Clemson University
Chemical Hood Program

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Introduction

Chemical hoods are critical to the safety of laboratory personnel and the advancement of research throughout Clemson University. They are the most important component used to protect laboratory workers from exposure to hazardous chemicals and other agents used in the laboratory. When properly installed, maintained, and used, they can provide protection from these hazards. When this does not occur, the health and safety of laboratory occupants and maintenance personnel can be severely compromised, and research efforts can be hindered. A chemical hood system is designed to protect the operator from being exposed to undesirable substances, so its most important function is containment. The type of hood selected; installation of the hood and exhaust ductwork; balance of supply and exhaust air; type of fan chosen; maintenance of the system; and operator use of the hood all affect the performance of the hood.

This document has been developed to establish policy and outline specific guidelines to ensure that hoods and other ventilation devices are properly selected, installed, maintained, and used in order to prevent the compromise of the health and safety of Clemson University personnel and to limit possible hindrance to research efforts as a direct result of chemical hood performance deficiencies.

Approval For Purchase/Installation Of Hoods/Ventilation Devices

The purchase, relocation, installation, or modification of any laboratory hood or other laboratory exhaust device (canopy, snorkel, glove box, ventilated storage cabinets, etc.) requires prior approval by the Office of Environmental Health and Safety (EHS). EHS must be notified of any changes to be made in hazard control ventilation systems including chemical hoods. EHS shall review all hazard control ventilation system plans/ blueprints/change orders to ensure the safety of these systems. EHS must approve the selection of chemical hoods before they are purchased in order to ensure that the proper hood has been selected to protect laboratory occupants from the hazards that they are working with.

Procedure For Hood Repairs

University Facilities receives deficiency data or is informed that chemical hood work must be completed

1. A work order is initiated by calling University Facilities (UF) at 656-2186.
2. UF assigns the work order to proper maintenance personnel
3. UF informs person/persons who called in the work order, building Security and/or departmental contacts that work is to be performed; when work will begin and an estimated time to completion
4. UF employee places warning label on chemical hood(s) involved in repair order. If work includes a large number of hoods within a building, UF will post laboratory doors. Departmental contact/building managers or other assigned departmental personnel will be responsible for notifying all hood users by email or other written notification.

The department must ensure that all employees are informed and understand how the information for hood shut downs will be disseminated. For shut downs where a large number of hoods are involved and UF is posting only lab doors, if email messages and postings on lab doors do not seem to be sufficient; the department should assign someone to post individual hoods within the labs.

5. After work is completed, UF employee fills out work order (work order should include nature of deficiency; corrective action taken; any additional deficiencies not included in the work request and whether or not action was taken to correct these other deficiencies
6. If changes are made that could affect the performance of the hoods, UF contacts Environmental Health and Safety Office to initiate hood air flow/capture testing. If not, UF will remove the postings and inform the department contact that the hoods may be used again.

Responsibilities

Primary Investigators (PI's)

Ensure that lab personnel have been trained on how to use Chemical hoods safely and effectively.

Ensure that lab personnel understand and follow University health and safety policies and procedures regarding the use of laboratory hood/exhaust devices.

Ensure that lab personnel know how to respond in the event that Chemical hood airflow has been compromised.

Ensure that all laboratory employees understand how to find information regarding the shut down of hoods--email messages, posting on hood or lab door (both should be checked prior to using hood).

Ensure that hoods have been cleaned out and/or decontaminated prior to removing a hood from service for repairs, modifications, or removal/relocation. All chemicals and other hazardous materials must be removed from the hood. If the hood is used for work with radioactive materials, the proper survey/decontamination procedures must be conducted before any work on the hood is allowed.

If a laboratory hood or exhaust system has been used for perchloric acid heated above ambient temperature, you must inform maintenance personnel and EHS personnel before any inspection, maintenance, cleaning, or any other work is done on any part of the exhaust system or hood interior. The hood and all parts of the exhaust system must be posted. (see p. 10 for more info on Perchloric acid)

Contact EHS to initiate a hazard survey of any hoods (used for work with radioactive materials) that are going to be taken out of service or prior to any repairs/maintenance scheduled for the hood(s),

Submit all requests for purchase or installation of any chemical hood/exhaust device to EHS and University Facilities for approval before ordering/obtaining/or installing any such equipment.

Do not alter/modify any laboratory hood/exhaust device without prior approval of EHS and University Facilities.

If hood(s) fail to perform properly or any deficiency associated with the hood is identified, call 656-2186. Provide description of work, location of hood(s), lab contact information, etc. to dispatcher. Ensure that the hood is safe for maintenance personnel to begin work before calling in the work request.

If it is determined/suspected that a hood is not functioning properly, the hood must be posted and the hood must not be used until it is determined by Facilities and/or EHS to be functioning properly. Ensure that all employees/students working with chemical hoods understand and follow this rule.

Laboratory personnel

Report all Chemical hood deficiencies to supervisor and to University Facilities at 656-2186, immediately upon their identification. Information provided to dispatcher should include: description of work, location of hood(s), lab contact information, etc. Deficiencies that should be reported include: No air flow or apparent reduction in air flow; sash that does not operate smoothly; broken/cracked glass in sash; malfunctioning air monitor alarm; light in hood not working, etc.

