

Support Cleaning Apparatus

Operation, Cleaning, & Safety Manual



Revision 1.1

31 May 2014

WARNING: The instructions and precautionary statements contained herein are intended for the Support Cleaning Apparatus with use of the Ecoworks™ powdered cleaning agents. Use of other agents such as WaterWorks™ Soluble Concentrate liquid cleaning agent may pose a much more serious personal safety risk and should not be used with these instructions.

CAUTION: Not following the directions in this manual may cause minor to moderate personal injury. The cleaning station liquid, when heated, can potentially be hazardous. Additionally, the station contents and concentrated powders cannot be simply dumped down the drain as property damage may result.

Note that in order to comply with local and university policy, these instructions must be followed and supersede any instructions found on individual product packaging, unless said instructions are more restrictive than what is provided here.

How the Support Cleaning Apparatus (SCA) Works

The SCA (also referred to throughout this document as the “cleaning station”) heats a very pH-basic solution to a hot temperature (70 °C – 75 °C; 158 °F – 167 °F). The combination of chemicals and heat work to dissolve the softer support material from the rest of the printed structure. A colder solution takes longer to dissolve the support material. A hotter solution may warp the structural material.

The Ecoworks™ cleaning solution is a lot like oxygenated detergents found in the grocery stores. As such, when properly dissolved in solution and cool, it is unlikely to pose a health risk. However, when the powder is concentrated or the solution is heated, there is a risk of minor or moderate personal injury.

When to Clean the Solution

When first cleaned, the cleaning station solution will likely be a milky white color and have a pH of about 12. As the support material is dissolved and becomes part of the solution, it turns the liquid brown and lowers the pH of the liquid. As the solution becomes more dissolved plastic than cleaning solution, its ability to clean diminishes, requiring longer cleaning times.

The solution should not be cleaned after every use. When it is noticed that the solution has turned a dark brown (“mocha coffee”) color and about an hour or so of additional time is required to properly clean, the solution should be changed. Per the Ecoworks™ directions, this will occur after about 40 cu in (655 cu cm) of support material is cleaned away. If you pay attention to how much support material is typically put down in a print job, you’ll understand that this is quite a bit.

SCA Components

The following diagrams show various elements of the SCA that are referred to throughout the remainder of this document.



Figure 1: Support Cleaning Apparatus (SCA)

