



ENVIRONMENTAL HEALTH & SAFETY

Administrative Policy

Formaldehyde Policy

Source: Environmental Health and Safety

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Policy Statement: The formaldehyde exposure for any person entering a space within the University of Colorado Denver | Anschutz Medical Campus and its affiliated locations will be kept below the applicable Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) and/or short term exposure limit (STEL). The Department of Environmental Health and Safety (EHS) will implement this policy and maintain the document on Formaldehyde Safe Work Practices (Appendix 1) to include aspects of the OSHA Formaldehyde Standard ([29 CFR 1910.1048](#)) to ensure that hazards associated with formaldehyde are anticipated, recognized, evaluated, and controlled to protect personnel who are potentially exposed. The requirements of this policy shall apply to all clinics, laboratories, teaching, and research areas that use formaldehyde gas, its solutions, and materials that release formaldehyde.

Overview of Health Effects: Formaldehyde is a Group 1 carcinogen – known human carcinogen, and can have a variety of health effects. Skin contact with formaldehyde can cause irritation and/or rash in the short and long term; inhalation of formaldehyde can result in short term, acute or long term, chronic health effects. Acute exposure can cause irritation of the eyes, nose, and throat; at higher concentrations individuals may experience shortness of breath, cough, and chest tightness. Chronic exposure can lead to sensitization of the skin and respiratory tract, including asthma-like respiratory problems, dermatitis, and can cause cancer.

Exposure Monitoring: Work areas throughout the university where potential formaldehyde exposure(s) may occur (e.g., where mixtures or solutions composed of greater than 0.1 percent formaldehyde are used), are periodically monitored to determine the formaldehyde concentration. The following exposure limits have been established for formaldehyde.

Formaldehyde concentration	Type of limit	Exposure Duration
0.5 ppm	OSHA action level	8 hour TWA
0.75 ppm	OSHA PEL	8 hour TWA
2 ppm	OSHA STEL	15 minute TWA



EHS will adhere to the OSHA standard and perform sampling at least every 6 months in areas that are at or above the OSHA action level (AL); if the formaldehyde concentration is at or above the OSHA STEL, sampling will be performed at least once per year during worst-case conditions. Additionally, monitoring may be performed if an employee reports signs or symptoms of health effects associated with formaldehyde exposure. If there is a concern regarding formaldehyde exposure, please contact EHS at 303-724-0345. EHS will notify affected employees of the sampling results within 15 working days after receipt of the results. If the sampling results reveal a work area to be defined as a regulated area, appropriate signage, access restriction(s), and training will be implemented [a regulated area is defined by OSHA as an area where the concentration of formaldehyde exceeds either the PEL or the STEL; regulated areas must have signage compliant with the OSHA standard, limited access to authorized and trained personnel, and communication of the hazard to other employees in the work area].

Work Practices, Engineering Controls, PPE, and Respiratory Protection: Implementing proper controls, such as administrative/work practice controls, engineering controls, and personal protective equipment (PPE), are critical in reducing formaldehyde exposure. The Formaldehyde Safe Work Practices (Appendix 1) outlines the controls to be used in situations with the potential for formaldehyde exposure. In short, regulated areas may have restrictions regarding the time allowed to work in a particular work area and/or requirements for PPE to be in that area. Several areas throughout the university have engineering controls such as local exhaust ventilation, downdraft tables, etc. that may be recommended or required for use during work with formaldehyde or materials that may emit formaldehyde. Similarly, PPE can be a critical component in protecting workers from formaldehyde; some areas may require splash protection such as chemical resistant aprons, while others may only require chemical resistant gloves and eye protection. Respiratory protection, including but not limited to a half or full face respirator, is required for certain tasks. If you are unsure about the level of protection required for your work, or the applicable work practices and engineering controls, please contact EHS.

Housekeeping, Emergency Procedures, and Spill Response: Managers of facilities where formaldehyde is used shall implement procedures to ensure that good housekeeping is maintained and spills are prevented. This may include routine visual inspections for leaks, preventative maintenance of equipment, signage, testing of equipment to ensure that it is properly functioning, provisions for spill cleanup, and proper hazardous waste disposal. During an emergency situation (e.g., equipment failure, failure of local exhaust ventilation, or an emergency-scale spill that may result in formaldehyde exposure), staff shall call University Police and request EHS response, and the university's Contingency Plan will be implemented. Employees responsible for performing any cleanup work or maintenance will be required to wear PPE and enroll in formaldehyde medical surveillance. For incidental spills (those that are not an emergency; staff present has the proper spill cleanup materials, PPE, and training; nobody is injured; and involves less than one gallon of chemical), staff should warn others in the vicinity, wear PPE, clean up the spill, and dispose of the spill debris as Hazardous Waste. Additional information on spill response can be found in the online Chemical Waste Management training and Formaldehyde Safe Work Practices document.

