

**Guidelines for Using and Storing Perchloric Acid
(up to 70%) At Room Temperature in a Standard
Chemical Fume Hood**

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A. Purpose

To ensure that all Columbia University personnel who are approved to use perchloric acid at concentrations up to 70% do so in a manner that is appropriate and safe for all personnel both in the laboratory and in the larger academic community.

B. Applicability/Scope

The use of perchloric acid is largely prohibited at Morningside, Manhattanville and Irving Medical Center campuses, due to a lack of purpose-built perchloric acid specific hoods per NFPA 45 Chapter 7.12.1.2. Therefore, most applications involving perchloric acid are not permitted.

There are case-specific considerations that may permit perchloric acid use after consultation with EH&S. All permitted work in a standard chemical fume hood must trap or scrub perchloric acid vapors before they are exhausted. Assessments may be requested using the form linked here [Qualtrics Survey | Qualtrics Experience Management](#).

This policy applies to all Columbia University personnel who are approved to use and store perchloric acid at concentrations up to 70% at room temperature in a standard chemical fume hood.

Please note that the use of perchloric acid at concentrations higher than 70%, especially anhydrous perchloric acid (>85%), or heating of perchloric acid at any concentration, is required to be performed in a designated perchloric acid chemical fume hood, currently only located at Lamont Doherty Earth Observatory (LDEO) campus.

C. Definitions and Background

Perchloric Acid

“Most of the numerous and frequent hazards experienced with perchloric acid have been associated with either its exceptional oxidizing power or the inherent instability of its covalent compounds, some of which form readily. Although the 70–72% acid of commerce behaves when cold as a very strong, but nonoxidizing acid, it becomes an extreme oxidant and powerful dehydrator at elevated temperatures (160°C) or when anhydrous”¹.

Perchloric acid is usually found as a colorless, odorless liquid. When chilled or diluted, perchloric acid can be used as an oxidizing agent. Interaction with organics, bases, and

reduction agents may result in a fire or explosion as perchloric acid is heated. Perchloric acid becomes unstable and a strong oxidizer when heated to temperatures over 160°C. At concentrations higher than 70%, perchloric acid becomes unstable and is shock sensitive when dry. Anhydrous perchloric acid may ignite at room temperature if mixed with combustible materials. Work with concentrations higher than 70%, and all work involving the heating of perchloric acid, must be conducted in a Perchloric Acid Fume Hood that has a proper wash down system to prevent the buildup of perchlorate salts, which can lead to explosions.

Perchloric acid in concentrations >72% acid by mass, is forbidden for transportation per the US Department of Transportation (49 CFR 172.101).

Routes of Exposure

Perchloric acid is toxic and highly corrosive to all tissues and presents both acute and chronic health hazards. Acute effects may include, but are not limited to, severe burns on contact with respiratory tract, mucous membranes, eyes, and skin. Prolonged exposure to perchloric acid may lead to bronchitis, angina, nosebleeds and/or perforation of the nasal septum, nasal congestion, tooth erosion, conjunctivitis, dermatitis, and ulceration of the skin.

Anhydrous Perchloric Acid

Anhydrous perchloric acid (>85%) is highly unstable and will react in the presence of organic materials. Columbia University strongly urges against the use of anhydrous perchloric acid and requires work with concentrations higher than 70% along with all work involving the heating of perchloric acid to be performed in a designated perchloric acid chemical fume hood, currently only located at Lamont Doherty Earth Observatory (LDEO).

Chemical Fume Hoods

Chemical fume hoods are engineering controls that are utilized as a protective measure against workplace hazards. Standard chemical fume hoods protect workers against exposure to gases, chemical vapors and aerosols. Each laboratory's standard chemical fume hood must be certified annually and be in proper working order for chemical work to take place in the hood. More information is available in the Columbia University [Chemical Fume Hood Policy](#). For questions about the status of a laboratory's standard chemical fume hood, please contact EH&S.