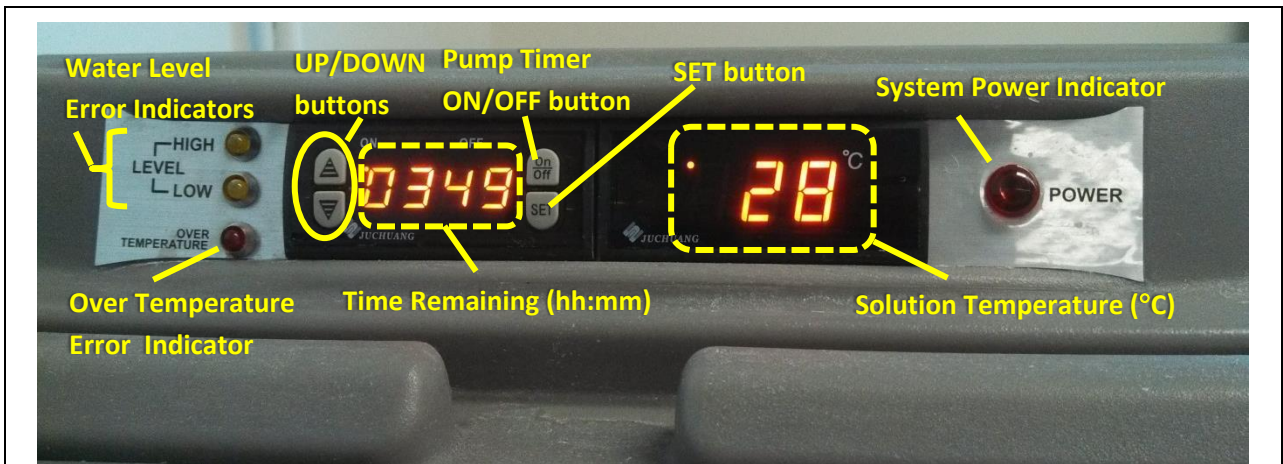


Figure 2: SCA Control Panel

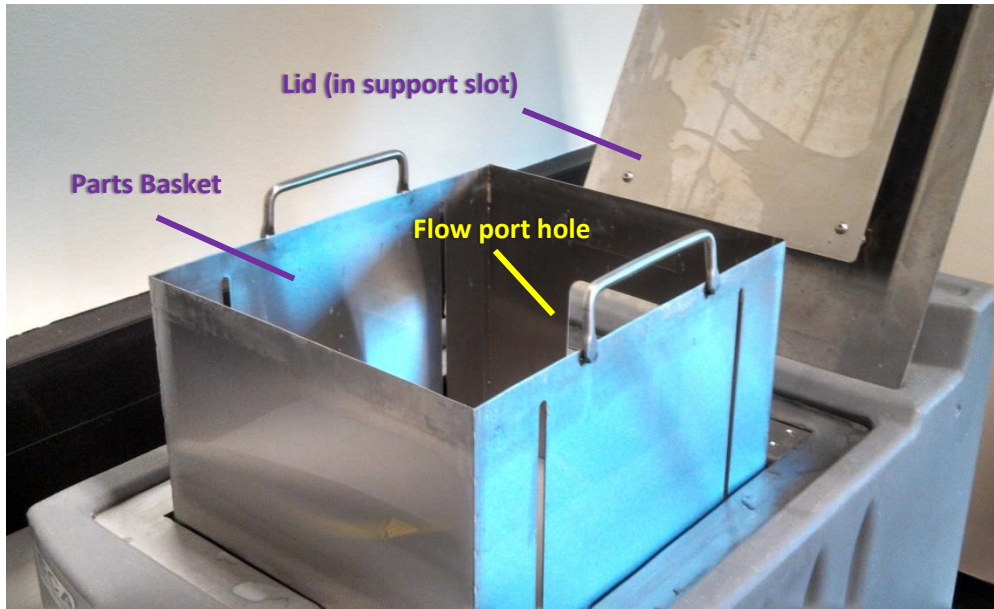


Figure 3a: Parts Basket (Raised Position)



Figure 3b: Parts Basket (Inside View)