Medical Surveillance: Enrollment in Formaldehyde Medical Surveillance (FMS) is dependent on a hazard assessment; for example, some work areas and tasks at the university have previously been identified as requiring FMS, based on industrial hygiene sampling – per the OSHA standard FMS is required for all employees exposed to formaldehyde at or above the STEL or AL. Additionally, FMS is available for employees who develop signs and symptoms of exposure to formaldehyde and to individuals exposed to formaldehyde in emergencies. The exact components of FMS depend on the completion of the [Formaldehyde Medical Disease Questionnaire](#) (minimum requirement for FMS enrollment), which shall be completed initially upon hire and annually thereafter; FMS may include a medical examination including a physical exam and/or laboratory tests deemed necessary.

Information and Training: All employees enrolled in the FMS program must take annual training regarding potential formaldehyde exposures; EHS will provide this training, which must be taken annually. The content of the training will comply with the OSHA Formaldehyde Standard and Hazard Communication Standard ([29 CFR 1910.1200](#)). Formaldehyde training will be available online and individuals who are not enrolled in FMS will be able to take the training if they choose.



Formaldehyde Safe Work Practices

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APPENDICES

APPENDIX A: Additional Biological and Chemical Hazards Associated with Embalming

APPENDIX B: Guidance for Pregnant or Nursing Mothers

APPENDIX C: Formaldehyde Signage

Introduction

These procedures are established to reduce exposures to hazardous chemicals that create a potential for formaldehyde exposure; there are several areas on campus where these chemicals are used including, but not limited to: the State Anatomical Board (SAB) cadaver preparation area and cold storage room; anatomy classrooms located on the University of Colorado Denver and Anschutz Medical Campuses; School of Medicine teaching laboratories; the Pathology Department during specimen preservation; and assorted research laboratories throughout the university. Some areas, such as cadaver preparation areas, present a greater potential for long term chronic occupational exposures to formaldehyde as staff may work full-time in these areas. Instructors of anatomy courses have potential for long term occupational exposures, but generally to a lesser degree due to reduced formaldehyde concentration in these areas. Transient exposures are also possible for students taking anatomy courses, working in research



laboratories where formaldehyde is used, and for those entering the cold storage room such as Facilities Management personnel conducting operations and maintenance activities. This document provides information and protective procedures for these situations, primarily as they relate to exposures to formaldehyde (including embalming fluids), but the procedures and protective equipment detailed herein or referenced provide control against exposure to human pathogens. Additional information on biological hazards associated with cadaver and tissue preparation, and chemical hazards associated with embalming fluids can be found in Appendix A.

Formaldehyde Exposure

The potential for formaldehyde exposure at the university varies depending on the location. Some areas work strictly with formaldehyde or formalin, wherein the primary concern is formaldehyde exposure; There are other areas, such as the SAB, where cadaver preparation is performed and it is worth noting that embalming fluid contains several chemicals used to preserve cadavers including phenol, formaldehyde, methanol (methyl alcohol), and glycerin (syn: glycerine, glycerol). The focus of this document will be formaldehyde; further information on phenol and methanol associated with embalming can be found in Appendix A. While phenol and methanol are chemicals posing a health concern, these chemicals have higher permissible exposure limits (i.e., the anticipated airborne concentrations are less likely to reach levels presenting a health concern). Additionally, some individuals have an increased sensitivity to chemicals and/or to formaldehyde – these individuals and/or those who are nursing or pregnant, should contact EHS (303-724-0345) for additional guidance. There is information on formaldehyde exposure for pregnant or nursing mothers in Appendix B.

The permissible exposure limits established by regulation are presented in Table 1 (presented as time weighted averages [TWA] for either eight hour days for an anticipated 40-hour work week, or 15-minute average to represent ceiling concentration limits or Short Term Exposure Limit). The *permissible exposure* limits are established by OSHA to represent concentrations that the average worker may be exposed to without representing either a safety concern or long term health hazard. The concentrations listed as immediately dangerous to life or health (IDLH), pose an acute risk to life or health. IDLH concentrations are not anticipated for the activities and areas addressed by this document. Some organizations *recommend* lower permissible concentrations be adapted for formaldehyde as an assurance for worker health. The “action level” is that airborne concentration at which an employee with routine work exposures would be required to be enrolled in a medical surveillance program.