Perchloric acid fume hoods serve as engineering controls for perchloric acid work. Perchloric acid fume hoods are equipped with a washdown system that allows for thorough rinsing of interior surfaces, including ductwork, after each use to prevent the buildup of perchlorates. Purpose-built perchloric acid hoods are not available at the Morningside, Manhattanville, and Irving Medical Center campuses, as of the release of this policy.

D. Procedures

1. Chemical Substitution

Substitute the use of perchloric acid for a less hazardous chemical when possible. Where perchloric acid must be used, consider dilute solutions of <60% due to its less reactive nature at a lower concentration.

2. Administrative Controls

Prior to conducting perchloric acid work, the lab must develop a written Standard Operating Procedure (SOP) and all personnel must read and understand this policy. EH&S has prepared a template SOP that can be completed for the laboratory's perchloric acid experiment(s). This template is attached as Appendix B.

Below are additional administrative controls the laboratory must consider and employ, where possible:

- a. Purchase the smallest amount of perchloric acid for the specific task.
- b. Maintain Safety Data Sheet (SDS) in the laboratory where perchloric acid is used.
- c. Maintain a perchloric acid specific spill kit.
- d. Maintain and use personal protective equipment specific to perchloric acid, such as: poly vinyl chloride (PVC), Sol-Vex nitrile or neoprene gloves, safety goggles and a face shield with safety glasses underneath and rubber or chemical resistant apron over a lab coat.

3. Engineering Controls

According NFPA 45 Chapter 7.12.1.2, "Perchloric acid shall be permitted to be used in a chemical fume hood that is not specifically designed for perchloric acid operations where the vapors are trapped and scrubbed before they are released into the hood." **At Columbia University, work with perchloric acid up to 70%, at room temperature must be designed in such a way that perchloric acid vapors are trapped and scrubbed before being exhausted. All such experiments must be done in a chemical fume hood that contains no organic chemicals or materials, dehydrating agents, or radioactive materials.** The chemical fume hood must have a sign posted alerting lab personnel that perchloric acid work is being conducted in that hood. See Appendix A for Chemical Fume Hood Signage for Perchloric Acid Work.

Please contact EH&S if the laboratory is planning to use perchloric acid at concentrations greater than 70% or to heat perchloric acid in a standard chemical fume hood.

Please note: If a chemical fume hood had previously been used for radioactive isotopes, there must be no evidence of contamination, fixed or removable, for perchloric acid work to be performed in the chemical fume hood. If a chemical fume hood's radioactive history is unknown, please contact EH&S.

4. Emergency Equipment

Perchloric acid may only be used in rooms equipped with an emergency eyewash and an overhead emergency shower or handheld deluge hose.

5. Personal Protective Equipment (PPE)

The following is a list of PPE to be used when working with perchloric acid at concentrations up to 70% at room temperature in a standard chemical fume hood. PPE requirements must be documented in the task specific SOP and must include at a minimum:

- a. Safety goggles and a full-face shield
- b. Neoprene, poly vinyl chloride (PVC) or Sol-Vex nitrile gloves
- c. Lab coat, with appropriate laboratory attire (e.g., full length pants, or equivalent, and shoes that completely cover the foot)

- d. Rubber or chemical resistant apron
- e. Long pants
- f. Closed shoes

6. Storage

- a. Quantities of perchloric acid in labs should be kept to a minimum and never exceed a total of 1L per lab.
- b. Perchloric acid must be kept in its original container with a tight lid and stored within a compatible, secondary container and/or tray.
- c. Perchloric acid is incompatible with most other chemicals and can react violently with organic and oxidizing agents. In summary:
 - i. Do not perchloric acid on wooden shelving.
 - ii. Perchloric acid must be stored separately from all other chemicals.
 - iii. Perchloric acid must NOT be stored near flammable chemicals or combustible materials, nor may it be stored near anhydrous phosphorous pentoxide or sulfuric acid.
 - iv. Do not mix perchloric acid waste with any other types of chemical waste.
- d. Perchloric acid containers should be visually inspected weekly by the laboratory to ensure the integrity of the container. If the experiment has concluded, please submit a chemical waste pickup request promptly.
- e. Perchloric acid containers that are compromised (found to have turned dark, have crystals formed around the bottom of the bottle or otherwise exhibit visible forms of deterioration including solid matter in the solution) must not be moved. A compromised bottle of perchloric acid is an explosion hazard. Immediately notify the PI and contact EH&S for immediate assistance at CUIMC at 212-305-6780, Manhattanville or Morningside Campuses at 212-854-8749. At LDEO please contact the Safety Department emergency line at 845-359-2900.

