

1. HAZARD OVERVIEW

The coronavirus disease (COVID-19) and all hazardous chemicals used to disinfect surfaces that may become contaminated with COVID-19 pose a hazard to personnel who come in contact with them. Extreme caution by those who come in contact with these hazards is strongly recommended.

Coronavirus disease 2019 (COVID-19) is a respiratory illness caused by a virus called SARS-CoV-2. SARS-CoV-2 is part of the larger SARS family of single stranded RNA viruses affecting the epithelial cells of the lungs. It is approximately 120 nanometers in diameter and is believed to enter the host cell by binding to the ACE2 receptor. COVID-19 was first recorded in Wuhan China in December of 2019 but within a few months spread across many other countries quickly earning pandemic status with the World Health Organization.

COVID-19 is thought to spread from person to person with close human contact (within 6 feet) through respiratory droplets produced when an infected individual coughs, sneezes, or talks. Recent studies indicate that the virus can be spread by people before they develop symptoms (pre-symptomatic) or who never develop symptoms (asymptomatic). It also may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes. However, this is not thought to be the main way the virus spreads. People infected with the COVID-19 virus can be asymptomatic or experience mild to moderate respiratory illness and recover without requiring special treatment. However, older people (65 and older), those who are immune compromised, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness. Common symptoms often include a fever, cough, body aches/muscle pain, or shortness of breath. For more information please visit the CDC, WHO, or NIH websites at:

<https://www.cdc.gov/>

<https://www.who.int/>

<https://www.nih.gov/>

Chemical disinfectants used to clean and sanitize high touch surfaces like door knobs, elevator buttons, stairway railings, etc. are hazardous for personnel working in offices, labs, or entering campus buildings. Most disinfectants are strong oxidizers, flammable, toxic, corrosive, eye/skin irritants, or hazardous to the respiratory system. Care should always be practiced when using disinfectants or touching objects recently sanitized with chemical disinfectants. Persons applying chemical disinfectants must read the safety data sheet (SDS) for any products they use and wear appropriate personal protective equipment (PPE) listed in section 8 of the SDS.

2. HAZARDOUS CHEMICAL(S)/CLASS OF HAZARDOUS CHEMICAL(S)

The primary chemical disinfectants used on campus during the COVID-19 pandemic are: Quaternary Ammonium Compounds, Alcohols, Hydrogen Peroxide Based Disinfectants, Bleach. There is a brief explanation of each listed below. Each of these chemical disinfectants has hazards associated with it but this list is by no means exhaustive. For a full list of chemical disinfectants, to use for the effective control of the coronavirus please visit the EPA website at: <https://www.epa.gov/>. For more information concerning the hazards associated with a specific chemical disinfectants, please consult the manufacturer's SDS.

A. Quaternary Ammonium Compounds

These compounds are found in various forms such as benzalkonium chloride, benzethonium chloride, methylbenzethonium chloride, cetalkonium chloride, cetylpyridinium chloride, cetrimonium, cetrimide, dofanium chloride, tetraethylammonium bromide, didecylmethylammonium chloride and domiphen bromide (see https://en.wikipedia.org/wiki/Quaternary_ammonium_cation for more info). Some forms are not considered antimicrobial.

The hazards associated with QACs range from skin irritation to death, as well as QACs being a possible reproductive toxin. The amount of hazard associated with a product is a result of both the QAC itself and the dilution of the QAC in the proprietary solution. Please carefully read the SDS of your proprietary solution and the instructions for use to minimize hazards. Generally QACs, even when diluted, have a long shelf life.

QACs are beneficial in the treatment of porous surfaces (i.e. wood, clothing, etc.) and they are not generally corrosive to metal. However, they can be deactivated in the presence of common soaps. The residuals will also most likely stay on surfaces unless removed by washing with soap/water. Depending on the formulation of your product, it may or may not act as a cleaning agent, areas that are not clean cannot usually be disinfected. The amount of time that a surface has to stay in contact with a QAC in order to disinfect varies according to its formulation, read the instructions of your formulation for how much time you should leave it.

