Iowa State University
Extension and Outreach

Water line system management for swine production

This production tool is designed to help improve the quality of water line system administration and management, improve drinking water quality, and preserve the efficacy of water antimicrobials and vaccines. Best practices are provided for the administration of vaccines and antimicrobials, including water medicator protocols and calibration, water line cleaning and disinfection protocols, water line system design, and water quality diagnostic protocols. Implementing best practices for these topics will enhance the adoption of effective strategies to improve the efficacy of mass medication and vaccination in swine herds.

Water and Water Line Management's Role in Pig Production

Water is a physiological need for pigs, regulating growth, temperature control, and overall behavioral needs. A pig's body is comprised of 82% water at birth and 51% when it reaches 113.4 kg. Each pig requires 0.12 to 0.22 L of water per kg of body weight, meaning a 68 kg market pig needs approximately 8.16 L of water daily. Water is an essential component of daily pig production, though its quality and management are often overlooked.

Water lines are one of the main routes for antimicrobial and vaccine administration, but the systems within each barn that contain filters, regulators, meters, and medicators vary significantly. A survey identified typical features of swine farm water systems in the Midwest commercial production region. Forty-eight participants completed the 33-question survey that determined the farm type and features of the current water line system. The survey found that on 96% of the farms, well water is the primary water source, and 56% of the farms do not have a water line cleaning standard operating procedure (SOP). Standardized protocols used across the industry for the cleaning and disinfection of water line systems benefit producers by reducing biofilms that can impact the pig's health, production, water-administered medication, and antimicrobial stewardship efforts.

Water line cleaning and disinfection is not a one-size-fits-all approach; it requires tailored regimens to accommodate farm goals, management, water quality challenges, water source, and water system design restrictions. High-performing water lines and water quality are critical for antimicrobial and vaccine administration efficacy. Never administer any antimicrobial or vaccine without first consulting a veterinarian.

Additional water medicator products are available, and this material is not intended to endorse one brand over others. Information is intended to focus on the basic operations and similarities of medicators.

Swine Water Systems: Elements of Design

The Water Medicator

Compared to a feed medication program, where antibiotic consumption is reduced due to off-feed events caused by illness, a pig's water consumption typically remains unaffected by illness and therefore water medication intake is likely to be maintained. It is important to use medicators correctly and clean them between each use. All water medicators should be calibrated at least twice a year or when a new water medicator is installed to ensure correct dosage.

Water Medicator Types

There are three primary medicator types: flow-activated pump, piston, and diaphragm (Figure 1). Refer to Table 1 for details about each medicator type, as well as a list of pros and cons.



Figure 1. Three types of water medicators used in swine facilities, including the flow-activated pump, piston, and diaphragm medicator models.

Table 1. Summary of the advantages and disadvantages of different types of water medicators used in swine facilities. Key factors such as efficiency, cost-effectiveness, and potential impact on system performance are included.

	Pros	Cons
Flow-Activated Pump Medicator	Performs well with poor water quality, such as grit, hardness, and iron. Made for the purpose of administering vaccine.	Relatively expensive
Piston Medicator	Relatively inexpensive.	Performs poorly with contamination or pollution in the medicator. Works best with clean, high-quality water.
Diaphragm Medicator	Inexpensive and performs well in poor water conditions, such as sand, algae, or high mineral content .	Potential need for additional maintenance and parts replacement.

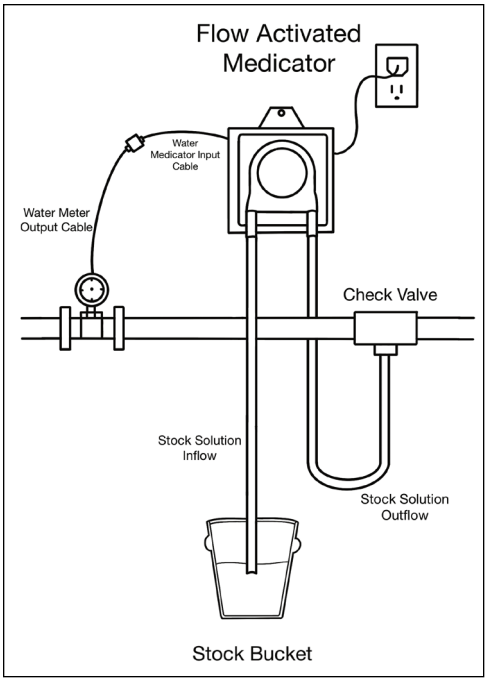


Figure 2. A flow-activated water medicator: as water flows through the water meter, it triggers the medicator to draw a precise amount of antibiotic or vaccine and deliver it into the main water line, ensuring accurate dosing for swine treatment.