7. Usage

a. At Room Temperature

Perchloric acid up to <70% may ONLY be used in a standard chemical fume hood at room temperature. Perchloric acid may ONLY be used in a standard chemical fume hood that does not house any organic materials or dehydrating agents.

b. Heating of Perchloric Acid

Perchloric acid must not be heated inside a standard chemical fume hood. Heating of perchloric acid may only be done inside a chemical fume hood with washdown capabilities specifically designed for such work. Such fume hoods are currently not available at the CUIMC, Manhattanville or Morningside campuses. Do not use direct flame or oil baths to heat perchloric acid. Laboratories that plan on conducting work involving the heating of perchloric acid, must contact EH&S for assistance before proceeding, at CUIMC at 212-305-6780, Manhattanville or Morningside Campuses at 212-854-8749.

8. Emergency Response

a. Explosion Hazard

- i. Perchloric acid containers that are compromised (found to have turned dark, have crystals formed around the bottom of the bottle or otherwise exhibit

visible forms of deterioration including solid matter in the solution) must not be moved.

- ii. A compromised bottle of perchloric acid is an explosion hazard. Immediately notify the PI and Contact EH&S for immediate assistance at CUIMC at 212-305-6780, Manhattanville or Morningside Campuses at 212-854-8749. At LDEO please contact the Safety Department emergency line at 845-359-2900.

b. Personal Exposure

- i. In the event of skin contact with perchloric acid, flush the area with soap and water immediately, removing any clothing that may have been contaminated. Seek medical attention immediately.
- ii. In the event clothing, including a lab coat, is contaminated with perchloric acid, immediately remove it.
- iii. In the event of eye contact, lift the upper and lower lids of the eye and flush the eye with copious amounts of water for at least 15 minutes. Seek medical attention immediately.
- iv. In the event of perchloric acid ingestion, seek medical attention immediately.
- v. In the event of inhalation, move the exposed person to fresh air and seek medical attention immediately.
- vi. Notify the Principal Investigator and contact EH&S for immediate assistance at CUIMC at 212-305-6780, Manhattanville or Morningside Campuses at 212-854-8749.

c. Unmanageable Perchloric Acid Spills:

1. Contact Public Safety immediately.
2. Wear appropriate PPE: neoprene, rubber, or PVC gloves, lab coat, and lab glasses.
3. Please sprinkle acid-neutralizing absorbent in a circle around the spill to contain the spill.
4. If the perchloric acid is at concentrations of 70% or higher, please moisten the spill area with water using the spray bottle to avoid dehydration of the perchloric acid.
5. Evacuate the room, and stay nearby to answer any questions from EH&S.

d. Manageable Perchloric Acid Spills:

1. Wear appropriate PPE: neoprene rubber or PVC gloves, lab coat, and lab glasses.
2. Sprinkle the loose absorbent in a circle around the spill to contain and neutralize the acid. Working from the outside inward, gently pour absorbent onto the rest of the spilled acid until it is completely covered.
3. Assess the color of the absorbent. The original absorbent color of purple/pink is neutral. A yellow color is acidic. Add additional absorbent until the purple/pink color is achieved.
4. Using the small dustpan and broom, scoop the pinkish-purple, neutralized material into a waste container.
5. Using the spray bottle provided in the perchloric acid spill kit, spritz the residual spill area with water and add some more loose absorbent to neutralize any remaining perchloric acid.
6. Transfer the absorbent to a waste container.
7. Rinse any residual spill materials into the waste container. Once decontaminated, the dustpan and broom can be discarded.

