PURIFIED WATER REQUIRED FOR INSTRUMENT CLEANING

LEARNING OBJECTIVES
1. Explain that purified water is essential for instrument cleaning
2. Discuss the importance of water testing to confirm it is purified
3. Review selected factors that impact water quality
4. Describe alternative processes by which water can be purified

ALTHOUGH IT IS OFTEN TAKEN FOR GRANTED, WATER IS A VERY important cleaning tool, and the quality of the water used for cleaning and rinsing instruments makes a significant difference in cleaning outcomes. Poor water quality can affect the chemicals’ ability to clean and disinfect, and it can also impact the rinse phase of instrument processing by leaving deposits on items that have been cleaned. For those reasons, the quality of water used in the decontamination area is very important.

OBJECTIVE 1: EXPLAIN THAT PURIFIED WATER IS ESSENTIAL FOR INSTRUMENT CLEANING
Water used by a healthcare facility may originate from a municipal water source or a natural aquifer: an underground layer of water-bearing permeable rock or unconsolidated materials, such as gravel, sand or silt, from which groundwater can be extracted with a water well. Alternatively, it may be surface water that originates from the ground, such as in a stream, river or lake.

Regardless of its source, water must be purified to provide the proper quality required for instrument cleaning. There are many impurities in water that have not been purified, including potable (suitable for drinking) tap water that has been processed at a municipal water treatment plant. For example, water from any source typically contains minerals, dissolved solids, particles, gases, and organic and non-organic chemicals. Note: Some communities voluntarily add fluoride to drinking water systems as a public health measure to help reduce the incidence of tooth cavities among the treated population. Some water sources also contain bacteria, algae and parasites. As a result, water that has not been purified may contain contaminants that may impede cleaning and biocidal processes and, in some cases, certain contaminants may...
There are several commonly-used methods to purify water. Maintenance department personnel in many facilities monitor the CS department’s water purification system, and vendors may also perform this task. These services minimize the need for system upkeep by CS personnel, but they must still be able to identify when their system is not working properly.

OBJECTIVE 1: IDENTIFY THE REASONS FOR CORRECTIVE ACTION IN WATER PURIFICATION SYSTEMS

Properly maintained systems work properly. When a system is not working properly, it must still be able to identify when their system is not working properly.

For these reasons, water used as a final rinse in any cleaning process should be purified to reduce or eliminate these elements.

OBJECTIVE 2: DISCUSS THE IMPORTANCE OF WATER TESTING TO CONFIRM IT IS PURIFIED

As suggested above, purified water refers to all types of water from which chemicals and living organisms are removed using one or more of several alternative water purification processes.

It is important to confirm that all water used for the final rinsing of instruments during the cleaning process is purified.

Tests of water samples should be made at each site where water is used as a final rinse in manual and mechanical (ultrasonic, cart washer, and washer-disinfector) processes. Tests can be performed by facility personnel or, alternatively, manufacturers and distributors of cleaning products, cleaning machines, and water treatment products often provide these tests without charge.

A five-step process can be used to conduct a test of water used in manual or mechanical cleaning systems:

- Obtain a sterile plastic container to collect the sample. Note: Sterile urine sample containers can be used.
- Locate the source where the final rinse enters the sink (manual system) or the cleaning equipment. Note: Maintenance, biomedical or service contractor personnel may need to disconnect the water lines to obtain the test samples.
- Let the water flow for several seconds and then fill the collection container.
- Close the lid tightly and send the container to the testing facility as quickly as possible. Doing so will minimize the changes that can occur over time with gasses in the water.
- A report about water quality, including conductivity, total dissolved solids, acidity (pH), chlorides, silicates, and particle count, will be returned by the testing facility.

OBJECTIVE 3: REVIEW SELECTED FACTORS THAT IMPACT WATER QUALITY

Several water quality factors are commonly evaluated in water quality tests.

WATER CONDUCTIVITY. This factor indicates the water’s ionic (electrical) charge. The greater water’s electrical charge, the more elements are in it. When the elements are removed, the electrical charge is lost, and aggressive attempts to regain the charges occur. This is why water should not be purified to the fullest extent; doing so strips weaker metal from the instruments being processed. Deionization and reverse osmosis are the most commonly-used methods to treat final rinse water used for cleaning.

TOTAL DISSOLVED SOLIDS. Water contains many elements, but iron, silicates, calcium, and magnesium are of most concern to CS technicians because they affect the appearance of processed devices after cleaning. Hard water stains appear as water spots, iron and silicates create bluish or rainbow-type stains, and powdery stains or chalky build-ups result from calcium and magnesium in the water.

SILICATES. Silicates can leave a bluish rainbow stain on stainless steel and, if noticed, they should be removed from the water. After corrective action is taken, water should be tested daily for a few weeks to ensure a level of 100 ppm (parts per million) or less.