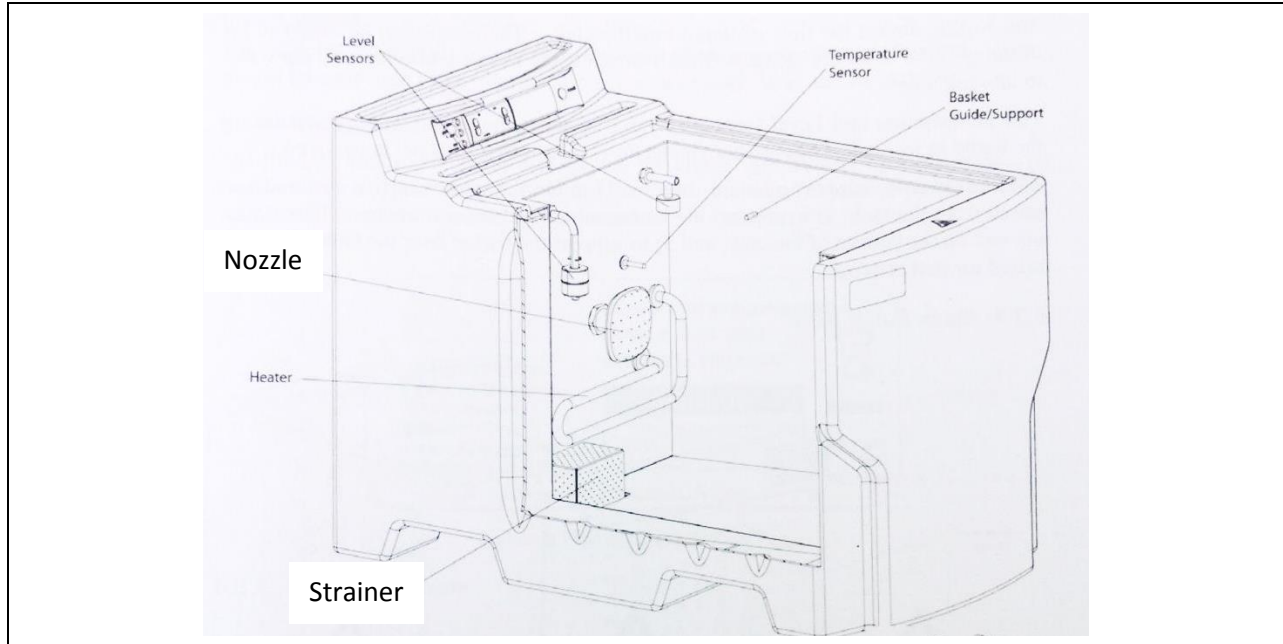


Figure 4: SCA Tank Area (Separator Panel Removed)

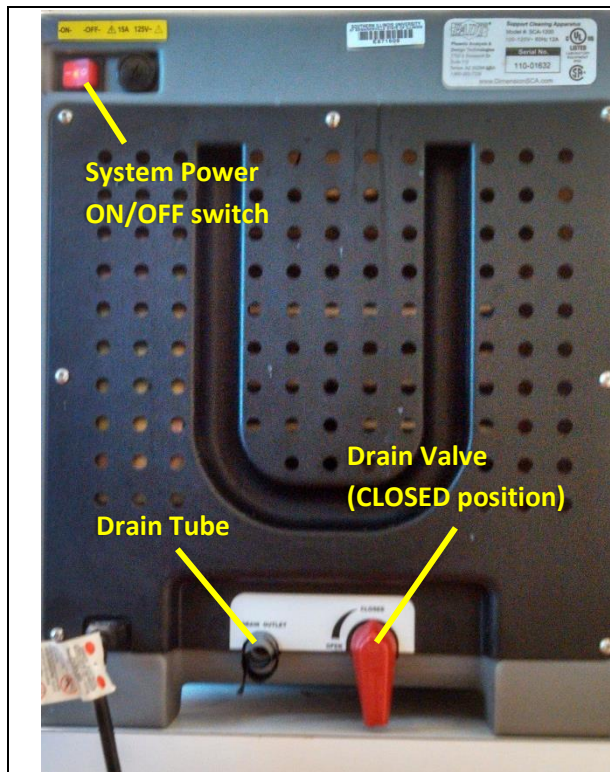


Figure 5: SCA Back View



Figure 6: Small Parts Cage

Operating the Cleaning Station

CAUTION: Heated cleaning solution may cause minor or moderate personal injury such as skin irritation and/or damage to eyes. Wear personal protection such as eyewear and gloves before adding or removing parts from the cleaning station.

As stated above, the cleaning station solution works best at temperatures of 70° C – 75° C (158° F – 167° F). Parts may be placed in a cold solution while the system heats up. It is suggested that you add an hour to the wash time if this is done. Alternatively, the cleaning station may be run during the last hour of printing to bring the solution up to temperature.

Follow these steps, in order, to operate the station and clean printed parts:

1. Don protective eyewear and gloves.
2. Open the cleaning station lid and place the lid in its storage slot in front of the control panel (see Figure 3a).

CAUTION: If the cleaning solution is hot, vaporous solution which may potentially irritate the eyes may escape as the lid is first lifted.

