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LEARNING OBJECTIVES

1. List hazards found in decontamination when using automated cleaning equipment
2. List hazards found on the clean side when using automated cleaning equipment

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Self-Study Test Answers:
1. C, 2. A, 3. B, 4. A, 5. C, 6. D, 7. D, 8. C, 9. A, 10. A

Mechanical Cleaning Safety: A Tale of Two Sides

by Cody McElroy, Heide Ames

Most medical devices that go through sterile processing departments spend time in mechanical cleaning. Dirty medical devices enter, and clean ones leave. Many assume all the safety hazards are found on the dirty side of operation, but mechanical cleaning safety is truly a tale of two sides.

Decontamination and Equipment Safety

Decontamination removes soils from medical devices and disinfects them in preparation for patient use or further processing as necessary in the device’s instructions for use. The process is split between two principal areas of medical device processing, the “dirty side” and the “clean side.” The dirty side, also called decontamination side, receives soiled instrumentation. Technicians clean, rinse, and disinfect the medical devices in preparation for patient use or further processing as needed. Technicians use ultrasonic cleaners, washer disinfectors, cart washers, and other mechanical cleaning equipment to perform this task. Technician must be aware of the hazards and safety features of their equipment.

Ultrasonic Cleaners

Ultrasonic cleaners convert sound waves into a mechanical cleaning action. As sound waves pass through the ultrasonic cleaner’s tank, small bubbles form in the cleaning solution. The bubbles implode near devices pulling soils from surfaces. This action is called cavitation.

Cavitation can cause aerosolization of the cleaning solution. Breathing the aerosolized solution brings chemicals and potential pathogens into the lungs. Lids trap aerosolized material within the cleaner. However, lids can be removed mid cycle allowing access to contents. Placing or removing instrumentation mid cycle exposes hands to ultrasonic sound waves which can irritate skin and potentially damage fluid filled joints.

Larger cleaners give rise to tray hazards. Trays cause back strains when technician bend and twist during placement and removal. Dripping trays can create slip

hazards and expose technician to contaminated cleaning solutions.

Modern ultrasonic cleaners have many features designed for safety. Lid locks stop removal of the lid mid cycle preventing technician exposures to aerosols and the temptation of adding or removing instrumentation. Some cleaners include mechanical tray lifters to reduce the amount of bending and twisting.

Automated systems that include rinsing removes dripping cleaning chemistry hazards. Some of the advanced safety features include drying of instrumentation ending the threat of slip hazards.

One safety threat cannot be solved with cleaner design, cleaning personal items. This is hazardous for both the personal items and the technician. Ultrasonic cleaners use sound waves sized for the items they clean. Too low, and the item is not cleaned. Too high, and the item could be damaged. Such is the case with personal items. Personal items include organic materials, gemstones, plated metal, and a host of incompatible materials damaged by medical device ultrasonic cleaners.

Even when the personal item is compatible, hazards exist. Cleaning chemistries used to clean medical devices are vastly different from those that clean personal items. The ultrasonic cleaner’s chemistry could damage the personal item, not completely rinse off, or become trapped within the personal item transferring cleaning chemistry directly to technician’s skin. Facility’s must have policies with proper training to reduce the occurrence of processing personal property within department cleaners.

Washer Disinfectors

Washer disinfectors clean racks filled with surgical devices, containers, bowls, and more. Specialized racks address the needs of specialty surgical equipment. Following initial manual cleaning, medical devices are placed in trays or directly on racks. Instrumentation that requires lumen flushing attach to flow ports. Once pushed into the washer disinfectant, devices are cleaned, rinsed, lubricated, if needed, and thermally disinfected.

Safety hazards exist throughout the process. Carrying dripping trays and devices from sinks to racks create slippery floors. Pushing loaded racks weighing upwards of 50 pounds cause muscle strain. Moving parts create pinch hazards.

Washer disinfectors use spray arms to distribute cleaning solutions, lubricants, and water for thermal disinfection reaching temperatures in excess of 80 °C/ 176 °F. Opening doors mid cycle to add or remove items could expose technicians to hazardous chemicals and scalding water.

Several safety innovations help reduce the possibility of harm from washer disinfectors. Transfer carriages carry racks from sinks to the washer disinfectors reducing muscle strain. Drips are caught in carriage bottoms preventing wet floors.

Using carriages adds new hazards. Moving carriages could cause racks to fall during transfer. Wheel locks prevent carriages from moving but often, technician will not use them. Some washer disinfectors overcome this with a docking system that locks carriages in place prior to rack transfer.