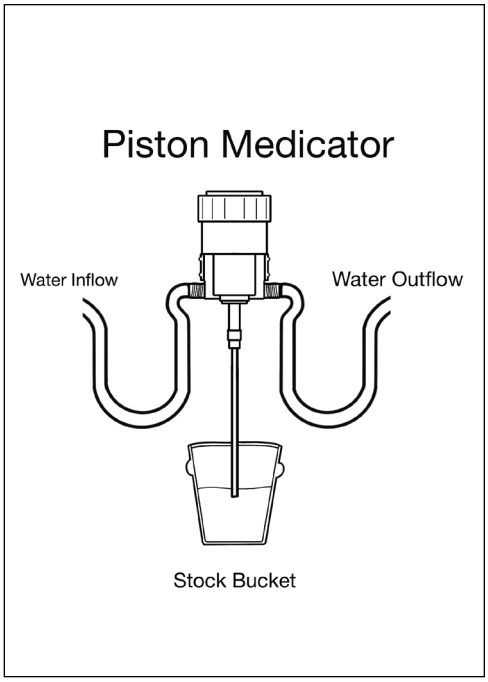


Figure 3. A piston water medicator: as water flows through, the medicator activates, precisely drawing and mixing medication into the water supply to ensure accurate dosing for swine hydration and treatment.

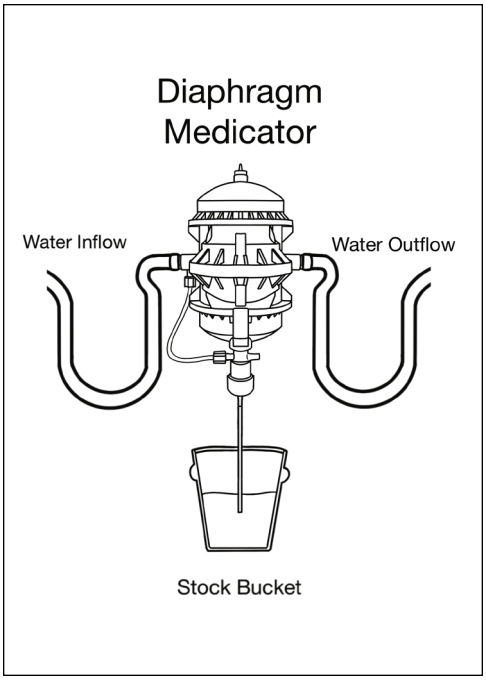


Figure 4. A diaphragm water medicator: powered by a hydraulic motor, the medicator activates as water flows through the system, precisely drawing and mixing medication into the water supply to ensure accurate dosing for swine hydration and treatment.

The flow-activated pump medicator is activated by a dry-contacting water meter with pulse rates of one part per L (Figure 2). The piston medicator is operated using water pressure as a power source. The concentration is directly proportional to the water volume entering the medicator, regardless of variations in flow or pressure that occur on the main water line (Figure 3). The diaphragm medicator uses a hydraulic motor and pump that is powered by the existing water supply. This ensures it will inject at a rate that creates a consistent concentration of compounds in the water leaving the pump, regardless of water pressure and flow rate (Figure 4).

Within the US swine industry, there are many different brands and types of medicators (Figures 5a-d). The most commonly used water medicators are the piston and diaphragm systems.

These medicators typically operate at a 1:128 ratio, or one ounce of stock solution per 128 oz (1 gallon) of water in the main water line. to every 128 gallons of water in the main water line. They are marketed for lifelong proportioning accuracy but should still be calibrated at least annually to ensure consistent performance. Their portable design offers the advantages of simplifying maintenance and replacement.

A 2023 study found that 79% of farms using water medicators had possible risk factors of calibration accuracy, poor maintenance of the pumps, and dosage measuring variability. Of the producers surveyed, 6.4% visually estimated the amount of veterinary medical product, 21.3% used a measuring cup, and 75% used a scale to measure stock solution dosages. Some farms answered on more than one device, creating a total of 102.7%.

Figures 5a-d. Various brands of water medicators commonly used in swine facilities.



5a. Dosatron Piston Water Medicator

5b. Dosatron Diaphragm Water Medicator

5c. Chemilizer Diaphragm Water Medicator

5d. Stenner Pump Flow Activated Medicator

Best Practices for Water Medication Administration

Water Quality Impacts Medication Efficacy

When administering product through water lines, it is important to understand the water's pH, temperature, water hardness, and mineral elevations, all of which could affect antimicrobial and vaccine efficacy.

The water's pH should range between 6.5 to 6.8. Water pH levels can affect product efficacy, increase producer costs, and potentially lead to antibiotic resistance. If pH is found to be outside this range, seek professional help from a veterinarian or livestock water treatment professional to investigate solutions.

Temperature is an important consideration during the mixing process of specific antibiotics. For example, it is best practice to add an acid (e.g., citric acid) to tetracyclines (a class of antibiotics used to treat bacterial infections). The added acidity and heat generated from the acid's activity improves the solubility of the tetracycline. It is not the pH that eases the solubility, but the chemical energy added by the acid heating the water. Increased temperature can also affect the efficacy of some medications. Amoxicillin, for example, is more sensitive to higher temperatures, and agitators in stock solution buckets can heat the water to a level that may inactivate the amoxicillin.