Check lab door and hood for posting (Appendix A or B) before using hood. If hood has been posted with one of these notices, DO NOT use the hood until the notice has been removed.

Utilize proper and safe work practices as related to Chemical hoods in this program. (also, see section IV “Ventilation” of the 2000 Chemical Hygiene Plan)

Do not use hoods when posted with a danger label (UF) or “Attention: This hood has failed inspection” (EHS) or other notice indicating that the hood is not functioning properly. Do not remove any such posting unless directed by Facilities, EHS, or departmental contact.

Contact EHS to perform testing/inspection of hood(s) if the inspection sticker indicates that the last inspection was conducted more than one year from the “date of last inspection” marked on the sticker.

Ensure that all chemicals or other hazardous materials have been removed from the hood and the hood has been decontaminated before UF personnel are scheduled to begin work on the hood(s). If the hood is used for work with radioactive materials, the hood must be surveyed/decontaminated before scheduled hood work begins.

Departmental Contact:

Information must be provided to all laboratory personnel to explain the methods that Facilities will use to notify users of hood shut downs (posting of individual hoods if small number of hoods are involved; posting of lab doors if large number of hoods are affected).

Communicate/distribute information pertaining to scheduled hood shut downs as well as how users should respond to hood system failures. At a minimum, this message should be distributed by email and/or other written notice to all users. If the message is sent by email, a request for notification of receipt should be used. Information must also be provided to all users explaining how lab personnel will be notified by the department in the event of a scheduled or an unplanned outage. If sending email or other written message to lab personnel, as well as instructing lab personnel to check hoods and lab doors for postings before using hoods, proves not to be effective; the department should implement other safeguards, such as having the departmental contact or other designated personnel post individual hoods.

Information must be provided to explain the methods that Facilities will use to notify users of hood shut downs (posting of individual hoods if small number of hoods are involved; posting of lab doors if large number of hoods are affected).

In the event of a scheduled or unscheduled hood shut down, Facilities must be informed that all affected hoods have been checked and that it is safe for them to begin repair work.

Call in repair order to Facilities dispatch (656-2186) whenever lab personnel or EHS personnel report to you that there is a hood malfunction or deficiency.

University Facilities

Communicate pertinent information related to compromised airflow to, or work on chemical hoods to departmental contact and UF employees who will be performing the hood or roof work.

Provide advanced notice (as much as possible) to the residents of buildings housing chemical hoods of regularly scheduled maintenance that will impact hood performance. UF will post hoods (Appendix A) if only a small number of hoods/labs will be affected by the shutdown. Otherwise, UF will post laboratory doors where any exhaust hoods or other exhaust device(s) that may be affected by the shut down are present.

Ensure that work required to correct Chemical hood deficiencies is completed in a timely manner.

Routine work which will compromise air flow to Chemical hoods in a manner which is least disruptive to building occupants, and will be coordinated through the department contact.

Communicate pertinent information related to work that will require UF personnel to work in or pass through Chemical hood exhaust streams to department contact and UF Employees.

Maintenance personnel must be provided with, trained in the use of, and required to use the appropriate personal protective equipment (PPE) when they are performing work involving potentially hazardous exposure. PPE for this type of work would normally include goggles, gloves, and protective clothing, but may also include a respirator. Anyone using a respirator for protection from a respiratory hazard must be part of the University Respiratory Protection Program (656-7557 or 656-2583).

The PPE necessary for each job should be determined individually.

Notify EHS of any changes in hood/exhaust systems that will effect airflow, or accuracy of chemical hood database.

Where changes in airflow/hood performance might occur as a result of maintenance activity, EHS must be notified once work has been completed. If no such changes are made, UF will remove postings and inform department contact that hoods may be used again.

Perform routine maintenance on all chemical hoods/exhaust devices semiannually. Calibration of airflow alarms/monitoring devices should be performed annually or anytime they are reported to be malfunctioning. (Maintenance schedule attached)

Maintain maintenance and repair records for each hood. Records should include date of work; type of maintenance/repair; name(s) of maintenance personnel. Routine maintenance categories should be listed and criteria given for corrective action for deficiencies.

UF Employees

Confirm that all chemicals or other hazardous materials have been removed and hood surfaces have been decontaminated by laboratory personnel before beginning work, if work involves contact with the hood interior. If this has not been done, contact the department contact to ensure removal of chemicals and other hazardous materials and decontamination of the hood surfaces before beginning work.

Before beginning work on a call for hood failure, check with lab personnel (if one lab) or departmental contact (if multiple labs) to ensure that it is safe to begin work on hood/ exhaust system.

Use all required PPE and follow all University health and safety policies and procedures.

Prior to working on Chemical hood exhaust systems or work that will in any way effect the function or performance of the operation of a chemical hood(s), inform departmental contact and post hoods (whenever a small number of hoods/labs are affected), otherwise; inform departmental contact and post affected labs. (Appendix A).