3. Visually inspect the cleaning solution. If it looks too dirty, stop here and then follow the procedure in the Cleaning the Cleaning Station Solution section, below.
4. Ensure that the station is properly plugged in and that the red drain valve at the back is fully in the 'CLOSED' position—vertical with the handle downward (see Figure 5). Turn on the system using the red system power switch at the back of the unit (see Figure 5). The power indicator on the front panel (Figure 2) should light up.
5. Raise the cleaning tank basket and lock in the up position using the guide pins as shown in Figure 3a. As the basket is lifted, you may get a low water indicator alert. This is good as it means the system is properly functioning.
6. Insert all parts to be cleaned into the raised basket. Any small parts that can fit inside the smaller parts cage should be placed there. Gently lower the basket(s) into the tank. As the basket is lowered, you may trigger the high water level alarm. Again, this is a good test and ensures that the system is working correctly.
7. With the parts submerged and the large cleaning basket fully resting within the tank, visually inspect the cleaning solution water level and the front panel lights. The water level must be between the upper and lower water level lines—right around the basket support/guide pins. If too low or too high, the appropriate control panel light should light up (and an audible alarm will be heard, too). **If you notice that the water level is inaccurate but the appropriate light does not illuminate, stop here and contact Dr. Lee or Dr. Mayer.** Otherwise, using the cleaning station at this point may damage it further.

8. If the water is just a little too low, you may slowly add fresh water to get it to the correct height. Using warm water reduces the heating time.

If the water is a little too high, use a small bucket to scoop some of the solution out of the tank—a couple of cups in volume at a time. If the solution is high due an abnormally large volume of printed parts, you can save the solution in the bucket to pour back in the tank once the cleaned parts are removed. If you elect to dispose of the extra solution, clean out the sink, turn on the cold water sink faucet at full volume, and slowly pour the extra solution down the drain. Allow the faucet to continue to run for at least a minute after you dump the last cup or so of solution.

Note that the SCA should not operate if the water level is not correct.

9. With the cleaning solution level at the proper height, replace the tank lid. The lid must be in place during operation. It increases safety and minimizes heat loss and evaporation during operation.

Protective eyewear and gloves may be removed. Gloves should be rinsed and dried.

10. Set the desired wash time. Press the 'Set' button on the front panel. The 'Minutes' will blink. Press 'Set' again and the 'Hours' will blink. Use the 'UP' and 'DOWN' arrows to change the desired hours or minutes as they are blinking. With the Ecoworks™ solution, a typical wash time of five to six hours is recommended.

Remember to add an hour if the solution is cold. You will also need more time if there are a large number of parts and/or the solution is getting dirty.

11. Press the pump timer 'On/Off' button on the control panel once the desired time is set. The system pump and heater will automatically start and the timer will begin counting down. The system will automatically shut off after the timer reaches zero.

During operation, the system will automatically attempt to maintain proper temperature. If at any time during operation the water level goes too high or too low, the system will provide an audible alarm and shut off the pump and heater until a proper water level is restored. If the cleaning solution overheats, the "Over Temperature" indicator will light, an audible alarm will be heard, and the system will not operate until the solution has cooled to a proper temperature. The system should not overheat the solution. If this occurs more than once, shut off the system power switch and contact either Dr. Lee or Dr. Mayer.

CAUTION: Lifting the lid during operation does not directly affect operation of the pump or heater. If the cleaning solution is hot, vaporous solution which may potentially irritate the eyes may escape as the lid is first lifted.

Removed Cleaned Parts

CAUTION: Cleaning solution may be hot, potentially causing skin irritation or mild burns from heat even through the rubber gloves. If the temperature feels uncomfortable, then let the solution cool before proceeding.

CAUTION: If the cleaning solution is hot, vaporous solution which may potentially irritate the eyes may escape as the lid is first lifted.

1. Clean out all items from the sink and turn on the cold water faucet.
2. If the cleaning station is running, press the **'On/Off'** button on the front panel to turn the pump and heater off. Then, turn the power switch on the back of the unit to the **'Off'** position.
3. Don protective eyewear and gloves.
4. Slowly open the lid, keeping your face away from the opening until the steam has escaped. Place the lid in its holder in front of the control panel.
5. Gently lift the parts basket up its rails and out of the solution; lock the basket in the up position on the rails.
6. Examine the printed parts, especially small and "blind" corners to ensure that all support material has been washed away.
7. Remove all clean printed parts and printing platforms. Ensure that no small pieces are missing. Place them under the running water in the sink and rinse thoroughly.
8. If any pieces still have support material on them and a second wash has not yet been attempted, then insert these parts back in the basket.
9. Lower the basket slowly back into the solution and replace the cleaning station lid. Note the color of the solution. If it is dirty, use the instructions above for cleaning the solution once the parts removal is complete.
10. Rinse the gloves thoroughly under the running water.
You may remove the protective eyewear and gloves.
11. Handle the parts and printing platforms. If they still feel soapy, continue to run them under the water. Once clean, set them to dry and turn off the cold water faucet.
12. If any parts are in the basket for rewash, then follow the instructions above under **Operating the Station** for cleaning the parts. Use four hours as a rewash time.
13. If parts have had two washes and support material remains, and the cleaning solution is not very dirty, then the parts should be thoroughly washed with water and dried. All remaining support material will have to be removed via mechanical means.