Water hardness measures dissolved calcium and magnesium concentrations in water. High levels of water hardness in combination with a pH higher than 7 can cause the accumulation of mineral deposits ("scale") on anything the water touches, including water lines and equipment. The development of scale on the interior of water line pipes can lead to water restrictions for the pig. This reduction in water availability can impact the amount of feed that is consumed by the pig. Hard water can also inhibit medicator effectiveness through the accumulation of scale and potentially decrease antimicrobial or vaccine efficacy.

Stock Solutions

Many stock solution products are available in powdered form. A stock solution is the initial dilution that transforms the powder into a concentrated liquid solution. This solution can then be drawn up by the medicator and injected into the water system at the appropriate final concentration for the animals to consume. Stock solutions are formulated for several different solutions, including antibiotics, vaccines, acidifiers, and disinfectants

When product residues and debris in the stock solution bucket mix with these solutions, it can create alternative compounds that affect the solution performance. There should be different buckets designated for administering vaccines and antibiotics; these buckets should be labeled and never used for the alternate product (Figures 6a and 6b). Stock solution recipes need to be easy to understand to avoid underdosing or overdosing pigs and to reduce waste. Stock solutions need to be kept fresh by replenishing every 12 to 24 hours, depending on the dosage regimen prescribed by the veterinarian.

Antibiotic or vaccine administration should include the use of a clean stock bucket and lid, as well as sturdy mixing equipment. If a clean bucket is not available, use bucket liners to prevent the mixing of previous antimicrobial residue and the current substance being administered (Figures 6a and 6b). The solution should be mixed thoroughly with an agitator. Agitators ensure the product remains uniformly suspended and helps prevent settling (Figure 7). When mixing new stock solutions, it is important to develop a consistent routine every time a new batch needs to be prepared.

Figures 6a and b. Examples of bucket liners used in stock buckets in the swine industry, including quality and price, to highlight the benefits and suitability of different liner types.



6a. Uline Product:
Molded Poly Drum Liners, Smooth
5 Gallon

- Allows for full product recovery
- Molded lip holds liner in place
- Withstands pumping and mixing, will not tear or crack
- $3.60 (as of Oct 2025)



6b. Uline Product:
Round Bottom Drum Liners, 18 x 22" 4 Mil

- 2.13 (as of Oct 2025)

Figure 7. Example of agitator pump: Little Giant Agitator Pump



Medicator Calibration

Antimicrobials and vaccines prescribed by a veterinarian are dosed at a specific ratio aligned with the delivery specifications of the medicator's brand and model. If this ratio is improperly calibrated, it can cause overmedicating, undermedicating, antimicrobial residues, and contribute to antimicrobial resistance. Review piston and injectable water medicator calibration instructions (Figure 8).

Figure 8. Demonstrating the water medicator calibration process.

1. Turn off the water to the medicator.
2. Detach the outflow line of the medicator from the main water line.
3. Set the water medicator to the desired ratio (1:128).
   NOTE: if your injection rate is not 1:128, use the correct corresponding measurements, see Table 2 for the ratio legend.
4. Place the outflow line into an empty five-gallon bucket.
5. Use a scale to confirm that the bucket holds five gallons. Ensure the scale and bucket are on a flat surface. With the scale, weigh 640 oz (40 lbs) of water into the bucket and draw a line inside the bucket to mark the fill line's exact location for five gallons to make a calibration bucket.
6. Empty the calibration bucket of water and place the outflow line into this bucket.
7. Prime the drop hose line using an additional bucket of water.
8. Fill a measuring cup with five ounces of water.
9. Remove the filter from the bottom of the primed drop hose.
10. Insert and hold the drop hose into five oz of water in the measuring cup.