8. Label the waste with “neutralized perchloric acid and sodium polyacrylate”, marking oxidizer and toxic hazard characteristics, and submit it as hazardous waste:
<https://research.columbia.edu/chemical-waste-pick-up-request>.
9. Contact EH&S via labsafety@columbia.edu to obtain new supplies.

e. Disposal

Perchloric acid waste should be collected for disposal in its original container. Should that container no longer be available, contact EH&S for a plastic waste container.

Once the perchloric acid waste is ready for disposal, submit a waste pick up request at <http://vesta.cumc.columbia.edu/ehs/wastepickup/>.

9. Responsibilities

It is the PI or Lab Manager’s responsibility to ensure that a lab worker who plans on working with perchloric acid reviews and follows:

1. This policy, Guidelines for Using and Storing Perchloric Acid (up to 70%) At Room Temperature in a Standard Chemical Fume Hood.
2. The laboratory’s task specific SOP on the perchloric acid work that will be done (see Section 2).
3. Location of perchloric acid spill kit and knowledge on how to use it.
4. Laboratory-specific training that covers the hazards associated with perchloric acid. In addition, the PI is required to ensure that their laboratory staff have fulfilled the Laboratory Safety Training requirement.

E. Emergency Contacts

In the event of an emergency, please call the following numbers:

- **LDEO:** Emergency line at 845-359-2900
- **Manhattanville:** Public Safety 212-853-3333 and then call EH&S 212-854-8749.
- **Morningside:** Public Safety 212-854-5555 and then call EH&S 212-854-8749.
- **Medical Center:** Public Safety 212-305-7979 and then call EH&S 212-305-6780.
- **NYSPI:** Contact Security at 212-543-5555 and then call EH&S:212-305-6780.

In the event of a medical emergency, please seek medical attention at the following [locations](#):

Columbia University Laboratory Emergency Procedures					
	Columbia University Irving Medical Center (CUIMC)	Lamont-Doherty Earth Observatory (LDEO)	Manhattanville Campus	Morningside Campus	Nevis Laboratories
EMERGENCY CONTACTS:					
Public Safety	212-305-7979	Business Hours: 845-359-2900 After Hours: 845-359-2900	212-853-3333	212-854-5555	212-854-5555
Environmental Health & Safety (EH&S)	Business Hours: 212-305-6780	Business Hours: 845-359-2900 After Hours: 845-359-2900	Business Hours: 212-854-8749 After Hours: 212-853-3333	Business Hours: 212-854-8749 After Hours: 212-854-5555	212-854-8749
	After Hours: 212-305-7979				
For Medical Attention / Emergency Medical Services (EMS)... contact Public Safety to arrange EMS transport	Staff (Business Hours): Workforce Health & Safety- Harkness Pavilion First Floor (212) 305-7580 Student (Business Hours): Student Health Services – 60 Haven Avenue (212) 305-3400	Staff (After Hours): NYP Emergency Department – Broadway & 167 th St Student (After Hours): NYP Emergency Department – Broadway & 167 th St	Call 911 directly THEN notify Public Safety @ 845-359-2900. Nyack Hospital 160 North Midland Ave Nyack, NY 10960 (845) 348-2000	Harlem Hospital 506 Lenox Ave New York, NY 10037 (212) 939-1000 Mount Sinai St. Luke's Hospital 1111 Amsterdam Avenue & 114th St, New York, NY 10025 (212) 636-3375	St. John's Riverside Hospital Dobbs Ferry Pavilion 128 Ashford Ave Dobbs Ferry, NY 10522 (914) 693-0700

F. Cross References – N/A

G. Medical Surveillance –

In the event of personal exposure, seek medical attention immediately in accordance with Section F.

