

# Chemical Safety – Special Hazards

Safe Work Procedure (SWP – 009)

## Piranha Solution

Last revised: March 16, 2026

### REVISION HISTORY

	<i>Revision Date</i>	<i>Author</i>	<i>Position</i>
1.	May 13, 2021	Paraskevi Lagaditis	OHSE Consultant
2.	January 28, 2022	Paraskevi Lagaditis	OHSE Consultant
3.	March 16, 2025	Paraskevi Lagaditis	OHSE consultant

### DOCUMENT APPROVAL

*Approved by:* Laboratory Safety Committee

Jody Spence  
*Chair, Laboratory Safety Committee*

February 4, 2022  
*Date Approved*

*\*This revision replaces all previous versions of this document. If a copy is printed, it is the users' responsibility to verify the copy is the most current version of the document.*

## PURPOSE

To provide guidance and instruction of the safe preparation and use of Piranha solution in laboratories. In addition to this general Safe Work Procedure (SWP), each lab must develop a lab-specific work procedure unique to the experiments and activities being performed. The Lab SWP must be reviewed by OHSE (see Procedures, #7)

## SCOPE

The SWP applies to preparation, handling, storage and disposal of Piranha solution (also known as Piranha etch), being both a strong acid and oxidizer. It is commonly used as an agent to remove organic residues from substrates (e.g. silicon wafers). Piranha solution is a mixture of concentrated sulfuric acid ( $H_2SO_4$ ) with hydrogen peroxide ( $H_2O_2$ ) typically in a 3:1 ratio by volume but Piranha solution can also be prepared as 4:1 or 7:1 mixture ratio. This SWP will not cover base Piranha solution which is a 3:1 ratio of ammonium hydroxide ( $NH_4OH$ ) and hydrogen peroxide ( $H_2O_2$ ).

## TRAINING

The following training is required to be completed prior to being permitted to prepare and work with Aqua Regia:

- [WHMIS](#)
- [Lab Safety for Lab Workers](#)
- Lab SWP with documented signoff by the individual and their supervisor.

Refresher training in the General and Lab SWP must be provided when:

- there has been an extended timeframe of inactivity, or
- there has been an incident or injury, or
- 2 years has elapsed since the original training

## REGULATION AND POLICY

The University of Victoria will follow WorkSafeBC Occupational Health and Safety Regulation, specifically sections 30.20 (1-4) and the University of Victoria Occupational Health and Safety & Environment Department.

## RESPONSIBILITY

It is the responsibility of personnel undertaking activities with special hazards to complete all required training and adhere to these safe work procedures, including any additional lab or job-specific procedures.

It is the PI's or supervisor's responsibility to ensure that individuals working with special hazards have been trained prior to commencing work and have demonstrated competency in safely performing all duties associated with the special hazard in accordance with these procedures.

## DEFINITIONS

Circumvent® caps: A vented cap liner to relieve pressure in containers while maintaining integrity against liquid leaks/spills

## MATERIALS

- Acid waste container dedicated to Piranha solution waste equipped with a venting cap (such as Circumvent® caps which are available at Science Stores). Containers must be glass or Pyrex.
- For overnight use of Piranha solution, use Pyrex or glass container and label “Piranha Solution (sulfuric acid & hydrogen peroxide) Extremely Corrosive”.
- Spill X-A or sodium bicarbonate ( $\text{NaHCO}_3$ ) are commonly used acid neutralizers. When sodium bicarbonate is used to neutralize acids, carbon dioxide gas is released which is a non-toxic, non-flammable gas. Spill X-A is a proprietary product comprised of mainly 60-100% magnesium oxide ( $\text{MgO}$ ) blended with other chemical additives. Spill X-A has a reddish colour and minimal gas release is produced when used to neutralize acid spills.

## HAZARD

Piranha solution is a strong acid and oxidizer. Both liquid and vapours are corrosive to the skin and respiratory tract. Piranha solution can become hot, more than 100 °C. Explosion can occur when gas generated from Piranha solution pressurizes closed containers or Piranha solution is in contact with organic compounds. Ensure dedicated lab bench area is clearly delineated and labelled for Piranha solution only. Before preparing and handling Piranha solution, consider less hazardous alternatives to achieve the desired goal.

Piranha solution is a high risk hazardous material and should not be prepared or handled while working alone. Plan to work with Piranha solution during business hours when assistance is readily available should an incident occur.

## PROCEDURE

### 1. Handling

- a. Ensure the area where Piranha solution is prepared has an adequate amount of an acid-neutralizing spill kit (Spill X-A, sodium bicarbonate, or equivalent) and is immediately accessible to neutralize accidental spills.
- b. Conduct all work with Piranha solution within a fume hood.
- c. Prepare small amounts of solutions to be used up for each application. Do not store Piranha solution.
- d. Don PPE (safety glasses, lab coat and gloves).
- e. Prepared Piranha solution may self-heat to hot temperatures (up to 120 °C). Heat insulated gloves may be necessary.