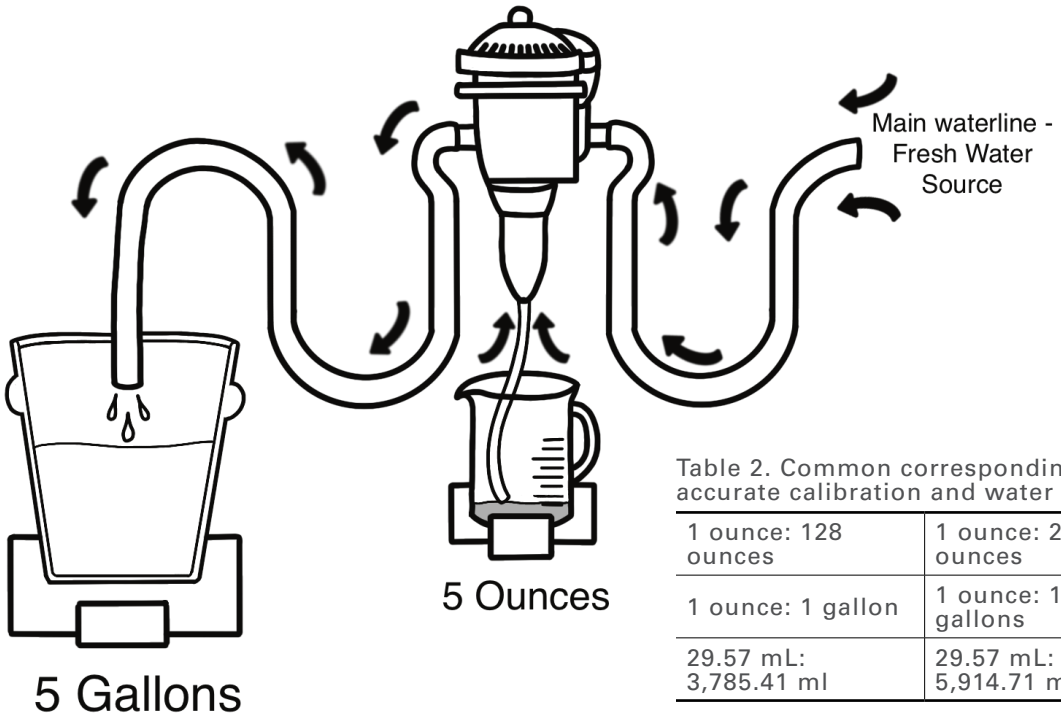


Table 2. Common corresponding measurements to assist in accurate calibration and water medication dosage calculations.

1 ounce: 128 ounces	1 ounce: 200 ounces	1 ounce: 100 ounces
1 ounce: 1 gallon	1 ounce: 1.56 gallons	1 ounce: 0.78 gallons
29.57 mL: 3,785.41 ml	29.57 mL: 5,914.71 ml	29.57 mL : 2,957.35 ml

11. Slowly turn on the main water line. Ensure the medicator is working. An audible clicking sound should be heard.
12. Allow the water to flow until the water in the measuring cup is completely consumed.
13. Turn off the incoming water.
14. If the medicator is calibrated appropriately, it should have five gallons in the calibratingbucket. If the medicator is underdosing, water will remain in the measuring cup when the calibrating bucket is at the five-gallon mark. If the medicator is overdosing, the five-ounce measuring cup will be empty and the water in the five-gallon bucket will not reach the five-gallon mark.
15. If the medicator is not properly calibrated, change the o-rings and run the calibration protocol again.
16. If the medicator is still not properly calibrated, seek out manufacturer installation instructions. If it's installed appropriately, consider servicing or replacing the medicator.

Water Quality Diagnostics

Determining Optimum Water Quality

Water should be evaluated to ensure optimum drinking quality and determine whether water line cleaning and disinfection is necessary. Water quality should be tested at least annually to evaluate the physical, chemical, and microbiological characteristics. Water's physical qualities, including its color, turbidity, and odor, should be evaluated, especially when abnormal, to reduce potential health and productivity implications. Discoloration, such as yellow, red, black, or orange hues can indicate elevated levels of minerals (iron or manganese) or the presence of dissolved organic matter. Turbidity in water may result from the presence of silt, organic and inorganic matter, algae, or other microscopic organisms. A strong odor or unpleasant taste, often caused by chemicals or bacteria such as sulfur, can make the water unappealing to pigs, potentially leading to reduced intake.

Water should also be evaluated by its chemical qualities. Total Dissolved Solids (TDS), or the measurement of water salinity, is a measurement of target minerals in the water. TDS in drinking water should be less than 1,000 ppm to be considered ideal. TDS is composed of magnesium, calcium, sodium, bicarbonate, chloride, and sulfate concentrations. As TDS levels increase, it can cause water refusal or even a mild osmotic diarrhea for the pig, observed at TDS levels of 3,000 ppm. TDS levels of 7,000 ppm or higher are considered unsafe for pigs. Other chemical components of water quality can be evaluated as well, such as water hardness, iron, manganese, sulfates, and nitrates.

The pH level will determine if the water is acidic or basic. If pH is below 7, it is considered acidic; if it is above 7, it is considered basic. If the water is too acidic or too basic it can contribute to the corrosion of pipes (acidic) or mineral scale formation inside water lines (basic) if water calcium and magnesium concentrations are elevated.

Lastly, water should be evaluated for microbial contamination. Total coliforms and *Escherichia coli (E. coli)* are commonly measured for potential fecal contamination. Not all coliforms and *E. coli* are pathogenic; however, they serve as indicators for potential pathogens. Total coliforms and *E. coli* should also be considered in the context of how the water sample was collected. Fecal contaminated water nipples, cup waterers, or dirty spigots can contribute to increased total coliforms and *E. coli*.

It is important to sterilize the spigot or water nipple prior to collecting the water sample to accurately reflect total coliform and *E. coli* presence in the water.

Research also demonstrated that differences in coliforms and *E. coli* exist based on water sample location, e.g. wells versus room-collected water samples. In a study by Iowa State University's Swine Medicine Education Center, room-collected water samples showed elevated coliforms and *E. coli*. This suggests that multiple water samples should be collected and tested for the microbial fraction of water quality to determine what is being consumed by the pig.