Complete the required work as directed on the work order. If problems/deficiencies other than those listed on the work permit are discovered, make repairs/corrections required to correct the deficiency.

Fill out work order and it return to University Facilities upon work completion. Include any repairs/adjustments, etc. that were not included on the original work description.

Where changes in airflow/hood performance might occur as a result of maintenance activity, EHS must be notified once work has been completed. If no such changes are. made, UF will remove postings and inform department contact that hoods may be used again.

Environmental Health and Safety

All chemical hoods will be tested/inspected by EHS on an annual basis to ensure that adequate airflow and proper containment is being provided. Hood inspections will include measurement of the hood face velocity as well as airflow visualization tests (smoke challenge). Chemical hood face velocities should measure 100 linear feet per minute (lfm) at an 18" sash height. The face velocity must be a minimum of 60 lfm with the sash fully open. The hood must meet a smoke challenge test at both sash heights. Hood velocities for volatile radioactive materials (unbound Iodine or unbound tritium) should be 120-125lfm. Face velocities approaching or exceeding 150lfm should generally not be used, because they may cause turbulence around the periphery of the sash opening and can reduce the capture efficiency of the hood. A sticker will be placed on the left side of the hood at the sash. This sticker will inform the user of: the date that the hood was tested; the average airflow (lfm) at the face of the hood; the sash height at which the hood should be operated (maximum opening); what types of materials are allowed to be used in the hood; and the date by which the next inspection/text should be conducted. Where it is recognized that hoods are deficient in a manner that could compromise the safety of the occupants of the lab, EHS shall post the hood (Appendix B—ATTENTION—This hood has failed…), then notify the department contact. Where deficiencies are recognized but do not compromise the immediate health/safety of the lab occupants (cracked sash glass, sash not operating properly, etc), EHS will contact the PI, lab manager, or department contact and provide information about the deficiency.

Ensure that each hood is marked appropriately with sash height requirements; check airflow alarms/monitors to ensure that they are functioning properly. Sashes will also be inspected to ensure that they are functioning properly and safely, glass is not cracked or broken, etc.

Report all chemical hood deficiencies to lab personnel or department contacts in a timely manner

Monitor the chemical hood program to ensure compliance with policy.

Review and revise this policy when necessary.

Perform a radiation survey on hoods used for work with radioactive materials prior to removal when they are being decommissioned and before maintenance or repairs are performed, etc.

Maintain a hood database (database should include: identification/location of hood, performance of hood at last testing, date of testing/inspection, whether or not hood has properly operating alarm/air flow monitor, exhaust information (does hood exhaust meet current regulations), any deficiencies found during testing/inspection

Review all plans/blueprints/change orders for hazard control ventilation systems including hoods prior to the initiation of such work.

Review all requests for purchase and/or installation of any chemical hood/exhaust device prior to purchase/installation of those devices.

Conduct airflow/containment testing after any hood repairs that could affect hood performance as well as renovations/new installations, etc. and post accordingly. If hood(s) is functioning properly, EHS will remove any EHS or UF postings and place appropriate sticker on hood(s).

System Malfunction

In the event that an airflow indicator would signal low or no airflow, or that lab personnel recognized that such a condition exists otherwise, the person first recognizing this problem must:

1. Hood Failure Procedures (Unplanned Shut-down)
    a. Immediately stop all work in the hood.
    b. If possible to do safely, stabilize reactions and turn off equipment (i.e., hot plates) or other electric devices.
    c. Close any opened/exposed containers of chemicals or radioactive materials currently under the hood (if safe to do so).
    d. Close the hood sash (if safe to do so).
    e. Report the problem immediately to University Facilities (656-2186) and the Lab Director and/or /Building Manager.
    f. Notify others in the area and on additional shifts that the hood(s) is/are not operating and cannot be used.
    g. If it can be accomplished safely, the hood(s) should be posted with a sign that boldly states that the hood(s) is/are not functioning and may NOT be used until repairs/corrections have been made and sign is removed. If it is determined not be safe to take the time to post the hood, it should then be decided whether or not it is safe to post the lab door after exiting the lab. If it is safe to do so at that time, the door should be prominently posted “HOOD FAILURE—DO NOT USE CHEMICAL HOOD(S)”.
    h. If processes/reactions that could create a hazard to lab/building occupants cannot be stopped/contained, the lab(s) and/or possibly the building should be evacuated until the hazard is eliminated. Activate fire alarms; call 656-2222 and give details to the dispatcher. This information must also be provided to Facilities personnel, the Lab Director, Departmental Safety Contact/Building Manager.
    i. Departmental personnel are responsible for ensuring that all labs affected by hood failure are checked to ensure that all operations that might create a hazard are stopped. Hoods or lab doors should be posted at this time. If this cannot be done safely, call Police Department at 656-2222 and tell them that the HazMat team is needed and a brief description of the situation. Then, evacuate the floor or building, if necessary. UF will be notified when the hood(s) and/or building is safe for repairs.

j. Do not use the hood(s) until repairs have been made and UF provides information that the hood(s) is ready for use and removes posting. If changes/ repairs are made that could potentially affect the performance of the hood, UF will contact EHS to test and approve the hood(s). After testing, EHS will remove “DO NOT USE” sign(s) if hoods meet performance standards. If not EHS will contact UF to request further repair.