B. Alcohols

Alcohols particularly isopropanol and ethanol are used as disinfectants for many microorganisms. Methanol is less effective as a bactericide than ethanol or isopropanol, so it is seldom used as a disinfectant. Ethanol and isopropanol have broad spectrum antimicrobial activity against bacteria, viruses, and fungi but are not sporicidal. Therefore, they are not typically used for sterilization but often used for disinfecting hard surfaces or as antiseptics.

According to the CDC website the exact mode of antimicrobial action is not completely known but alcohols are believed to denature proteins. The most effective of these seems to be ethanol because it is less volatile and toxic than isopropanol. Pure ethanol is a dehydrating agent. Strong concentrations of ethanol (above 80%) are less effective as a disinfectant than mixtures of ethanol and water because proteins are denatured more quickly in the presence of water. Since alcohols are relatively volatile, the 60%-80% ethanol and water mixture evaporates more slowly than strong concentrations when applied to hard surfaces giving the mixture more time to work.

However, alcohols are hazardous to personnel. All alcohols are flammable, reactive, eye irritants, volatile, some are toxic, and all are harmful. Since all alcohols are flammable with a low flash point you should never use them near an open flame, spark, heat source, or chance of ignition. Alcohols are polar and relatively reactive, so never mix alcohols with other chemical disinfectants/cleaners. Mixing alcohols with certain other cleaners can produce toxic gasses. All alcohols are eye irritants so goggles should be worn at all times when using them. Alcohols are volatile, so they should only be used in well ventilated areas. Some alcohols like methanol or isopropanol are toxic and should never be consumed. All alcohols are harmful. They target certain organs like the liver and kidneys, so any persons using them should be very cautious and limit their exposure.

For more information on alcohols as disinfectants please see the CDC website and read through the manufacturers SDS before using any chemicals:

<https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html>

D. Hydrogen Peroxide Based Disinfectants

Hydrogen peroxide based disinfectants are effective in killing microorganisms including bacteria, viruses, spores, and fungi. During the COVID-19 pandemic UCD custodial services use several different types of disinfectants. One of the more commonly used disinfectants is a hydrogen peroxide based multi-surface cleaner/disinfectant (FaciliProPeroxide). Here is the SDS for this product:

<https://www.gofacilipro.com/product-categories/category/facilipro-peroxide-glass-and-surface-cleaner>

Hydrogen peroxide works by producing destructive hydroxyl free radicals that can attack membrane lipids, DNA, and other essential cell components. Catalase, produced by aerobic organisms and facultative anaerobes that possess cytochrome systems, can protect cells from metabolically produced hydrogen peroxide by degrading hydrogen peroxide to water and oxygen. This defense is overwhelmed by the concentrations used for disinfection.

Strong concentrations of hydrogen peroxide can be toxic, corrosive, and very reactive. Concentrated hydrogen peroxide is a very strong oxidizer that reacts with acids, bases, flammables, metals, etc.. Under no circumstances should hydrogen peroxide based disinfectants be mixed with other compounds. According to the CDC normal concentrations of hydrogen peroxide used in disinfectants (< 3%-6%) are not usually toxic or as hazardous. With this being said, some people are more sensitive to hydrogen peroxide than others. Caution should always be used with any disinfectant or cleaning product to avoid accidents and injuries. Anyone using these products should read the SDS before opening the container.

For more information on hydrogen peroxide based disinfectants please visit the CDC website at: <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/chemical.html#Hydrogen>

E. Bleach (sodium hypochlorite)

Bleach is a great disinfectant. You must use a bleach that contains sodium hypochlorite as its active ingredient. This is because it is the chlorine that is released that does the killing. Bleach will also remove color from all fabrics, etc. and is quite corrosive to metal. It will pit stainless steel so a follow up rinse on all metal surfaces is advised. It is a strong oxidizer, so be careful where you use it for chemical compatibility. Bleach will react with dishwashing soap, which sometimes contains ammonia, to make chloramine gas, which is toxic. Bleach will react with acids (including vinegar) to release chlorine gas, again highly toxic. Bleach itself is toxic, corrosive to skin, and the fumes an irritant to eyes/nasal passages/lungs. Some people are more sensitive than others, so take all appropriate PPE precautions and use in a well ventilated area. Here is the link to the SDS for Clorox household bleach: <https://www.thecloroxcompany.com/wp-content/uploads/cloroxregular-bleach12015-06-12.pdf>