Water Sample Collection

Water samples should be collected where the water supply enters the barn and at the end of the water line for branched systems (Figure 9). Branched water systems have terminal ends to the water line pipe where water flow stops. At the terminal ends of branched systems, valves are normally available to flush the system. It is important to collect water only after flushing the lines for a minimum of 10 to 20 seconds to avoid false elevations due to the buildup of biofilms or minerals in the "dead-ends" of the branched system. Sanitize the location where the water is sampled to obtain representative results. This allows testing to evaluate the point at which the water is sourced and the point at which the pigs are drinking. Samples should be taken in a clean container from both points. Prior to any water sample collection, consult with the diagnostician for collection equipment and instructions.

Recommended Water Sample Collection Protocol

1. Have bagged cubed ice or ice packs available for shipment.
2. Identify the ideal water sample collection points:
   - Near the well head, before any treatment systems (Figure 9).
   - At the end of the furthest water line in the barn (Figure 10).
3. Clean any debris or rust off the water spigot with a scrub brush and water.
4. Open the spigot and allow water to run for ten seconds or until the water runs clear.
5. Turn off the spigot.
6. Sterilize the faucet with alcohol swabs, a mild bleach solution, or a flame for 5 to 10 seconds.
   - If using flame sterilization, ensure there is no rubber valve on the insideof the spigot before flaming it. If there is a rubber valve inside the spigot, sterilize it with alcohol or bleach.
   - Important Note: Ensure pit gases, such as methane, are absent before using the flame sterilization method, as methane can be a fire hazard.
7. Fill the bottles above the fill line (~500 mL is generally required for complete water quality testing) to ensure the minimum required amount is captured.
   - To avoid cross-contamination:
     - Do not touch the inside of the lid or the mouth of the bottle.
     - Do not put the lid down.
     - Do not rinse out the bottle.
     - Do not touch the mouth of the bottle to the faucet while filling.
8. Place the bottles in an upright position in the cooler.
   - Include the bagged cubed ice to keep the bottles cool.
9. Complete the submission form, including the following:
   - Name, address, and sample identification.
   - Date and time of sampling.
   - Requested testing (information obtained during the laboratory consultation).
10. Place the submission form in a plastic bag and include with the shipment.

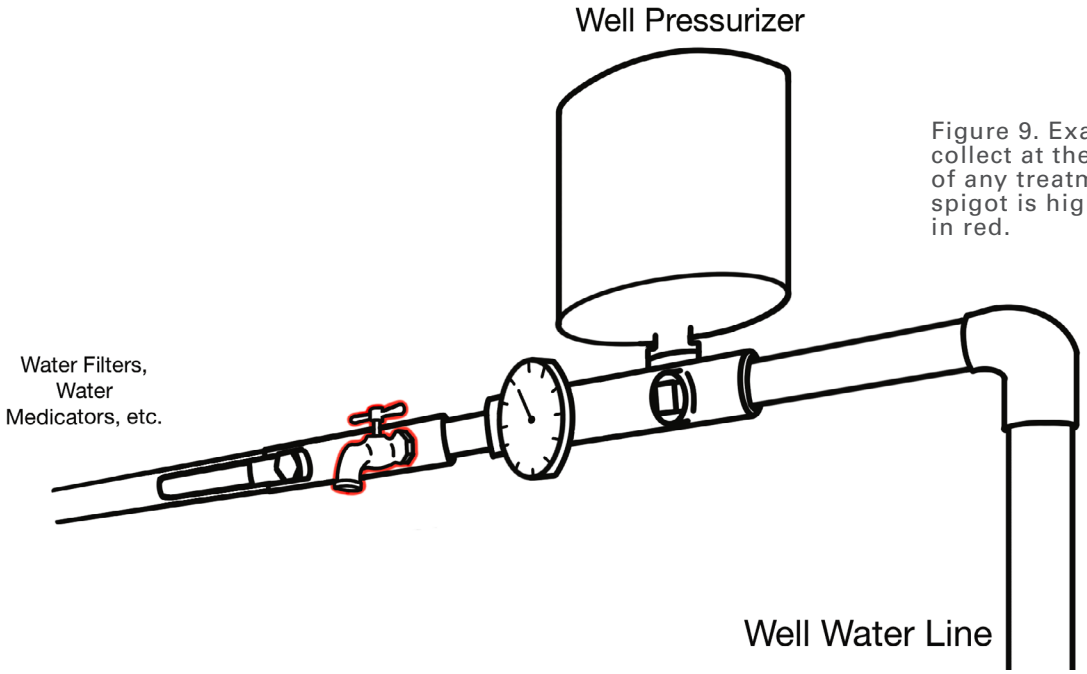


Figure 9. Example of where to collect at the well head, ahead of any treatment system. The spigot is highlighted in red.