Full racks on carriages obstruct the technician's view during movement creating and opportunity for accidents injuring a technician, equipment, and other obstacles. Adding department safety mirrors can increase visibility.

Automated loading reduces the potential for injury by pulling or pushing the rack into the washer disinfector from the carriage. Conveyor belts with automated rack movement between washer disinfectors eliminate technician back strains.

The last safety feature often overlooked is the emergency stop button. The stop button is used when there is immediate threat of damage to equipment or injury to a technician. The button stops all activity in the washer and allows immediate access to the chamber.

Cart Washers

Cart washers are floor loading washers designed for cleaning and disinfecting case carts. Some cart washers include cycles and racks for cleaning and disinfecting rigid sterilization containers and surgical instrumentation. Cart washers have all the same risks as washer disinfectors with a few unique risks.

Cart washers install at or above floor level. When above the floor level, carts and racks must be pushed "uphill" and into the washer. The hill creates an opportunity for carts to roll backwards and across the processing area. Floor grips and wheel locks slow and prevent movement.



Figure 1: Washer disinfector with red emergency stop button and white carriage docking system.

The tall racks obstruct technician views. Installing safety mirrors in key locations can give technician the visibility they need to prevent accidents.

Cart washers have a tilt function that raises one side of cart to promote drainage. Using a cart cycle for an instrument rack could tip racks over in the washer damaging rack contents and the washer itself. Safety is compounded when technician must enter the washer to tip racks upright exposing them to falling rack contents, slip hazards, and hot surfaces.

Employees also need to enter the washer to remove and clean floor drain screens. This creates a unique hazard of a person being trapped in the cart washer while another starts a cycle leading to severe injuries and potentially death. Cart washers with interlocking doors prevent starting a cycle when a door is open. They can also prevent the opposite side from closing the door and beginning a cycle.

Emergency stop ropes within the chamber allow trapped technician to stop the cycle from inside. It also opens the doors allowing escape. It's important that both the internal rope and the external emergency stop button immediately stop all washer activity. This is different from a cancelled cycle. Canceled cycles often complete specified activities, such as draining, before the doors can be opened. A delay like this during an emergency could cause added harm.

Cleaning Chemistry Safety

Cleaning chemistries are common for all mechanical washers. Chemical hazards can include skin irritation, respiratory irritation, and corneal damage. Personal protective equipment (PPE) is required whenever chemistries are manually added or removed from mechanical equipment. PPE should include:

- fluid resistant shoe covers, aprons, and hair covers

- eye protection such as goggles, safety glasses with eye shields, and full-face shields
- Chemical resistant gloves that extend past the wrist to cover the sleeve

Cleaning chemistry may be supplied from a central location with bulk bottles feeding several washers. The chemistries bottles weigh 30 or more pounds with drums weighing upwards of 300. Moving and replacing containers gives rise to muscle and back pain. Foot injuries are a possibility if bottles are dropped. Employing concentrated and ultraconcentrated chemistries can help reduce the volume of chemistry needed and the bottle sizes along with them.

Clean Side and Mechanical Cleaning Safety

Clean side technician should be aware of the safety hazards that washer disinfectors and cart washers bring to them. As mentioned before, thermal rinses create devices and racks too hot to handle with bare hands. Pooled and dripping water in carts, on racks, and devices create a burn hazard. Hot pooled water from misloaded racks or movement of concave items can splash on technician. Moisture resistant thermal protective gloves should be available to manage these items. Residual water can drain to floors creating slip hazards. Carefully consider floor grade and floor drain placement. Racks and carts should be allowed to cool to a safe temperature before transferring to use areas.

Just as on the dirty side, wheel locks, docking mechanisms, and well-placed safety mirrors help prevent injuries while moving racks and carts.

Emergency stop buttons should be available on the clean side for emergency situations. In addition to the stop buttons, the cart washer's internal safety rope should be accessible when entering the cart washer from the clean side.

Storage of cooling transfer carts and racks can quickly lead to clutter. Be aware of peak usage times and consider alternative storage of cleaned items to allow racks to return more quickly to the dirty side. A rack return may be ideal for reducing clutter. Rack returns can double as cooling stations. A bonus is that returns capture dripping water preventing slip hazards.

Though rack returns can help reduce burns, ergonomic injuries, and clutter they do bring new hazards with their use. Racks are pushed along rack returns. As with any moving items, pinch hazards are a possibility as fingers, hands and arms come between the racks or between racks and the

return. Muscle strain and back pain are possibilities as technician move heavy racks.