Household bleach is sold as a 3-6% solution of sodium hypochlorite in water. You then take that solution and dilute it further to 1 part bleach to 4 parts water for use as a disinfectant. The contact time is 10 minutes for a good disinfection. It is best if you follow up the disinfection with a wipe of clean water to remove the residue. Diluted bleach has a shelf-life of hours or minutes. The diluted bleach is best used immediately if you wish to use it as a disinfectant. Sunlight (or UV) will deactivate diluted bleach very quickly.

3. ENGINEERING/VENTILATION CONTROLS

There are no special engineering or ventilation controls required for commercially available cleaning/disinfecting products. However, certain people may be more sensitive or have allergic reactions to some disinfectant products. Those people should not use these products. Anyone who starts showing symptoms of an allergic reaction should seek medical attention immediately from [UCD Occupational Health Services](#) or [Sutter Davis Emergency Room](#).

4. ADMINISTRATIVE CONTROLS

The following elements are required:

1. Complete the [UC Laboratory Safety Fundamentals](#) (or approved equivalent) training prior to working in the laboratory;
2. Complete laboratory-specific safety orientation and training on laboratory-specific safety equipment, procedures, and techniques to be used, including any applicable laboratory-specific Laboratory Safety Plan(s), prior to receiving unescorted access to the laboratory;
3. Demonstrate competency to perform the procedures to the Principal Investigator (PI), Laboratory Supervisor, laboratory-specific Safety Officer, and/or trainer;
4. Be familiar with the location and content of any applicable Safety Data Sheets (SDSs) for the chemicals to be used (online SDSs can be accessed from [UC SDS](#));
5. Implement good laboratory practices, including good workspace hygiene;
6. Inspect all equipment and experimental setups prior to use;
7. Follow best practices for the movement, handling, and storage of hazardous chemicals (see Chapters 5 and 6 of [Prudent Practices in the Laboratory](#) for more detail). An appropriate spill cleanup kit must be located in the laboratory. Chemical and hazardous waste storage must follow an appropriate segregation scheme and include appropriate labeling. Hazardous

chemical waste must be properly labelled, stored in closed containers, in secondary containment, and in a designated location;

8. Do not deviate from the instructions described in this SOP without prior discussion and approval from the PI and/or Laboratory Supervisor;
9. Notify the PI or Laboratory Supervisor of any accidents, incidents, near-misses, or upset condition (*e.g.*, unexpected rise or drop in temperature, color or phase change, evolution of gas) involving the process, hazardous chemical(s), or hazardous chemical class described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, if applicable.

REQUIRED - Insert descriptions of any additional administrative controls (*e.g.*, restrictions on procedure/quantity/work equipment/work locations/unattended operations/etc.), including controls that may be chemical-specific (*e.g.*, peroxide formers).

Follow all chemical segregation requirements and secondary containment procedures per the campus Chemical Hygiene Plan (ie: segregate acids from bases, segregate oxidizers from flammables, etc.) to reduce the risk of chemical reactions or accidental mixing. If you have any questions regarding proper chemicals segregation, please contact your department safety coordinator Andrew Ross at: 752-2592 or abross@ucdavis.edu

5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

At a minimum, long pants (covered legs) and closed toe/closed heel shoes (covered feet) are required to enter a laboratory or technical area where hazardous chemicals are used or stored.