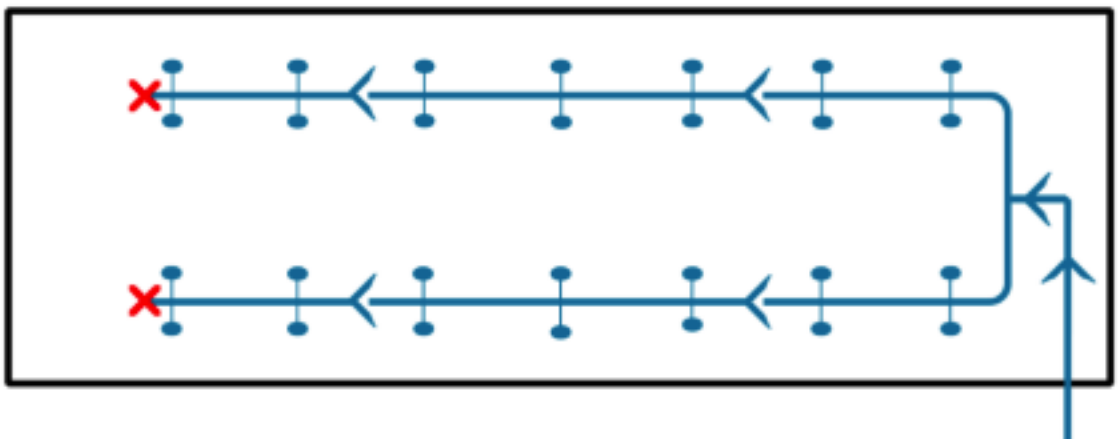


Figure 10. Example of where to collect at the end of the furthest water line in a branched water line system. Main pipes are represented by blue solid lines. Arrows indicate the direction of water flow. Drinkers are represented by closed circles. Walls of the building are represented by the solid black lines. Red 'X' is the spot of collection.

Available Water Quality Assessments

A variety of water testing options are available at Midwest Labs (Table 3). Analytical Chemistry Services are available at the Iowa State University Diagnostic Laboratory for testing water quality and antibiotic residual (Table 4) Note: Producers should contact the labs for consultation and to order supplies.

Table 3. Typical livestock water tests available at Midwest Labs as of December 2024.

Test Name	Sample Type	Detection Elements	Price
W – Livestock Suitability	(2) 250 mL	Sodium, conductivity, iron, calcium, sulfate, copper, magnesium, nitrate nitrogen, total dissolved solids, chloride, pH	$55
Total Coliform	125 mL sterile	Total coliforms, *E. coli*	$30

Table 4. Water tests available at the Iowa State University Diagnostic Lab, including sample type, detection elements, and prices as of January 2026.

Test Name	Water Sample	Detection Elements	Notes	Price
Individual Element	100 mL	Calcium, copper, iron, potassium, magnesium, manganese, molybdenum, phosphorus, selenium, sodium, zinc		$25
Mineral Panel	100 mL	Calcium, iron, potassium, magnesium, manganese, molybdenum, phosphorus, selenium, zinc	Panel includes nine minerals, excluding sodium.	$50
Liquid Chromatography-Mass Spectrometry (LC-MS) Toxicant Screen	100 mL	Environmental contaminants and toxicants as well as drugs (antibiotics, anthelmintics, growth promoters, and ionophores)	Data matched to a library of +9 million spectra*contact the laboratory for specific questions.	$150
Gas Chromatography- Mass Spectrometry (GC-MS) Toxicant Screen	100 mL	Pesticides, industrial pollutants, natural products, alkaloids, vitamins, and drugs	Data matched to library of +200,000 compounds*contact the laboratory for specific questions.	$150
Mass Spectrometry Toxicant Screen (GC-MS and LC-MS)	100 mL	Environmental contaminants and toxicants as well as drugs (antibiotics, anthelmintics, growth promoters, and ionophores) Pesticides, industrial pollutants, natural products, alkaloids, vitamins, and drugs	Data are matched to a library of +9 million spectra. Data are matched to a library of more than 200,000 compounds.	$225
Cyanobacterial Harmful Algal Bloom (CHAB) Toxins	500 mL	Anatoxin-A, cylindrospermopsin, microcystin LA, microcystin LR, microcystin RR, microcystin YR		$200
Phytoplankton (Blue green algae identification)	500 mL	Phytoplankton / Blue green algae		$40
pH	100 mL	pH		$7
Toxic Element Panel	100 mL	Antimony, arsenic, barium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, phosphorus, selenium, thallium, zinc	Panel includes all detected toxic elements. Heavy metals are more sensitive but are limited *contact the laboratory with specific questions.	$50
Nitrate/Nitrite	50 mL	Nitrate/Nitrite	Keep refrigerated.	$30
Urea	100 mL	Urea	All specimens should be frozen and kept frozen during shipment.	$40
Water Quality Panel	500 mL	Nitrate, total dissolved solids, sulfur, coliform bacteria	Samples should be submitted in clean unused bottle. If submitting samples in a coliform bottle, add an additional 400 mL in a separate clean bottle.	$40

Water Line Management

Water Line Cleaning and Disinfection

When selecting a water line cleaner and disinfectant, it is important to consider the quality of the farm's water, management requirements of the product, labor availability, hazards associated with handling the product, and necessary safety measures. Additionally, producers should assess the capabilities of their facilities and equipment for proper application, as well as the overall cost of the product. In a recent survey of Midwest swine production sites, 20% of the farms had a water line cleaning standard operating procedure (SOP) that was regularly implemented. When visiting the sites to conduct the survey, it was noted that most water lines were not regularly disinfected. Of the 20% of farms that had a water line-cleaning SOP, no continuous disinfectant was used. A lack of disinfection programs and no equipment performance validation leads to a poor standard of water line quality.