H. Recordkeeping – N/A

I. Appendices

- Appendix A: Chemical Fume Hood Signage for Perchloric Acid Work
- Appendix B: [Standard Operating Procedure Template for Highly Hazardous Chemicals: Perchloric Acid](#)
- Appendix C: EH&S Provided perchloric acid spill kit contents
- Appendix D: EH&S Provided perchloric acid spill kit directions
- Appendix E: EH&S Provided perchloric acid spill kit label

J. Forms

- [Chemical waste disposal link](#) for all campuses excluding LDEO
- LDEO Safety Office campus specific [waste pickup](#)
- Assessment request form
[Qualtrics Survey | Qualtrics Experience Management.](#)

K. References

1. Urben, P.G. (Ed.). (2017) *Bretherick's Handbook of Reactive Chemical Hazards*, 8th Ed. Elsevier.
2. Smith, G.F (1951). *Perchloric Acid*. (2nd) Columbus, Ohio: G.F. Smith Chemical Company.
3. International Labour Organization (2000, April). *Perchloric Acid (72% Solution)*. International Chemical Safety Cards (ICSCs).
https://www.ilo.org/dyn/icsc/showcard.display?p_lang=en&p_card_id=1006&p_version=2

4. The National Academy of Sciences. (1995) *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*. The National Academies Press.
http://www.nap.edu/openbook.php?record_id=4911
5. Harvard Campus Services: Environmental Health and Safety (2019) Laboratory Safety Guideline, Perchloric Acid [CAS No. 7601-90-3].
https://www.ehs.harvard.edu/sites/default/files/lab_safety_guideline_perchloric_acid.pdf
6. University of South Florida. (2020) Standard Operating Procedure – Perchloric Acid.
<https://www.usf.edu/administrative-services/environmental-health-safety/documents/labsafety-sop-perchloric.docx>

L. Acknowledgements

- Martin Q. Fleisher, Geochemistry Department, Lamont-Doherty Earth Observatory, Columbia University
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- Cathy Troutman, Safety Department, Lamont-Doherty Earth Observatory, Columbia University
- Mark Ziffer, Jonathan Owen and P. James Schuck laboratories, Chemistry and Mechanical Engineering, Columbia University

Appendix A: Chemical Fume Hood Signage for Perchloric Acid Work

WARNING

**PERCHLORIC ACID CURRENTLY
IN USE**

**NO OTHER MATERIALS MAY BE
USED OR STORED INSIDE HOOD**

Appendix B: Standard Operating Procedure Template for Highly Hazardous Chemicals: Perchloric Acid

Standard Operating Procedure Template for Highly Hazardous Chemicals: Perchloric Acid

Before beginning work with perchloric acid, laboratories must prepare a Standard Operating Procedure. Complete all sections in red and review with all users. All personnel working with perchloric acid must read and sign the completed SOP in Section 11.

Section 1 – Laboratory Information

Principal Investigator Name:	Click here to enter text
Department:	Click here to enter text
24-hour Emergency Contact Information:	Click here to enter text
Date SOP was approved by PI:	Click here to enter text
Date of last SOP revision:	Click here to enter text

Section 2 – Potential Hazards

Perchloric acid

- Perchloric acid is an extremely corrosive superacid (an acid stronger than sulfuric acid) with a pK_a lower than -9 . At cold or room temperature, industrial grade perchloric acid (70-72%) acts like a strong, non-oxidizing acid. At elevated temperatures (>160 °C), perchloric acid can become an extreme oxidant.
- Though perchloric acid is not flammable, it can increase the intensity of a fire. Perchloric acid can spontaneously combust when in contact with organic materials like spill pads, paper towels, clothing, wood or paper. Oxidizable organic compounds like alcohols, ketones, ethers, and sulfoxides can react violently with perchloric acid. Anhydrous perchloric acid ($>85\%$) poses explosion hazards.
- Skin contact can cause severe burns and irritation; eye contact can cause serious damage and irritation; harmful when swallowed.
- **Additional Hazards (specific to the laboratory or procedure):**
 - [Click here to enter text](#)
 - [Click here to enter text](#)
 - [Click here to enter text](#)



Section 3 – Designated Area

Storage Location:	Building and Room Number(s)
Location of Use:	Building and Room Number(s)
Amount Stored:	Quantity, Concentration, and Number of Bottles (e.g., 2 x 500-mL 60% perchloric acid)
Storage Conditions:	Storage Conditions (e.g., inside secondary containment, room temperature, acid cabinet, inert atmosphere)