Regardless of how University Facilities receives notification of deficient hoods they must treat these as high priority. In the event that University Facilities is notified of a deficient hood they must notify the department contact which hood will be affected by shut down and post accordingly. They must ensure that (ask user) that all hazardous operations, materials, etc. have been stopped/contained. If there are a large number of hoods involved or perhaps an entire building, UF should contact their departmental contact to make sure that all labs have been checked and appropriate action to contain hazards has been taken. Facilities personnel will not enter any area until they have been given information by lab personnel or departmental personnel that it is safe to begin repairs. If the Fire Department has been called to control a hazard, UF personnel will wait for permission from the Incident Commander or EHS personnel before entering the area or initiating repair work.

UF will subsequently notify the responding shop of the problem and will communicate to them the room numbers of the rooms having hoods in them that are serviced by any risers that will be effected during repair.

Once repairs or maintenance has been completed, the UF employee will notify the departmental contact that work in the hood(s) may resume and that the signs may be removed. If the work involves any change that could potentially affect the performance of the hood, UF will contact EHS to initiate testing of the hood(s) before any signs are removed.

If maintenance/repairs involve activity that could potentially affect the performance of a hood/hoods, EHS will conduct appropriate testing. If it is determined that a hood or hoods do not meet performance criteria, EHS will contact UF to initiate corrective action. If, however, hoods do meet performance criteria, EHS will remove “Do Not Use” signs.

Design and Construction

Review all hazard control ventilation system plans/blueprints/change orders with EHS to ensure the safety of these systems.

Chemical hood face velocities should measure 100 linear feet per minute (lfm) at an 18” sash height. Face velocity should measure a minimum 60lfm with the sash fully open.

All new hoods should be purchased with sash stops. These should be set at 18” when the hood is installed.

Stainless steel used for hood ducting must be a minimum of 18 gauge and seams must be welded (i.e. no slip fits). Materials selected for hood ductwork must be resistant to corrosion by the agents used.

Chemical hoods must have dedicated ductwork, which is not integrated with other ventilation ducts.

The positioning of hoods with respect to doorways and ventilation registers must always be considered in order to prevent disturbance from air currents. (ANSI Z9.5) Materials for ductwork use for exhaust of chemical hoods must be selected based on the materials that will be used in the hood. Exhaust system materials must be noncombustible.

All chemical exhaust devices must be properly exhausted to the exterior of the building, with proper stack height/exhaust exit velocity (a minimum of 10ft. above adjacent roof lines or structures on the roof, or high velocity that will achieve an effective stack height of 10ft or more. Exhaust stack must be in a vertical up direction, as well as a minimum of 10ft. above any air intake that is within 50ft. of the stack. A minimum discharge velocity of 3000fpm should be maintained to ensure that no re-entrainment into the building or any surrounding building occurs. (ANSI Z9.5) Aesthetic conditions concerning external appearance shall not supersede the requirements for effective stack discharge. Architectural structures to mask the unwanted appearance of the stack, as long as the stack extends vertically one stack diameter or more above the masking structure and otherwise meets the requirements are allowable. An evaluation of the masking structure is required to assure that it is not counterproductive to avoiding discharge re-entrainment. (ANSI Z9.5)

If condensation within the duct is likely, all horizontal duct runs shall be sloped downward at least 1 inch per 10ft. in the direction of the airflow to a suitable drain or sump. In addition, appropriate cleanout ports shall also be provided.

Rain caps or elbows may not be used on hood exhaust systems.

Exhaust fans must be adequately sized to provide the necessary amount of exhaust airflow in conjunction with the size, amount, and configuration of the connecting ductwork. Each fan’s rotational speed and motor horsepower shall be sufficient to maintain both the required exhaust airflow and stack exit velocity. Where exhaust fans are applied to centralized or manifolded laboratory exhaust systems, all fans and motors shall be adequately sized and the overall system controlled to provide the necessary amount of exhaust airflow, stack exit velocity, and the necessary negative static pressure in all parts of the exhaust system.

Fans must be located physically outside the building (preferably on the highest level roof of the building served; or in a roof penthouse or roof mechanical room that is always maintained at a negative pressure with respect to the rest of the facility, and provides direct fan discharge into the exhaust stack(s).

There should be no flexible connections on the discharge side of the fan and all ductwork on the discharge side of the fan must be welded and/or flanged and gasketed construction.

Branch ducts shall enter a main duct so the branch duct centerline is on a plane that includes the centerline of the main duct. For Horizontal main ducts, branch ducts shall not enter a main duct on a plane below the horizontal traverse centerline of the main duct.

Horizontal runs of branch ducts shall be kept at a minimum.

Longitudinal sections a duct shall be a continuous seamless tube or of a continuously welded formed sheet. (When nonmetallic materials are used, joints cemented in accordance with the manufacturer's procedures may be considered equivalent to welding).

