Article 320–Backflow Prevention for Agricultural Wells

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BACKGROUND

The practice of injecting chemicals into agricultural irrigation systems supplied by water wells is common. The State of California Department of Health Services (DHS) provides guidelines for the use of backflow prevention devices on irrigation systems that are in use with public water systems. These devices must conform to American Water Works Association (AWWA) Standard C506-78 (R83) and may be of the reduced pressure (RP) or the double check valve (DC) type assemblies. Basic assemblies usually consist of two check valves and two isolation valves and are typically constructed of epoxy coated steel, bronze and cast iron. The assemblies are equipped with test cocks so that certified personnel may regularly test them.

DHS also approves the use of an air-gap (AG) separation method for the prevention of backflow. The AG separation method requires a physical break (air-gap) between the standpipe and the supply pipe that is twice the diameter of the supply pipe measured vertically from the flood rim of the standpipe to the supply pipe.

Although preventing the introduction of injected chemicals into groundwater through the use of backflow devices is necessary, DHS regulation of agricultural usage is non-existent at this time. The Department of Pesticide Regulation (DPR) does require backflow prevention while injecting pesticides in agricultural irrigation systems. The purpose of this standard is to provide guidance, based on current industry practices, on the type and application of backflow prevention devices and techniques used in the agricultural industry to protect groundwater from contamination.

DISCUSSION

The general term "chemigation" commonly refers to the injection of chemicals such as fertilizers, fungicide, herbicides, insecticides, biocides, acids and disinfectants, etc., into irrigation systems. There are several chemigation devices commonly being used by California farmers to deliver chemicals into agricultural irrigation systems. The simplest and least expensive is a venturi-based device operated by creating a pressure differential in the pump discharge piping. A potential hazard of this method is that the pump may unexpectedly stop operating during chemical delivery into the system. If the well is not equipped with a backflow prevention device the injection material may flow into the well by backpressure or backsiphonage.

Another popular chemigation delivery method and the most accurate device is an electric motor driven pump for metered injection of chemicals into the supply line. Chemical suppliers often move these injection pumps from site to site with power supplied from a temporary 480/110v transformer and convenience receptacle independent of the well pump motor contactor. However, if the well pump motor should stop unexpectedly, the electric motor driven pump could continue to operate and pump contaminants into the well.

Due to the widespread popularity and application of chemigation, there exists a great potential for groundwater contamination. Backflow prevention devices that conform to AWWA standards for use in public water systems are expensive. Moreover, approved RP and DC devices cause relatively high head losses. High losses in head pressure will cause pumping efficiencies to be severely compromised. In agricultural systems, this will result in significantly higher pumping costs and may discourage the use of backflow prevention.

The AG separation method is an approved and inexpensive technique for the prevention of backflow. However, while this backflow prevention method is highly effective, it is only practical when using surface water applications from non-pressurized systems such as in row crop irrigation or dairy waste flushing.

The demand for a reasonably priced and efficient backflow preventer for agricultural use has been met by some California based manufacturers. These units are made of cast aluminum with internal epoxy coating, galvanized and epoxy coated steel. They typically consist of one or two check valves, 4" inspection ports, 1-1/2" low pressure drains, ¾" test ports and air vents. Check valve flappers are usually stainless steel with a vulcanized rubber flapper plate. Head losses through a properly sized valve are typically less than two tenths of a pound per square inch at flow of five feet per second.

The Fresno State Center for Irrigation Technology (CIT) has published suggested specifications for commercially manufactured agricultural chemigation valves. Because agricultural water differs in use and potential risk from potable water, they have devised an adequate specification that protects groundwater from the "most hazardous class of chemicals, i.e., biocides." (Solomon and Zoldoske).

RECOMMENDATIONS

The California Groundwater Association in its efforts to protect groundwater encourages the use of backflow prevention devices and techniques in any irrigation practice that could allow contaminated water to flow back into wells and recommend the following:

1. Backflow prevention valve assemblies should be used in any application where chemicals are injected directly into a pipeline.
2. Regulatory agencies should allow the use of specialty "chemigation check valves" such as those listed by the Fresno State Center for Irrigation Technology
3. Farmers using low head applications such as row crop irrigation or dairy waste flushing from wells should protect the well and avoid the use of expensive backflow prevention devices by discharging into a "stand-pipe" at the head of the pipe line rather than pumping directly into the line. This provides an effective air-gap separation between any contaminated water and the well.
4. When injecting chemicals into the irrigation system by any means, the chemical should be injected downstream from a backflow prevention device. Further, all injection devices should automatically stop when the well pump stops.

REFERENCES

Solomon, K. and Zoldoske, D., "Backflow Prevention and Safety Devices for Chemigation," CATI Publication #981201, Aug 1998 (http://cati.csufresno.edu/cit/rese/98/981201/index.html)

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