Section 4 – Engineering Controls / Emergency Safety Equipment

Please Select Engineering Controls Below:

- Perchloric acid use and handling must occur only inside a functioning and EH&S-certified chemical fume hood. The sash of the fume hood should be kept at the lowest possible height for safe usage of reagents.
- Heating perchloric acid or use of anhydrous perchloric acid (>85%) must be done in a specialized perchloric acid fume hood with a wash down system. These specialized fume hoods are only available at the Lamont campus. Contact EH&S for more information.
 - Perchloric acid at elevated temperatures is an extreme and unstable oxidant. It can generate vapors that form shock-sensitive perchlorate deposits in the ductwork of fume hoods. The use of the wash down system that is found in perchloric acid fume hoods is necessary to remove such deposits.

Emergency Safety Equipment

An eyewash, safety shower, and ABC fire extinguisher must be available within the work area for immediate emergency use. All researchers must be aware of their locations prior to working with highly hazardous chemicals.

Please contact EH&S (labsafety@columbia.edu) about the use of perchloric acid. EH&S will provide the laboratory with a perchloric acid spill kit. Contact labsafety@columbia.edu to obtain replacements and supply refills.

Section 5 – Personal Protective Equipment

Please Select Required PPE Below:

Eye Protection

- Fully enclosed goggles or a face shield are recommended for work with solutions of perchloric acid as they offer greater facial protection than safety glasses.

Hand Protection

- Two sets of chemically resistant gloves must be worn. Recommended glove materials include Neoprene, poly vinyl chloride (PVC) or Sol-Vex nitrile gloves.
- If direct or prolonged contact is anticipated, [neoprene](#) gloves must be used.

Skin and Body Protection

- Lab coats with appropriate laboratory attire (e.g., full-length pants and closed shoes) are required. The use of a chemical resistant or rubber apron is also highly recommended. The experiment must be conducted in an EH&S-certified chemical fume hood.

Section 6 – Special Handling Procedures and Storage Requirements

Precautions for safe handling

- Do not store organic materials in the chemical fume hood while perchloric acid is in use. Avoid mixing perchloric acid with organic materials, which may cause a fire or explosion.
- Do not mix perchloric acid waste with any other type of chemical waste. Submit a waste pick up request immediately after concluding the laboratory research involving perchloric acid, even if the waste container is only partially full.
- Ensure that other members of the laboratory are aware of the perchloric acid work.
- Do not work alone while working with perchloric acid. Use of a safety shield, if necessary, if the experiment has an elevated risk of splash or explosion.
- Any transfer of perchloric acid from the stock bottle should be done over secondary containment (e.g., glass) to catch any spills and to simplify any cleanup.
- If perchloric acid in an older container appears discolored, submit a waste pickup request by completing the [Chemical Waste Pick-up form](#). At the LDEO campus, submit the LDEO Safety Office campus specific [waste pickup](#).
- If the perchloric acid solution shows signs of crystal formation, do not open the container. Contact hazmat@columbia.edu for assistance, as there may be a potential explosion hazard.

□ **Please Select for Heating Perchloric Acid (>160 °C)**

Any use of perchloric acid at elevated temperatures **must** be done in a dedicated perchloric acid fume hood that is affixed with a sign stating, “Perchloric Acid Use Only. Organics Prohibited”.

- Do not use or store organic solvents in the hood.
- Use a hot plate or steam bath to heat solutions. Do not heat perchloric acid using an open flame or an oil bath.
- Do not vacuum-distill perchloric acid. The unstable anhydride may be formed and cause a spontaneous explosion.
- Wash down the perchloric acid hood following the posted instructions and record on the log sheet, where available.
- Use only glassware with glass-to-glass joints and silicon-based lubricants for the joints. Do not use rubber stoppers, tubes or stopcocks.