Fire dampers shall not be used in hood exhaust systems

Fire sprinklers shall not be installed in chemical hood exhaust manifolds

Interior exhaust ductwork in unconditioned spaces shall be sloped toward the fan and insulated to reduce interior condensation and provide for its removal.

OSHA requires that a system be in place to allow users of a hood to determine whether or not the hood has airflow appropriate for the work being performed. To that end Chemical hoods should be equipped with airflow indicator (audible/visible) gauges. These devices are to be calibrated on an annual basis. Airflow monitors are required for all new hood installations and for hoods in buildings where renovation projects on the HVAC system involve the hoods. It will be the responsibility of University Facilities to calibrate these devices per manufacturer's specifications. A sticker, indicating the calibration date will be placed on each device upon calibration. EHS will catalog these devices into the Chemical hood database, and will check calibration stickers when performing chemical hood evaluations. All new hoods will be equipped with airflow monitors/alarms. All renovation projects involving hoods will include provisions for installing airflow monitors/alarms on new or existing hoods. Other existing hoods will be equipped with monitors/alarms as soon as possible.

Sinks that are incorporated into the hood surface should have a retaining edge surrounding them in order to prevent potential spills of hazardous materials from being inadvertently released to the sewer system, etc.

All new hood installations as well as hood relocations must be evaluated by the ASHRAE 110 method prior to being placed into/back into service. For new buildings where many hoods are installed in multiple labs, EHS will determine the number and location of hoods to be tested. This baseline data must be forwarded to EHS and the hoods certified by EHS before they are used.

A general ventilation system that gives 6 to 12 room air changes per hour is normally adequate. More airflow may be required to cool laboratories with high internal heat loads or to service laboratories with large specific exhaust system requirements. All air from chemical laboratories should be exhausted outdoors and not re-circulated. Thus, the air pressure in chemical laboratories should be negative with respect to the rest of the building unless the laboratory is also a clean room.

Supply air distribution shall be provided to create air jet velocities less than half, preferably less than one-third of the capture of the face velocity of the laboratory exhaust hoods.

As a general rule, airflow shall be from areas of low hazard, unless the laboratory is used as a Clean Room (Class 10,000 or better). When flow from one area to another is critical to exposure control, airflow monitoring devices shall be installed to signal or alarm a malfunction.

Manifolded systems shall operate continuously to provide adequate ventilation for any hood at any time it is in use and to prevent backflow of air into the laboratory or other parts of the building. Hoods should be on at all times. Fan redundancy must be included where hoods are manifolded.

All hoods should have an airfoil. Airfoils serve to minimize the turbulence as air enters the hood. Airfoils should not be removed from any hood and should be installed on those that do not currently have them.

Radioisotope hoods shall not be manifolded with non-radioisotope.

Perchloric acid hoods may not be manifolded with any other hood.

Hood ventilation systems shall be designed to include a minimum 25% excess capacity.

GUIDELINES FOR MAXIMIZING HOOD SAFETY AND EFFICIENCY

Chemical hoods shall be used in a safe manner, in accordance with standard safe work practices and manufacturers recommendations. Safe work practices include, but are not limited to the following:

Keep sash height at or below the 18” level at which airflow was determined to be adequate, as indicated by a certification sticker. The sash offers protection from accidents so, when possible, keep the sash between your face and the process/reaction in the hood. However, the sash is not designed to protect against explosions. When an explosion hazard is present, rounded safety shields should be used. Full face protection should also be used in such circumstances.

Sash stops installed on hoods shall not be removed unless necessary to place or remove equipment; decontaminate the hood, etc. Otherwise, they shall remain in position at the 18” installed position.

Do not use hoods for storage. Only that equipment which is necessary for current processes should be in the hood; chemicals, waste containers, etc. should be in the hood only when in immediate use; otherwise, they must be properly stored in appropriate storage cabinets.

Flammable liquids shall not be stored permanently in the cabinet under the hood unless that cabinet meets the requirements of NFPA 30 and NFPA 45 for flammable liquid storage.

Keep all items in hood at least 6 inches from the front of hood. This greatly improves capture rate for volatile chemicals. Paint a line or place a strip of tape 6” inside the hood as a helpful reminder.

Ideally, each chemical hood shall have a continuous monitoring device to allow convenient confirmation of adequate hood performance. If a hood does not have a properly operating alarm installed, attach a piece of tissue (Kim-wipe) to the corner of the hood. This will give, at least, an indication whether the hood is working or not until a proper monitor can be installed.

Check the airflow alarm/monitor before each use of the hood.

Motor-driven electrical equipment used in a chemical hood where volatile flammable chemical vapors may be present must be equipped with a non-sparking induction motor.

Sinks incorporated into the hood surface should have a retaining edge surrounding them to prevent spills/leaks inside the hood from being released to the sewer system. For existing hoods with sinks without a retaining lip, a drain plug or spill control pads, pillows, etc. should be used to prevent accidental releases to the sewer system.

Hoods shall be “on”: whenever chemicals are being used in the hood (if chemicals are in the hood—they are considered as being used--chemicals should not be stored in hoods); whenever chemicals are being dispensed in the hood (into secondary, waste containers, etc.)—dispensing of chemicals should always be performed in a hood; whenever chemical cabinets under the hood are ventilated into the hood and contain highly toxic chemicals or volatile chemicals.