ACIDITY (pH). This relates to the measure of alkalinity or acidity on a scale of 0 - 14; a pH of 7 is neutral (neither acid or base).
alkaline); pH below 7 is acidic because of an excess of hydrogen ions; pH above 7 is alkaline because of an excess of hydroxyl ions. Knowledge about the pH of water used to clean instruments is important for several reasons. Many cleaning chemicals used for decontamination require specific pH ranges to be effective, and the final rinse water must be free of impurities. CS managers who know the water’s pH level can make wise decisions when selecting and using cleaning and disinfecting chemicals, and they can also better determine the type of purification system needed.

CHLORIDES. These chemicals are always found in treated water. Most tap water contains 400 ppm; the goal is 100 ppm or less. High concentrations weaken the finish of instruments being cleaned, expose the core metal, and accelerate corrosion. Test kits are available that, when properly used, turn water to a specific color that helps determine the concentration of chloride in the water.

OTHER PARTICLES. These include pieces of rusted piping and miniscule elements of rubber, plastic, filter elements, and other materials. Water also contains sediment – small objects from the water source, including sand, clay, and dirt. Experts can visually detect turbidity, a situation that occurs when water is stirred, and its sediments and solids make it appear cloudy. Note: Gasses in water can temporarily make water turbid. Particles in water make it dirty and greatly reduce the cleaning ability of the detergents that are used.

OBJECTIVE 4: DESCRIBE ALTERNATIVE PROCESSES BY WHICH WATER CAN BE PURIFIED

CS managers must ensure that the water used for instrument cleaning meets the requirements for the specific use. To best ensure this, they should be familiar with basic information about water purification systems.

There are several commonly-used methods to purify water. Maintenance department personnel in many facilities monitor the CS department’s water purification system, and vendors may also perform this task. These services minimize the need for system upkeep by CS personnel, but they must still be able to identify when their system is not working properly.

FILTER SYSTEMS

The most common type of water purification system in CS departments is the use of filters. While filters can effectively remove some impurities, they are not generally appropriate for use without a supplemental purification system.

The filter system best known to most CS technicians is the granular activated charcoal (GAC) system used to remove chlorides in water. A common example of its usage occurs in a fresh water fish aquarium. GAC is also used to treat water in the deionization and reverse osmosis systems discussed below.

The GAC cartridge or tank is placed before the system to reduce the chlorides that would otherwise inhibit the effectiveness of a deionization system or dissolve the membrane in a reverse osmosis system. Testing the water with a chloride test kit can determine when the cartridge needs to be replaced.

WATER SOFTENERS

Water softeners are another type of purification system, and they are used to remove the calcium and magnesium in the water. Note: The word “softened” describes the result of the process. Water softeners use a cation resin tank into which untreated hard water flows through bead-shaped or membrane materials. In the process, the calcium and magnesium in the water are replaced with sodium.
When the chemicals are removed, the water is softened because they are the main elements that contribute to the “hardness” of water. Hard water leaves white deposits on instruments and glassware, and inside the processing equipment. These deposits can harm instruments, and they can also cause scale on the walls and in the motors and pumps of the cleaning equipment.

When the resin has attracted all the minerals it can hold, an indicator light signals the need to recharge the tank. This is usually done by a vendor who exchanges the used tank(s) with recharged tank(s).

**DISTILLATION**
Distillation is a third water purification system, and it involves using a still to heat water to stream and then allowing it to cool and condense. Distillation removes impurities like gasses and organics, and it also removes bacteria. When distilled water became less expensive to buy than to produce, most CS departments discontinued the use of stills. However, small and reasonably inexpensive stills can still be purchased for use with heating/cooling therapy units.

**DEIONIZATION**
Deionized water, sometimes called demineralized water, is a fourth water purification system. With this process, minerals, such as calcium, magnesium, and sodium, are removed from water using an ion exchange process.

Deionization systems are used for heating and cooling therapy units, and for the final rinse water in manual and automated cleaning processes. They use a combination of pre- and post-filters, GAC, and cation resin tank(s) to remove the ionic-charged elements in the water. When the tank(s) need to be changed, a resistivity light located at the end of the last tank will illuminate. Tanks are usually changed by a vendor.

**REVERSE OSMOSIS**
Reverse osmosis produces pure water by forcing impure water through a series of filters and then through a semi-permeable membrane through which impurities cannot pass. Maintenance on the system should be performed by someone qualified in reverse osmosis systems because the expensive membrane can be damaged if it is handled incorrectly. Reverse osmosis can remove a large percentage of dissolved solids and organics, and it is capable of removing all particles, bacteria, pyrogens, and endotoxins.

**IN CONCLUSION**
While alternative water purification systems can be used in CS departments, it is important to understand how to determine if the system is working properly. This responsibility is critical because non-functioning purification systems can cause damage to instrumentation and processing equipment.

Major tasks to maintain purification systems typically involve the facility’s maintenance department and/or vendors. However, CS personnel may routinely perform two ongoing activities: conduct of water tests and, where applicable, determination when tanks must be replaced.

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