Starting at the water's source is an important first step in understanding the farm's water quality and choosing a compatible disinfection product. The most common water source for swine operations in the Midwest is well water. Other common sources of water include surface water or rural water. Surface and well water can become contaminated and contribute to water quality challenges on farms. Understanding these challenges and obtaining water diagnostics are essential to choosing compatible cleaning and disinfection products. A single water sample is not sufficient to estimate the overall water quality of the farm. Biofilms in water lines can contribute to decreased water quality, so multiple samples that include the well and barn rooms are necessary. Biofilm is a structured collection of microorganisms, such as bacteria, viruses, fungi, and protozoa, that are embedded in a self-produced extracellular matrix inside the water lines. They need water to develop and typically adhere to solid surfaces or at the interface between liquids and air. As biofilms mature, they can disperse organisms into the bulk water supply. Biofilms can also grow back within three days after a one-time water line cleaning. Continuous water line disinfection is needed to manage biofilms and their long-term dispersal events. Chemical manipulations that remove potential mineral deposits are also needed.

There are two main water cleaning and disinfection methods: terminal (one-time) and continuous with residual disinfection activity. Terminal water line cleanings are usually more concentrated and should **not** be done when pigs are drinking from the water lines in the barn. Continuous disinfection is usually less concentrated; however, most products must be approved by the United States Environmental Protection Agency (EPA) and labeled for use in drinking water for livestock or swine to be legally used. Disinfection products are regulated by the EPA and have no legal extra-label use.

Recommended terminal and continuous water line cleaning/disinfection protocol:

1. Clean the line (Terminal Disinfection).
   - Clean when no animals are present.
   - Clean the entire system, including water lines, standpipes, regulator, and distribution pipes using a terminal cleaner and disinfectant.
   - Activate all drinkers to ensure complete water line cleanliness.
   - Use the correct dosage.
   - Reduce or eliminate biofilm. If water lines are thickly coated with mineral deposits or soiled with organic material or biofilm, multiple applications of the terminal cleaner/disinfectant may be needed to completely clean water lines.
2. Keep it clean (Continuous Disinfection).
   - Use a continuous disinfectant throughout the growing turn of pigs.
   - Use a sanitizer dose level that is safe for animals and follows the EPA label. Use a stabilized product.
   - Disinfect any dispersal organisms from biofilm.
3. Have a surveillance program.
   - Have a continuous daily water sanitation program.
   - Routinely monitor for water quality changes and challenges in farms. Complete water quality testing at least once annually, assessing minerals, nitrates, sulfates, total dissolved solids, coliforms, and *E. coli*.
   - Coliforms and *E. coli* may need to be tested more frequently, depending on farm considerations and available resources. Test from multiple sources (e.g., source water, multiple rooms at ends of water lines).
   - Remove water nipples and clean if they are clogged.

Recommendations for Proper Water System Cleaning and Disinfection

The following suggested water line and water medicator protocols are to be followed in between turns of pigs, and before and after any antibiotic or vaccine administration.

When There Are No Pigs in the Barn (Terminal Disinfection)

The producer administers the water line cleaning product through the water system using the medicator, allows the product to have a fixed contact time, then purges the product from the lines with fresh water.

Before Administering Medication or Vaccine, Pigs in the Barn (Continuous Disinfection)

- The producer ensures water lines are cleaned and flushed with a labeled swine drinking water disinfectant, followed by clean water, before antimicrobial or vaccine administration through the water medicator.
- The producer ensures that a clean stock bucket or a bucket liner is used prior to mixing the antimicrobial or vaccine.

Directly After Medication or Vaccine is Administered Through a Water Medicator (Continuous Disinfection)

The producer flushes fresh water through the medicator, following medication, then flushes a labeled swine drinking water disinfection product through the medicator to clean the water lines.

Commercial Livestock Cleaning/ Disinfection Agent Examples

A list of terminal and continuous water line cleaning and water disinfection agents is provided below. This list is not exhaustive and provides examples of water line cleaning disinfection agent categories that may be available for use in US swine production. The use of trade names is for informational purposes only and is not an endorsement from the Iowa Pork Industry Center or Iowa State University.

CHLORINE DIOXIDE

Dose and Administration

Refer to the manufacturer's instructions for the chemical. Can be used as a terminal water line cleaner or a continuous drinking water disinfectant, depending on dosage.