Cleaning the Cleaning Station Solution

CAUTION: The cleaning station solution must be below 30 °C (86 °F) before the solution is cleaned. Failure to do such increases personal safety risk and may damage the SCA heating element. When the SCA power is on, the display will indicate the solution temperature.

Follow these steps, in order, to clean the cleaning station of dirty liquid:

1. Turn off the cleaning station and unplug it from the wall. This will ensure that you do not accidentally turn it back on during cleaning and burn out the heating element.
2. Remove all items from the sink, including any stoppers.
3. Remove a few pH test strips from the container and set them aside.
4. Don the protective gloves and eyewear.
5. Open the cleaning station lid and prop up in its slot in front of the control panel. Then, slowly remove the main basket (and small parts basket, if it is inside). Do not lift too quickly or solution may spill out of the station. Place the basket(s) in the sink and thoroughly rinse off any support material residue.
6. Test the pH of the solution to get a base reading. Follow the directions on the test strip applicator container.
7. Add ½ cup of Malic acid to the cleaning solution and mix with your gloved hand.
8. Retest the solution pH.
9. Repeat Steps 6 – 8 until the pH of the solution is below 9, but no lower than 7.
CAUTION: If you added too much acid and the pH goes below 7, then stop here and contact Dr. Lee or Dr. Mayer immediately. Rinse your gloves.
10. Connect the drain hose to the drain tube on the back of the cleaning station and place the other end of the hose in the sink. Placing the hose in the basket in the sink is OK. Ensure that the enough of the hose is at the bottom of the sink to prevent the hose from ejecting itself once liquid begins flowing. You may place the hose end under the basket if the hose is not pinched shut.
11. Turn on the cold water sink faucet. Then, turn the red drain valve (see Figure 5) at the back of the cleaning station to the 'OPEN' position—the valve handle will be horizontal.
12. Once all solution has drained, add about a gallon of fresh water into the tank to flush out any remaining residue. It is good practice to allow fresh water to run in the sink for about a minute after the last of the dirty solution has drained. Visually inspect the station tank for small parts that may have fallen out of the basket and remove if present.

13. Remove the back separator panel that is in the station tank, toward the control panel. The square nozzle at the center of the back of the station should be unscrewed and thoroughly rinsed to remove debris. The strainer must also be removed and cleaned. See Figure 4. A nylon brush may be used if debris does not easily wash away. The manufacturer's directions for removing the strainer are as follows:

“To remove the strainer, slide the strainer forward towards the front of the unit until it clears the two sheet metal lips that hold it in place. Once clear, lift the strainer up and out of the tank.”

Visually inspect other parts, especially ports, for potential clogging. The other parts should be flushed using a bucket of water as needed. **NOTICE: If you see a lot of residue on other parts that will not easily clean off, then stop here and contact either Dr. Lee or Dr. Mayer.**

You may remove your gloves and protective eyewear after this step, if you wish.

14. Put the nozzle, strainer, and separator panel back in place. Per the manufacturer, “To insert the strainer, slide it along the bottom of the tank towards the rear into the two sheet metal lip. Make sure it is pushed all the way back against the rear wall.”
15. Turn the red drain valve at the back of the cleaning station to the ‘**CLOSED**’ position—the handle will be vertical, pointed down. Remove the hose from the back of the station and flush the hose with the running water.
16. Insert the large basket back into the tank and fill the cleaning station tank with fresh water until the water level is just below the basket support/guide pins. Note that the tank holds about eight gallons. **If you intend to use the cleaning station right after cleaning, it is recommended that you fill it with warm water.**
17. Don dry protective gloves and eyewear.
18. Open four packages of the Ecoworks™ cleaning material powder. Note that each package contains both an ‘A’ and ‘B’ side (see image below). **DO NOT PUNCTURE OR OPEN THE CAPSULES WITHIN THE PACKAGES.** The capsule wrapping is a water-soluble material. Carefully place all capsules in the water to avoid splashing.