Do not place large pieces of equipment in hood unless necessary.

Keep hoods clean and organized and clean up any chemical spill immediately.

Do not use the hood for any materials/chemicals that are not approved for use in that hood.

Do not use hoods for chemical waste evaporation.

Do not lean into the hood so that your head is inside the plane of the hood, as defined by the sash, without respiratory and other necessary personal protection whenever any process is in progress or chemicals are otherwise present in the hood creating the potential for release of vapors.

Avoid opening and closing the hood sash rapidly, and avoid swift arm and body movements in front or inside the hood. These actions may increase turbulence and reduce the effectiveness of hood containment.

Place equipment as far to the back of the hood as practical without blocking the bottom baffle.

If equipment is to be placed in hood, place it on a stand that allows air to flow under the equipment.

Do not operate the hood if the back baffles are not in place.

Always make sure that hood is functioning prior to using it. If alarm/monitor indicates that the hood is not functioning properly, or if the hood is posted “ATTENTION: Failed inspection…DO NOT USE, etc., the hood may not be used until the proper repairs/ corrections are made.

Do not disconnect or otherwise disrupt the function of hood alarms.

Do not remove airfoil or baffles.

Perchloric Acid Hoods

The use of perchloric acid requires the use a specially designed hood. The hood must be prominently labeled with a prominent sign stipulating that the hood is to be used for “perchloric acid work only”. Perchloric acid shall not be used in any other type of hood without the permission of EHS. If you are aware of any hood not designed for perchloric acid use that has been used for perchloric, this should be brought to the attention of EHS and UF.

Perchloric hoods shall be constructed with an integral liner of a single piece of 316 stainless with welded seams (and as few seams as possible) or ceramic coated material. They shall have integral bottoms, and covered interiors to facilitate decontamination. The liner shall have coved corners. Ductwork shall also be stainless steel or PVC (must be properly fire-rated). At a minimum, the blades and any other portion of the exhaust fan coming into contact with the perchloric fumes should be coated with PVC, Teflon, or another approved material that will resist the effects of the perchloric acid. In order to avoid buildup of perchloric precipitates in the hood and the duct system, the hood must be equipped with a washdown system that will rinse the system thoroughly at the end of each work session involving the use of perchloric acid. The washdown mechanism shall be capable of cleaning the entire duct from the point of exhaust all the way back to the hood.

Exhaust systems serving perchloric hoods may not be manifolded into a common exhaust plenum.

Perchloric hood fans/ductwork must be posted “Perchloric Hood Fan/ductwork—Authorized personnel only”

Perchloric acid (HCl04) is a colorless, odorless, fuming liquid that is miscible with water and extremely corrosive. Perchloric acid is noncombustible, however the anhydrous acid and certain perchlorate salts of organic, organometallic, and inorganic cations present a serious explosion hazard and have been set off by either heat or shock. Because of perchloric acid’s extremely corrosive physical properties and it tendency to react violently with many oxidizible substances, it is among the most hazardous substances found in the laboratory and should be used and stored with extreme care.

Perchloric acid is very corrosive to all living tissue. It can cause severe burns on contact with eyes, skin, and mucous membranes and is a severe irritant. Its acute toxicity is moderate. Perchloric acid has not been shown to be carcinogenic nor or reproductive or developmental toxin in humans.

Plumbed safety shower/eyewash unit must be readily available (within 10 seconds). Flush affected area(s) immediately and for at least 15 minutes while removing contaminated clothing and shoes. Seek medical attention immediately.

Although perchloric acid is not combustible, the anhydrous form is a serious explosion hazard due to its unstable nature and ability to react violently with many organic materials (e.g. wood, paper, cotton, etc.). Perchloric acid can cause violent explosions if it is misused, or if it is in concentrations greater than normal commercial grade strength (72%). At concentrations less than 72%, aqueous perchloric acid will not decompose spontaneously nor explode on standing. Many heavy metal perchlorates and organic perchlorate salts are very sensitive explosives. Mixtures of perchlorates with many oxidizable are explosive. When used cold, 70% perchloric acid acts as a strong acid, but is not considered to be a strong oxidizing agent; however, when heated it acts as a strong oxidizing agent. More concentrated solutions are strong oxidizers and increases in temperature increase the oxidizing power of perchloric acid. Hot concentrated solutions are very, very dangerous and should not be taken lightly.

Perchloric acid is a strong inorganic acid used for complete digestions of organic material. It is normally supplied in bottles of up to one gallon capacity at 70-72% strength. In many respects, its hazards are similar to those of nitric acid, as both are strong oxidizers. Perchloric acid presents an additional hazard in that perchloric acid mist and fumes can condense in ventilation systems to form metallic perchlorates which can be explosive.

All perchlorates are potentially hazardous when in contact with reducing agents. Oxidizable organic compounds including alcohols, ketones, aldehydes, ethers, and dialkyl sulfoxides can react violently with concentrated perchloric acid.

Personal Protective Equipment: The following PPE shall be worn when handling perchloric acid.