Racks can become misaligned during movement. This can create opportunities for the rack to tip or become stuck. Dislodging racks or lifting full racks to realign them can give rise to back injuries and an increased risk of items or racks falling onto technician. Never force a rack to move or try to reposition full racks on the rack return.

Automation of the process can help reduce potential injuries. Automation moves racks into and out of washers, and along the rack return. This can help reduce strain injuries and burns. However, just like the manual rack return, forcing movement and repositioning full racks can cause injury.

Rack return safety is increased with the introduction of robotic assistants. Technicians no longer interact with racks. Robots act as smart transfer carriages picking up racks and moving them to the next fixed location.

Maintenance and Repair Safety

Maintenance and repair must be done in a safe manner. Personnel may be exposed to:

- electrical currents
- hot surfaces and components
- chemicals
- pressurized water

- moving components
- pathogenic microorganisms

General safety requirements for electrical equipment should be followed. Unplug equipment or turn the power off at the breaker. Use lockouts to prevent plugging in or turning the breaker on during work.

Mechanical cleaning equipment has unique safety hazards. Interior surfaces, fluid lines, and water pumps may be hot enough to cause burns. Equipment may need to be cooled prior to work.

Should equipment failure occur prior to completion of the thermal disinfection phase, or the equipment does not have a disinfection phase, all surfaces, recirculating pumps, and recirculating fluid lines should be considered contaminated with biohazardous materials and proper precautions taken. Contaminated components may require disposal as biohazardous material. Work with the waste management team to determine the right disposal process.

Take special care when dislodging stuck items within conveyor systems and mechanical washers. It may be necessary to shut down the washer and remove all racks from the conveyor line to safely dislodge items.

Access to pumps and piping may require entering a restricted space. Ensure ease of exit and follow proper protocols to

prevent injury. Components found above the washer introduce the need for ladders or step stools. Ensure ladders and stools are stable on flat ground prior to climbing up.

It may be necessary to remove portions of a conveyor to reach washer disinfectant components. More than one person may be needed to safely move the piece. Be sure to follow proper lifting techniques to prevent injury.

Required personal protective equipment will depend on the maintenance or repair activity and the PPE needed for the room that the work is performed in. For example, work performed on washer disinfectant in an active decontamination area will require face shields, safety glasses, face mask, fluid resistant coverings such as aprons, shoe covers, and hair covers. Additional PPE such as fluid resistant thermal gloves may also be required if working on a hot chamber or pump.

Stay Safe

Working safe with mechanical cleaning equipment requires diligence on both sides of processing. Be aware, be alert, be safe. **HPN**

Reference:

1. Occupational Safety and Health Administration (November 3, 2023) Regulations Standard -29 CFR 1910. U.S. Department of Labor. <https://www.osha.gov/laws-regs/regulations/standardnumber/1910>

CONTINUING EDUCATION TEST • JANUARY 2024

Practice Test: Mechanical Cleaning Safety: A Tale of Two Sides

- What is the formation and implosion of bubbles by sound waves called?
 - Popping
 - Burst sound
 - Cavitation
 - Convexing
- What is made airborne during aerosolization?
 - Microorganisms
 - Dust
 - Pet Dander
 - Lint
- Cleaning personal items in facility ultrasonic cleaners does not pose a safety hazard.
 - True
 - False
- Which safety feature prevents technician from adding items mid washer cycle?
 - Locking doors
 - Instructions for use
 - Training
 - Stop button
- Which hazard is unique to transfer carriages?
 - Hot surfaces
 - Chemical exposure
 - Obstructed view
 - Wet floors
- Which safety feature found in cart washers allows technician to stop a cycle from inside the washer?
 - Emergency stop button
 - Cancel cycle screen
 - Photosensitive eye
 - Emergency stop ropes
- What is a safety hazard associated with chemistries delivered from a central location?
 - Back strain
 - Foot injury
 - Eye damage
 - All of the above
 - A and B only
- Which equipment can help reduce ergonomic and burn injuries on the clean side?
 - Cool down area
 - Safety Mirrors
 - Rack Return
 - Carriage locks
- What is a unique safety concern when servicing automated cleaning equipment?
 - Contaminated components
 - Electrical hazards
 - Dislodging items
 - Lift hazards
- Which type of personal protective equipment protects technician during removal of clean racks and carts from washers?
 - Fluid resistant thermal protective gloves
 - Fluid resistant gown
 - Face shield
 - Face mask



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