In addition to the minimum attire required upon entering a laboratory, the following PPE is required for all work with hazardous chemicals:

- A. Eye Protection:
 - i. Eye protection must be ANSI Z87.1-compliant.
 - ii. At a minimum safety glasses are necessary.
 - iii. Splash goggles may be substituted for safety glasses, and are required for processes where splashes are foreseeable or when generating aerosols.
 - iv. Ordinary prescription glasses will NOT provide adequate protection unless they also meet the Z87.1 standard and have compliant side shields.
- B. Body Protection: At a minimum a chemically-compatible laboratory coat that fully extends to the wrist is necessary.
 - i. If a risk of fire exists, a flame-resistant laboratory coat that is NFPA 2112-compliant should be worn.
 - ii. For chemicals that are corrosive and/or toxic by skin contact/absorption additional protective clothing (*e.g.*, face shield, chemically-resistant apron, disposable sleeves, etc.) are required where splashes or skin contact is foreseeable.
- C. Hand Protection: Hand protection is needed for the activities described in this SOP. Define the type of glove to be used based on the following:
 - i. Chemical(s) being used;
 - ii. Anticipated chemical contact (*e.g.* incidental, immersion, etc.);
 - iii. Manufacturers' permeation/compatibility data; and

- iv. Whether a combination of different gloves is needed for any specific procedural step or task.

REQUIRED - Insert descriptions of PPE and hygiene practices used with each process, hazardous chemical(s), or hazardous chemical class, including any specialized PPE needed for a procedural step/task.

6. SPILL AND EMERGENCY PROCEDURES

Follow the guidance for chemical spill cleanup from [SafetyNet #13](#) and/or the [UC Davis Laboratory Safety Manual](#), unless specialized cleanup procedures are described below. Emergency procedure instructions for the UC Davis campus and UCD Medical Center are contained in the [UC Davis Laboratory Safety Manual](#), [campus Emergency Response Guide \(ERG\)](#), and [UCD Health System ERG](#). The applicable ERG must be posted in the laboratory. All other locations must describe detailed emergency procedure instructions below.

Call 911 for all large spills or spills of acutely toxic materials. For small spills, follow directions in SafetyNet #13. Do not try to neutralize disinfectant spills with different chemicals. Many disinfectants are mixtures of reactive chemicals (H₂O₂, NH₃, etc.) and addition of other chemicals may produce toxic gasses or other hazardous compounds.

If you or anyone you work with starts to develop any symptoms consistent with COVID-19 (fever, coughing, shortness of breath) notify your supervisor immediately and seek medical attention. Follow the guidelines from the office of research regarding possible COVID-19 infection and decontamination procedures.

INSERT IF APPLICABLE - Descriptions of any specialized emergency procedures for locations outside of the UC Davis main campus and the UCD Medical Center campus.

7. WASTE MANAGEMENT AND DECONTAMINATION

Hazardous waste must be managed according to [Safety Net #8](#), and must be [properly labeled](#). In general, hazardous waste must be removed from your laboratory within 9 months of the accumulation start date; refer to the [accumulation time for waste disposal to ensure compliance](#). Hazardous waste pick up requests must be completed using [WASTE](#).

Note: See the [WASTE Factsheet](#) for instructions on how to complete a label.

REQUIRED - Insert descriptions of laboratory-specific information on the waste streams generated, storage location, and any special handling/storage requirements.

One of the best ways to avoid illness and the COVID-19 virus is by frequent hand washing. You should wash your hands with soap and warm water for a minimum of 20 seconds before and after using the restroom, before eating or drinking anything, before touching your face or any family members, after touching any common pieces of equipment (phones, computers, etc.), after touching any door knobs, elevator buttons or other high touch surfaces.

Upon completion of work with hazardous chemicals and/or decontamination of equipment, remove gloves and/or PPE to wash hands and arms with soap and water. Additionally, upon leaving a designated hazardous chemical work area remove all PPE worn and wash hands, forearms, face and neck as needed. Contaminated clothing or PPE should not be worn outside the lab. Soiled lab coats should be sent for professional laundering. Grossly contaminated clothing/PPE and disposable gloves must not be reused.

8. DESIGNATED AREA

INSERT - Description(s) of designated area(s) for your laboratory. Designated areas are required for "Particularly Hazardous Substances". The entire laboratory, fume hood, or a portion of the laboratory may be used, and must be labeled with the hazards.

9. DETAILED PROTOCOL

REQUIRED - Insert or attach detailed laboratory-specific procedures for the process, hazardous chemical(s), or hazard class. You may also include any relevant supporting resources such as SafetyNets, journal citations, etc. that are applicable.