Mechanism of Action

When chlorine dioxide (ClO_2) is used as a solution or gas, it demonstrates antimicrobial activity by interacting with, and destabilizing, cell membrane proteins, as well as oxidizing DNA and RNA, which leads to cell death. It also promotes protein denaturation, which prevents the binding of animal cells' viral envelope, and hinders viral entry.

ClO_2:

- Can be dangerous if not applied correctly, through the production of chlorine gas
- Requires activation by a co-reactant to initiate its chemical activity
- Should be measured through ClO_2 titration kits to measure ppm for quality assurance
- Is as effective as chlorine, with no documented resistance, and has more oxidation power
- Can be used as a terminal or continuous application, depending on the applied dose
- Must be activated on-site
- Is effective against bacteria, viruses, algae, and also descales

Figures 11a-c. Chlorine Dioxide Commercial Products



11a. PRO Oxine AH and LpH 100



11b. AquaPrime NeoKlor and BioSentry AquaPrime Activator



11c. Dutrion

Table 5. Pros and cons of using chlorine dioxide as a drinking water disinfectant in swine facilities, highlighting its effectiveness in water cleaning and disinfecting, benefits for pathogen control and potential health risks.

Pros	Cons
Long lasting residual/quick kill time	Needs to be mixed on site
Superior to bleach, good oxidizer	Individuals need to be trained to operate safely
Easy to maintain	Relatively expensive
Taste and odor control labels	Inconsistent products, creates solids

PERACETIC ACID

Dose and Administration

Variable, based on product. Consult the manufacturer's instructions.

Mechanism of Action

Peracetic acid disinfects by oxidizing the outer cell membrane of vegetative bacterial cells, endospores, yeast, and mold spores.

Peracetic Acid:

- Is effective for terminal line cleaning applications. After four hours of use, it demonstrated a reduction in biofilm, with even greater reductions observed after 24 hours.
- Acts as an oxidizer, making it effective for removing mineral scale. Performs well in environments with high organic matter.
- Peracetic acid is a broad-spectrum disinfectant with no documented resistances. It is effective against bacteria, viruses, algae, and molds, and can be used in both terminal and continuous applications.

Table 6. Pros and cons of using peracetic acid as a disinfectant in swine facilities, highlighting its effectiveness in water cleaning and disinfecting, benefits for pathogen control, and potential health risks.

Pros	Cons
Easy to apply	May need more application time—pending water quality
Used in the face of high organic matter	Potential decrease in efficacy with high iron water
Ready to use	Must have 5 to 7 pH to be most effective
Taste and odor control labels	Inconsistent products, creates solids

PEROXIDES

Dose and Administration

Variable, based on product. Consult the manufacturer's instructions.

Mechanism of Action

Peroxide inactivates pathogens through oxidative bursts and the generation of localized oxygen radicals, which damage cellular components and disrupt microbial metabolism.

Peroxide:

- Is effective on bacteria, viruses, algae, protozoa, and also descales
- Has no taste issues or chlorine by-products
- Is flammable and can be dangerous to store and handle
- Can be used as a terminal or continuous application, depending on the applied dose.

Figures 12a-d. Peracetic Acid Commercial Products



12a. AquaPrime Peraside 15%



12b. Cid 2000 Pro



12c. Peraside



12d. CID 15 X

Figures 13a-c. Commercial Peroxide Products



13a. FortiSolve



13b. Cid Clean



13c. Cid Clean Pro



13d. Siloxycide



13e. ProMax

Table 7. Pros and cons of using peroxide products as a disinfectant in swine facilities, highlighting its effectiveness in water cleaning and disinfecting, benefits for pathogen control, and potential health risks.

Pros	Cons
Not pH-dependent	Longer contact times are often necessary
No resistant pathogens	Requires higher concentration to be effective
Good oxidizer	

CHLORINE

Dose and Administration

Variable based on product. Consult the manufacturer's instructions.

Mechanism of Action

Chlorine inactivates pathogens through oxidation, reacting with cellular components such as proteins, lipids, and nucleic acids. This disrupts cell membranes, deactivates enzymes, and damages genetic material.

Chlorine:

- Is effective for terminal and continuous use application.
- Is effective against bacteria, viruses, algae, removes iron and manganese.

Disclaimer: All products must follow all EPA regulations. The legal application of these products does not permit any off-label use.

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Table 8. Pros and cons of using chlorine products as a disinfectant in swine facilities, highlighting its effectiveness in water cleaning and disinfecting, benefits for pathogen control, and potential health risks.

Pros	Cons
Inexpensive (bleach)	Resistant pathogens – not as effective as a disinfectant
Chlorine gas, after start-up costs, is efficient and inexpensive	pH-dependent (pH 3 to 7), warmer temperatures increase efficacy
Long lasting residual	Regulatory requirements and safety of gas



Figure 14. Commercial chlorine product.

Illustrations provided by Chantz Nittler.

Resources

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Midwest Labs midwestlabs.com/get-started/pick-analysis-package?industry=environmental

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