Lab personnel:

Splash/Impact Goggles
Faceshield
Nitrile, PVC, or neoprene gloves
Lab coat
Chemically-resistant apron

Perchloric Hood/Fan Maintenance

Access to the fan and stack shall be posted and restricted (roped or fenced).

Maintenance of perchloric hood systems shall be performed by authorized personnel only. All parts of the hood/exhaust system should be posted (“Perchloric Acid System—Authorized personnel Only”) to ensure that uncontrolled maintenance does not occur.

Prior to any maintenance, complete washdown of hood system must be ensured. Duration/type of washdown will be determined by EHS.

Only nonsparking tools shall be used.

Use only fluorocarbon grease for lubrication of fan

All parts of system must be handled carefully (potential explosion from shock or friction from tools)

Maintenance/decon/dismantling of perchloric hoods should be done when building is unoccupied.

If used for perchloric acid heated above ambient temperature, tests should be conducted for explosive perchlorates before any maintenance or cleaning is done on any part of the exhaust system within the airstream or hood interior.

All maintenance personnel working on perchloric hood must be trained in the hazards of perchloric acid.

Personal Protective equipment for maintenance personnel should include: Splash/ Impact goggles, faceshield, gloves (nitrile, neoprene, or PVC), chemically-resistant coveralls

Removing Hoods From Service

When a chemical hood is going to be taken out of service, the P.I. must first ensure that all hazardous agents have been removed and that it has been properly cleaned and disinfected. If radioactive materials have been utilized in the hood, the Chemical hood must be surveyed for radioactive material by the PI and by EHS. Once this has occurred the hood can be removed.

Roof Work

In the event that UF employees need to conduct work activities on the roof of any building containing hood exhaust(s), the department(s) having responsibility for the hoods must provide UF with all pertinent information as related to hood activities. Certain activities related to the use of hoods may need to be stopped until the work in complete. University Facilities will subsequently notify all department chairs and building safety contacts for affected areas to inform them of the time frame of the work to be conducted. If the roof work involves airstreams of any part of the hood system, the department chairs and safety contacts will be notified and the UF will then post all hoods that lead to all risers producing airstreams through which they may pass while completing the work. The sign to be utilized can be found in Appendix A:

Both the Baker ChemGard hood and the Labconco Xstream hoods are hoods that EHS has approved for use in Clemson University laboratories.

Specifications for these hoods can be found in the following pages.

The purchase or installation of any other hood must be approved by EHS.

Danger!

Do not use this Chemical Hood!

One of the following conditions currently exists:

- **Workers on roof and in hood air stream.**
- **Hood repairs are currently being conducted which will compromise airflow to this hood.**

Repairs began on Date:_____

Time:_____

Repairs will be completed by Date:_____

Time:_____

If you have questions, please call University Facilities at 656-2186

Appendix B

ATTENTION!

THIS HOOD HAS FAILED INSPECTION/TESTING.

THIS HOOD DOES NOT PROVIDE ADEQUATE PROTECTION.

THIS HOOD MUST BE REPAIRED BEFORE BEING UTILIZED.

ONCE THIS HOOD HAS BEEN REPAIRED, CONTACT ENVIRONMENTAL HEALTH AND SAFETY TO INSPECT AND CERTIFY THE HOOD.

IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT ENVIRONMENTAL HEALTH AND SAFETY @ 656-2583

INSPECTOR:_____ PHONE:_____

DATE:_____ ROOM:_____

HOOD IDENTIFICATION NUMBER:_____

CLEMSON UNIVERSITY ENVIRONMENTAL HEALTH AND SAFETY

FMH002 SEMIANNUAL FUME HOOD INSPECTION LUBRICATION

TOOLS: ANEMOMETER, BELT TENSION TOOL, AND STRAIT EDGE.

PRELIMINARY:

1. NOTIFY OPERATIONS CONTROL OF EQUIPMENT PM TASKS, EQUIPMENT SHUTDOWN. LOCKOUT/TAGOUT EQUIPMENT IN ACCORDANCE WITH SOP AND TEST LOCKOUT/TAGOUT. LOCKOUTS CAN BE REMOVED FOR TESTING.

2. ADHERE TO ALL APPLICABLE SAFETY PRECAUTIONS, POLICIES, AND PROCEDURES INCLUDING PERSONAL PROTECTIVE EQUIPMENT.

CAUTION: VERIFY THAT THE UNIT IS NOT BIOLOGICAL OR RADIOACTIVE. CONTACT DON WORTHY OR EHS IF IT IS EITHER. DO NOT WORK ON THE UNIT UNLESS THE TASK HAS BEEN APPROVED BY THE ENVIRONMENTAL GROUP. IF IT IS A CHEMICAL FUME HOOD UNIT, CONTACT THE DEPARTMENT OPERATOR TO SEE IF THE UNIT CAN BE SHUT DOWN AT THIS TIME.