CAUTION: DO NOT USE WET HANDS OR GLOVES when handling the cleaning material capsules as the casing will dissolve, causing the concentrated contents to spill. Concentrated contents may cause skin irritation and eye damage.



Ecoworks™ A-B package

19. Close the cleaning station lid and remove gloves and protective eyewear.
20. Plug the cleaning station back in and operate for about fifteen (15) minutes to dissolve the cleaning material. See Operating the Cleaning Station, above.
21. Thoroughly rinse the gloves and drain hose and then dry. Finally, stow all cleaning equipment and supplies.

Spills

Spills of the cleaning station solution, the Ecoworks™ concentrated powder, and the malic acid must all be neutralized prior to disposal. To clean up spills, follow these directions:

1. Fill a clean bucket with one gallon of warm water from the sink. **Be sure that the bucket is clean to avoid potential chemical interactions with unknown substances.** Also, be sure that there is at least a few inches of head room from the top of the water level to the top of the bucket (see below).
2. Set aside a few pH test strips.
3. Don protective eyewear and gloves.
4. Using a dampened cloth towel, wipe up the spillage and rinse the towel out in the bucket of water. Carefully wipe down all contaminated surfaces.
5. When contaminated areas are cleaned, place the towel into the bucket.
6. Use a pH test strip to measure the pH of the bucket of water.
7. While the pH of the bucket of water measures **below 7 OR above 9**, take the one of the appropriate following steps:
 - a. If the malic acid spilt and the pH is below 7 then the solution is too acidic. Dissolve two tablespoons to 1/4 cup of baking soda in a small bit of warm water. Carefully pour the baking soda solution into the bucket of water and gently mix with you gloved hand once bubbling (if any) has minimized.
CAUTION: Depending on the acidity and amount of baking soda, the bucket contents may bubble rapidly. Ensure that there is at least a couple of inches head room to the top of the bucket and pour the baking soda solution in slowly. Retest the pH and repeat this step until the pH reads between 7 and 9.
 - b. If the cleaning solution spilt and the pH is above 9 then the solution is too basic. Carefully add two tablespoons to 1/4 cup of malic acid to the bucket of water and gently mix with your gloved hand. Retest the pH and repeat this step until the pH reads between 7 and 9.
8. The bucket of water, at a pH between (and including) 7 and 9 may be safely poured down the sink while the cold water tap is running. Allow the faucet to run another

minute after all bucket contents have passed through the drain. Thoroughly rinse out the towel in the running water at this time and set aside to dry.

9. Wash the gloves under running water for about a minute.
10. Remove protective eyewear and gloves, and set aside to dry.

First Aid

In the event of contact of the concentrated powder or heated solution with the skin, wash affected area thoroughly under cool water for about a minute or two until soapy feeling is gone. Do not apply soap. If reddening of the skin appears due to irritation, seek medical attention.

In case of burns due to contact with high temperature solution, rinse the affected area thoroughly for a minute or two under warm water to remove the cleaning solution and then seek medical attention. Typical first aid for the extent of the burn injury may be followed.

