a spill.

Non-target application

An end gun shutoff that fails to function and unfavorable weather conditions are likely sources of non-target and off-target applications. End gun operations must be monitored to be certain they do not operate over roadways or across fence lines.

Spray from continuous moving irrigation systems can be carried considerable distance by wind. Drift can result in violations of the law for misapplication of a pesticide and illegal pesticide residues in or on a crop.

Drift can also damage your own non-target crops or a neighbor's.

Wind variations can have a detrimental effect on semi-permanent sprinkler systems such as wheel lines, hand lines, and solid set lines. To minimize problems associated with wind drift, these steps can be taken:

- Avoid use when winds are great enough (7-10 miles per hour) to cause significant drift
- Space the sprinklers and lines more closely together if possible
- Operate at night when winds are relatively low

Protective clothing and equipment

Because of the toxicity of many agricultural chemicals, pesticides in particular, they are potentially dangerous to people. Pesticide product labels have “signal” words that clearly indicate the degree of toxicity – and the degree of risk to the user – associated with that product. Pesticides labeled CAUTION are slightly toxic; an ounce to more than a pint, if taken orally, would kill the average human adult. Those labeled WARNING are moderately toxic; a teaspoonful to an ounce would be fatal to the average adult. Pesticides labeled DANGER include the skull and crossbones symbol and are highly toxic; a teaspoonful or less would be fatal.

Application to surface water

Don not use chemigation on fields with permanent or semi-permanent surface water areas. Direct discharge of pesticides into *any* surface water is a violation of WDEQ/WQD regulations. Such application may adversely affect wildlife, non-target plants and animals, or ground water quality.

Runoff/Deep Percolation

The irrigation system should be managed so runoff or deep percolation of the water-chemical mixture does not occur. If runoff does occur, precautions should be taken to prevent runoff from leaving the field when any chemical is being applied. With a given sprinkler package on a center pivot, reducing the application size by making a faster revolution will reduce the potential for runoff and deep percolation. Good irriga-

tion management practices must be used throughout the entire irrigation season to avoid movement of water below the crop root zone and to minimize the potential for chemical leaching.

Flushing injection equipment

To prevent accumulation of precipitates in the injection equipment, flush the injection system with clean water after each use. It is best to flush the injection system while the irrigation system is operating so that the water used for cleaning will be applied to the field where the chemigation application was made.

Flushing irrigation system

After injection is completed, operate the irrigation pump for at least 10 minutes to flush the irrigation system of any chemical. Some systems, especially drip systems, may take longer than 10 minutes to completely flush. If the irrigation system was shut down automatically, flush the system as quickly as possible after the shutdown is discovered, and extend the flushing period to a minimum of 30 minutes.

Reentering treated areas

In general, fields that have been chemigated with pesticide should not be reentered until the spray has dried. A specific waiting period may be specified on the container label of some products. In such cases, applicators have a legal obligation to prevent unauthorized entry into treated areas. To discourage such unauthorized entry, applicators may be required to post treated fields. The EPA may revise its label requirements to include more restrictive provisions on posting chemigated fields. Failure to properly post a chemigated field can result in prosecution of the applicator. Before chemigating, therefore, carefully read the product label and comply with posting requirements that may be specified. Check with the pesticide regulatory authority in your state to be certain you are in compliance with applicable state laws and regulations.

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For further information:

1. USCES bulletin B-1023 *Chemigation Equipment and Calibration Procedures*
2. Local weed and pest districts
3. Local university extension offices
4. Wyoming Department of Environmental Quality/Water Quality Division
5. Local conservation districts
6. Natural Resources Conservation Service
7. *Wyoming Chemigation Manual for Private and Commercial Pesticide Applicator Certification*, UWCES, Department of Plant, Soil, and Insect Sciences
8. Environmental Protection Agency (EPA) Region 8 office, 1-800-227-8917

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