PROCEDURE:

3. OBSERVE UNIT WHILE OPERATING AND CHECK FOR EXCESSIVE VIBRATION.

4. CHECK FOR ANY SIGNS OF LEAKS FROM THE EXHAUST PIPING FROM THE FUME HOODS. PAY CLOSE ATTENTION TO THE PIPING CONNECTORS. ALSO CLOSELY INSPECT THE PIPING CONNECTIONS WHEN IT PENETRATES A WALL, CEILING, OR A ROOF. CHECK THE ROOF FLANGE FOR CRACKS OR LEAKS.

5. DE-ENERGIZE UNIT. CHECK BELT (S) FOR FRAYING AND CRACKING (IF APPLICABLE).

6. CHECK BELT (S) FOR DISCOLORATION CAUSED BY HEAT FROM CHAFING/RUBBING.

7. CHECK PULLEYS FOR TIGHTNESS, WEAR AND PROPER ALIGNMENT.

8. REPLACE BELT (S) AS REQUIRED.

9. CHECK BELT ALIGNMENT AND TENSION. ADJUST IF NECESSARY.

NOTE: COMPLETE THIS PART OF THE P.M. ONLY IF THERE ARE NO CHEMICALS IN THE FUME HOOD OR IF THE FUME HOOD HAS BEEN DECLARED “CLEAN” BY THE CONTROLLING GROUP OR EHS.

10. RESTART UNIT. CHECK THE AIRFLOW WITH AN ANEMOMETER TO VERIFY THE RECORDED FACE VELOCITY (TAG ON THE UNIT). READ AIR FLOW IN VARIOUS LOCATIONS INSIDE THE HOOD WITH THE HOOD 18 INCHES OPEN. READ AT LEAST 6 AREAS, 3 IN THE BACK AND 3 IN THE FRONT.

11. MAKE SURE THAT THERE IS A TAG ON THE UNIT THAT TELLS WHAT THE VELOCITY OF AIR FLOW SHOULD BE (NORMAL MINIMAL IS 100 LINEAR FEET PER MINUTE, A MINIMAL 60 FEET PER MINUTE IF THE SASH IF FULLY OPEN, 125 FEET PER MINUTE IF THE UNIT IS RADIOACTIVE).

12. IF THE UNIT IS EQUIPPED WITH A FLOW ALARM, OPEN THE SASH ALL THE WAY (MORE THAN 18 INCHES) TO SEE IF THE UNIT WILL GO INTO ALARM. IF THE UNIT DOES NOT GO INTO ALARM, THEN REPORT IT. IF IT DOES ALARM, THEN CLOSE THE SASH TO THE PREVIOUSLY SET HEIGHT AND RESET THE ALARM.

13. ENSURE THE UNIT HAS A PERFORMANCE STICKER (NORMALLY LOCATED ON THE LEFT SIDE OF THE HOOD AT THE SASH). IF THE STICKER IS NOT THERE CONTACT DON WORTHY OR IF HE IS NOT AVAILABLE, CALL THE EHS DEPARTMENT AND LET THEM KNOW

14. VERIFY ALIGNMENT OF THE MOTOR AND SHAFT (IF APPLICABLE).

15. INSPECT FAN AND MOTOR HOUSING FOR RUST AND DETERIORATION.

16. CLEAN MOTOR GREASE FITTINGS AND REMOVE GREASE DRAIN PLUGS, IF INSTALLED.

17. LUBRICATE MOTOR WITH APPROVED GREASE. (GROUP ONE)

18. ALLOW EXCESS GREASE TO DRAIN AND REINSTALL GREASE PLUGS.

19. CLEAN AREA AROUND FAN SHAFT GREASE FITTINGS, BEARING HOUSING AND FAN SHAFT.

20. LUBRICATE BEARINGS WITH APPROVED GREASED (GROUP ONE).

21. CLEAN EXCESS GREASE FROM FITTINGS, BEARING HOUSING AND FAN SHAFT.

22. IF FAN HAS OILED BEARINGS LUBRICATE BEARINGS WITH APPROVED OIL (20 WEIGHT)

23. INSPECT MOTOR EXTERIOR FOR MISSING PAINT, CORROSION, EXCESS GREASE, EXCESS OIL.

24. AN MOTOR CASING, FAN/BLOWER GRID AND INSPECT IMPELLER BLADES IF APPLICABLE.

25. LUBRICATE THE AIR VOLUME CONTROLLING ACTUATOR. (USE SILICON SPRAY)

26. INSPECT NUTS, BOLTS, and WASHERS FOR TIGHTNESS/DETERIORATION.

27. ENSURE EQUIPMENT ALIGNMENT HAS NOT BEEN DISTURBED DURING REPAIRS OR REPLACEMENT OF FASTENERS.

28. REPLACE MISSING, WORN OR DETERIORATED FASTENERS

    REPLACE BROKEN COLLAPSED OR CORRODED SHOCK MOUNTS AS NECESSARY.

29. REMOVE LOCKOUT/TAGOUT DEVICES AND RETURN EQUIPMENT TO NORMAL OPERATION.

30. NOTIFY OPERATIONS CONTROL THAT PM TASKS ARE COMPLETE.

31. REPORT ALL DISCREPANCIES TO THE PROPER PERSONNEL. SUPERVISION OR FACILITIES FOR A WORK ORDER.