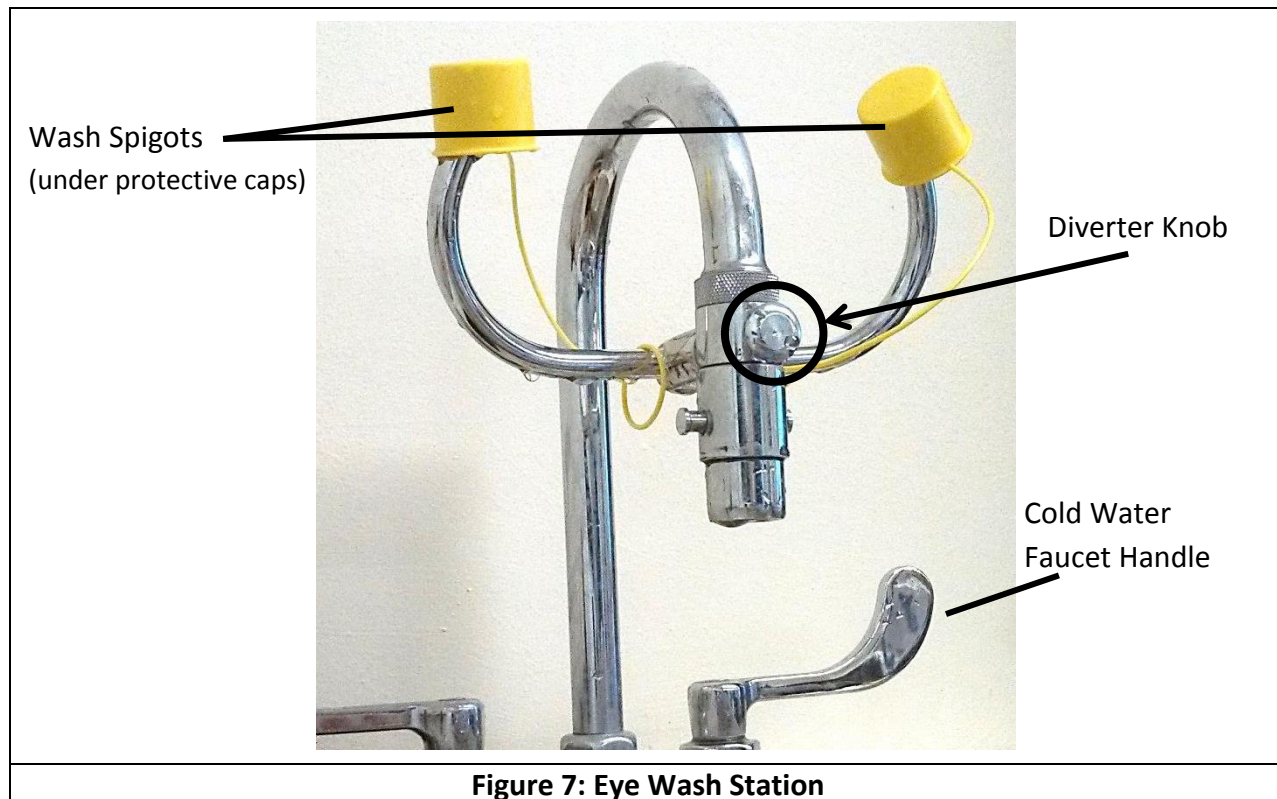
In the event of contact of the solution (heated or cooled) or the Ecoworks™ powder with the eyes, then use the eye cleaning station (see below). Thoroughly rinse the eye(s) for at least five minutes to ensure that all contaminants are removed and any solution is washed out. If eye irritation persists, seek medical attention.

All injury or exposure must be reported to Dr. Felix Lee at hflee@siue.edu once the immediate risk to personal health has been properly handled.

Operating the Eye Wash Station

The eye wash station (see Figure 7, below) for the cleaning station is plumbed into the sink faucet near the SCA. Water is fed from the standard water lines.

1. Turn on the cold water faucet.
2. Pull the diverter knob at the center of the faucet nozzle, between the two arms that hold the eye wash spigots. The exiting water will automatically eject the protective caps from the tops of the eye wash spigots.
3. Place eyes into the wash stream. Keep eyes open and rotate eyes in all directions.
4. To turn off the eye wash spigots, the knob may be pushed back in and the faucet turned off.



Note that the plastic wash port protective caps are to remain on the eye wash spigots at all times when not in use. They will automatically come off when water is diverted to the two wash spigots.

Contact

Questions or feedback about this document should be addressed to Dr. Gary Mayer at gamayer@siue.edu or Dr. Felix Lee at hflee@siue.edu.

Unauthorized use of the cleaning station should also reported to Dr. Mayer or Dr. Lee.