□ **Please Select for Use of Anhydrous Perchloric Acid (> 85%)**

Anhydrous perchloric acid is extremely unstable at room temperature and decomposes spontaneously.

- Do not work alone. Work only in a designated perchloric acid fume hood that has been emptied of other chemicals.
- Use a blast shield to protect against explosions.
- Wear additional PPE (e.g., thicker gloves, face shield).
- Use only freshly prepared acid. Dispose of any excess anhydrous perchloric acid at the end of the day/shift.

Section 7 – Spill and Accident Procedures

EMERGENCY PROCEDURES FOR CHEMICAL EXPOSURE

- Remove any contaminated clothing as quickly as possible.
- Flush any exposed skin or hair with water for at least 15 minutes, using the closest overhead safety shower or the eyewash/drench hose, if possible.
- For chemical exposure to the eye, flush with water for at least 20-30 minutes at an eyewash station. Hold eyelids open while flushing.
- Seek appropriate medical assistance. If transported to hospital, bring a Safety Data Sheet (SDS) for perchloric acid. Contact Public Safety or the Safety Department at LDEO immediately, who will in turn communicate with EH&S.

EMERGENCY PROCEDURES FOR CHEMICAL SPILL OR ACCIDENT

Spills can be considered manageable or unmanageable. Laboratories should consider their experience, preparedness and expertise in determining whether a spill, regardless of volume, is manageable or unmanageable. An unmanageable spill falls beyond the capability of laboratory

personnel to address in a manner that does not pose a danger to health and safety. A manageable spill is defined as one that will not readily spread and does not pose an immediate risk to health.

Note, that heat and gas emissions are to be expected due to the acid/base reaction between sodium carbonate and the perchloric acid.

ALL LABORATORIES WORKING WITH PERCHLORIC ACID MUST HAVE AN EH&S PROVIDED SPILL KIT

Unmanageable Perchloric Acid Spills:

- Contact Public Safety immediately.
- Wear appropriate PPE: neoprene, rubber, or PVC gloves, lab coat, and lab glasses.
- Please sprinkle acid-neutralizing absorbent in a circle around the spill to contain the spill.
- If the perchloric acid is at concentrations of 70% or higher, please moisten the spill area with water using the spray bottle to avoid dehydration of the perchloric acid.
- Evacuate the room, and stay nearby to answer any questions from EH&S.

Manageable Perchloric Acid Spills:

- Wear appropriate PPE: neoprene rubber or PVC gloves, lab coat, and lab glasses.
- Sprinkle the loose absorbent in a circle around the spill to contain and neutralize the acid. Working from the outside inward, gently pour absorbent onto the rest of the spilled acid until it is completely covered.
- Assess the color of the absorbent. The original absorbent color of purple/pink is neutral. A yellow color is acidic. Add additional absorbent until the purple/pink color is achieved.
- Using the small dustpan and broom, scoop the pinkish-purple, neutralized material into a waste container.
- Using the spray bottle provided in the perchloric acid spill kit, spritz the residual spill area with water and add some more loose absorbent to neutralize any remaining perchloric acid.
- Transfer the absorbent to a waste container.
- Rinse any residual spill materials into the waste container. Once decontaminated, the dustpan and broom can be discarded.
- Label the waste with “neutralized perchloric acid and sodium polyacrylate”, marking oxidizer and toxic hazard characteristics, and submit it as hazardous waste:
<https://research.columbia.edu/chemical-waste-pick-up-request>.
- Contact EH&S via labsafety@columbia.edu to obtain new supplies.

Section 8 – Waste Disposal

- Waste disposal requests should be directed to EH&S at <https://research.columbia.edu/chemical-waste-pick-up-request>.
- Perchloric acid waste must never be mixed with other organic wastes. It must be kept in a clear glass containers labeled “Perchloric Acid Waste”.
- Discolored perchloric acid must be discarded immediately.

- Perchloric acid that has formed crystals poses an explosion hazard. Do not touch the bottle and contact hazmat@columbia.edu immediately.