- f. Keep all organics and strong bases away from the area when preparing and handling Piranha solution as they will react violently.
- g. Use glass or Pyrex containers. Piranha solution is not compatible with plastic.
- h. Keep plastic and metals (e.g. spatulas) away from Piranha solution.
- i. Use a secondary container when preparing Piranha solution in case it overflows.
- j. Ensure glassware are rinsed and dried before coming into contact with Piranha solution.
- k. Use 30% hydrogen peroxide; avoid concentrations of hydrogen peroxide >50% to prevent explosions upon preparation.
- l. Always add slowly hydrogen peroxide to sulfuric acid. Never vice versa.
- m. Do not mix Piranha solution with incompatible materials such as organic acids, bases and organic solvents.
- n. Do not seal containers containing Piranha solution because toxic gases will pressurize the container; use venting caps (such as Circumvent® caps).
- o. Allow Piranha solution to cool before using.

## 2. Storage

- a. Do not store Piranha solution; it quickly loses its effectiveness due to oxidation of its reactive components.
- b. Dispose Piranha solution via hazardous waste (See Section 6. Disposal).

## 3. Spills

- a. Follow OHSE's general spill response instructions
- b. Do not attempt to clean up any spill if not trained or comfortable. See assistance or call Campus Security (250-721-7599).
- c. Specific steps for small Piranha solution spills (<500 mL) within a fume hood:
  - i. Don personal protective equipment: neoprene or nitrile gloves, safety glasses, lab coat and closed toe shoes.
  - ii. Slowly neutralize using an acid neutralizer (Spill X-A, sodium bicarbonate or equivalent) from the outs of the spill inwards.
  - iii. Wait for 15 minutes.
  - iv. Test with pH paper until the spill material is within the neutral range of pH 6-8.
  - v. Scoop the absorbed neutralized material into an appropriately sized plastic (polyethylene or polypropylene) container.
  - vi. Wipe up any residue with a moist paper towel or rag.

- vii. Soak the area with detergent, then rinse with water.
  - viii. Collect and label all materials used in the clean-up for disposal through the hazardous waste system indicating the material is “Neutralized Piranha solution spill absorbent and debris”.
- d. Specific steps for large spills (> 500mL) or any spill outside a fume hood:
- i. Secure the area and warn others
  - ii. Immediately evacuate the area
  - iii. Post “do not enter” signs on the doors of the lab
  - iv. Contact Campus Security at 250-721-7599
- e. Complete a [Department Incident & Investigation Report](#) to document and review the spill incident

#### 4. Decontamination

- a. Pre-rinse containers and labware with water to collect any residual Piranha solution and collect pre-rinse washing for hazardous waste disposal.
  - i. Use a [User Supplied Container](#) to collect rinsing as it will be strongly acidic
- b. Completely rinse all labware with copious amounts of water in a sink after pre-rinse.

#### 5. First Aid and Emergencies

- a. Call 911 to summon an ambulance if there is a medical emergency.
- b. Call Campus Security at 250-721-7599 for first aid.
- c. For eye contact, use the emergency eyewash and flush for at least 15-20 minutes.
- d. For skin contact, flush affected area with running water for at least 15-20 minutes.
- e. For inhalation, move immediately to fresh air; seek medical attention in the event of respiratory irritation, cough or tightness in the chest.

#### 6. Waste Disposal

- a. Do not mix Piranha solution waste with other waste.
- b. Use a **glass** [User Supplied Container](#) dedicated for Piranha waste only – do not use a plastic container.
- c. Do not fill the waste container more than 75% full.
- d. If Piranha solution is hot or warm, leave to room temperature in a fume hood for several hours (overnight) before disposal as waste.
- e. Do not seal containers closed, use a vented cap ([Circumvent®](#) caps available at Science Stores).

- f. Label the container “Caution, Piranha solution (sulfuric acid & hydrogen peroxide). May explode in closed container” and disposal date.
- g. Affix a green hazardous waste sticker on the bottle.
- h. Submit an online request for hazardous waste pick-up from OHSE.

## 7. Lab SWP

In addition to this general SWP, each lab that is using Piranha solution require a Lab SWP that includes specific procedures for:

- a. Amount permitted to prepare
- b. Personal protective equipment
- c. How to decontaminate any surfaces or reusable labware
- d. Spill containment and response
- e. Disposal procedure
- f. First aid and emergency response

## REFERENCES

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3. Concordia University *Piranha solution safety guidelines*. Retrieved from [https://www.concordia.ca/content/dam/concordia/services/safety/docs/EHS-DOC-019\\_PiranhaSolutionSafetyGuidelines.pdf](https://www.concordia.ca/content/dam/concordia/services/safety/docs/EHS-DOC-019_PiranhaSolutionSafetyGuidelines.pdf)
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