Section 9 – Brief Description of Procedure

Describe the experimental procedure that uses perchloric acid, including main hazards, reaction conditions, and specify whether the experiment employs a scrubber or trapping system. Please note any decontamination steps for the workstation and equipment.

Include the citation for any papers referenced for the procedure.

Section 10 – Training

Prior to conducting any work with perchloric acid, the Principal Investigator must ensure that all laboratory personnel receive the following training:

- The content of this SOP
- Lab Safety, Chemical Hygiene, and Hazardous Waste Management Training (RASCAL TC0950 or TC4951)

EH&S can obtain the research group's training records upon request.

Section 11 – Attestation

I have read and understand the content of the referenced SOP:

Name (please print)	Signature	Date

Appendix C: EH&S provided perchloric acid spill kit contents

- ~150 g or 150 mL of [New Pig acid neutralizing absorbent](#) in [Narrow Sampling Bottles \(250 mL capacity\)](#)
- Spray bottle or [spritz bottle](#) or misting spray bottle – labeled with “For Water Only”
- Laminated directions provided by EH&S, Appendix D, EH&S Provided perchloric acid spill kit directions
- Mini dustpans - <https://www.grainger.com/product/2ZPC5?gucid=N:N:FPL:Free:GGL:CSM-1946:tew63h3:20501231>
- Hazard tape on the exterior
- Perchloric acid spill exterior label provided by EH&S, Appendix E, EH&S Provided perchloric acid spill kit label
- Affixed bar code to for entering the kit as an asset into LION when at the Morningside campus

Appendix D: EH&S provided perchloric acid spill kit directions

EMERGENCY PROCEDURES FOR PERCHLORIC ACID SPILL OR ACCIDENT

Spills can be considered manageable or unmanageable. Laboratories should consider their experience, preparedness and expertise in determining whether a spill, regardless of volume, is manageable or unmanageable. An unmanageable spill falls beyond the capability of laboratory personnel to address in a manner that does not pose a danger to health and safety. A manageable spill is defined as one that will not readily spread and does not pose an immediate risk to health.

Note, that heat and gas emissions are to be expected due to the acid/base reaction between sodium carbonate and the perchloric acid.

All labs using perchloric acid must have an EH&S provided spill kit.

Unmanageable Perchloric Acid Spills:

- Contact Public Safety immediately.
- Wear appropriate PPE: neoprene, rubber, or PVC gloves, lab coat, and lab glasses.
- Please sprinkle acid-neutralizing absorbent in a circle around the spill to contain the spill.
- If the perchloric acid is at concentrations of 70% or higher, please moisten the spill area with water using the spray bottle to avoid dehydration of the perchloric acid.
- Evacuate the room, and stay nearby to answer any questions from EH&S.

Manageable Perchloric Acid Spills:

- Wear appropriate PPE: neoprene rubber or PVC gloves, lab coat, and lab glasses.
- Sprinkle the loose absorbent in a circle around the spill to contain and neutralize the acid. Working from the outside inward, gently pour absorbent onto the rest of the spilled acid until it is completely covered.
- Assess the color of the absorbent. The original absorbent color of purple/pink is neutral. A yellow color is acidic. Add additional absorbent until the purple/pink color is achieved.
- Using the small dustpan and broom, scoop the pinkish-purple, neutralized material into a waste container.
- Using the spray bottle provided in the perchloric acid spill kit, spritz the residual spill area with water and add some more loose absorbent to neutralize any remaining perchloric acid.
- Transfer the absorbent to a waste container.
- Rinse any residual spill materials into the waste container. Once decontaminated, the dustpan and broom can be discarded.
- Label the waste with “neutralized perchloric acid and sodium polyacrylate”, marking oxidizer and toxic hazard characteristics, and submit it as hazardous waste:
<https://research.columbia.edu/chemical-waste-pick-up-request>.
- Contact EH&S via labsafety@columbia.edu to obtain new supplies.

PERCHLORIC ACID SPILL KIT

Provided by Columbia EH&S

Contact us at labsafety@columbia.edu or 212-854-8749
or 212-305-6780