Table 1
Exposure Limits in Parts per Million (ppm)

Chemical	Action Level	OSHA PEL	OSHA STEL	IDLH
Formaldehyde	0.5 ppm	0.75 ppm	2 ppm	20 ppm
Phenol*	N/A	5 ppm (skin)	-	250 ppm
Methanol	N/A	200 ppm	-	6000 ppm

PEL - permissible exposure limit

STEL - short term exposure limit (for 15 min)

IDLH - Immediately dangerous to life and health

OSHA - Occupational Safety and Health Agency

Action Level - is explained within the formaldehyde section that follows.

* as a solid



It should be noted that high levels of any flammable or combustible liquid (including formaldehyde and methanol) can present a fire and explosive hazard if concentrations in air reach lower explosive limits (LEL). Standard practices within these facilities present little danger for this as long as ventilation levels are maintained at the normal operating parameters (for the existing equipment and conditions).

The following chemical information is for formaldehyde in its pure form and does not necessarily directly represent the health risks of solutions that contain these chemicals at lower concentrations. While the terms formaldehyde and formalin are often used interchangeably, the potential exposure depends on the concentration of formaldehyde being used. Some areas at the university work with materials containing 37% formaldehyde while others work with more diluted products, often labeled as “formalin” and these products may have as little as 4% formaldehyde. As with all chemicals, the manufacturer’s Safety Data Sheet (SDS) will give information about the potential hazards associated with a specific product at the given concentration; it is important that current SDS are provided by the manufacturer or distributor of the chemicals and chemical solutions being used. These SDS, package/container labeling, and other information must comply with the revised OSHA hazard communication standard [29 CFR 1910.1200] and new Globally Harmonized System (GHS) of chemical classifications. In keeping with updates to the standard, signage must be posted that meet specific criteria for communicating general chemical hazards and specific formaldehyde hazards [29 CFR 1910.1048]. See the Formaldehyde Signage and Labeling section of this document for specifics.

At room temperature formaldehyde is a nearly colorless, highly irritating gas with a sharp odor. Vapors are slightly heavier than air. It is flammable as a liquid. Considered a human **carcinogen**, prolonged exposure to formaldehyde has been associated with cancers of the lung, nasopharynx, oropharynx, and nasal passages (nose and throat). Individuals can become exposed by contact to solutions and contaminated surfaces, or through inhalation of solutions and through off-gassing from formaldehyde-containing or formaldehyde contaminated materials such as clothing, shoes, and equipment. Symptoms or adverse effects of exposure to formaldehyde include skin irritation; respiratory irritation; coughing; wheezing; watery or itchy eyes; burning sensation in eyes, nose, and throat; itchy, runny, or stuffy nose; dry or sore throat; nausea; and headache. Formaldehyde is an irritant and sensitizer (inhalation and skin contact).

Contact with formaldehyde solutions, vapor, or resins can cause eczema (dry, flaking and itching skin) and may lead to allergic contact dermatitis or hives.

Respiratory sensitization is possible with repeated or occupational exposures to formaldehyde and can cause allergic asthma. Symptoms of asthma include chest tightness, shortness of breath, wheezing, and coughing. Occupational asthma can develop.

A wide range of eye injuries are possible as a result of accidental splash to the eyes of aqueous solutions of formaldehyde (formalin) and adverse effects are possible with exposure to vapors. Injuries can include corneal opacities, corneal necrosis or ulceration, perforation, and acute



glaucoma (can cause blindness). These effects may be delayed for 12 hours or more. For splashes, the severity of eye injury is dependent on the concentration of formaldehyde in solution and the amount of time elapsed before emergency procedures (eye washing) and medical care.

Drinking formaldehyde solutions can cause severe burns to the throat and stomach. Ingestion of 30 milliliters (about 2 tablespoons) can cause death. Means of ingestion can be direct or associated with secondary means such contamination of hands, eating utensils, etc.

The OSHA formaldehyde permissible occupational exposure limit of 0.75 ppm as an 8-hour TWA was established in part due to potential chronic, long term exposure concerns (related to occupational carcinogenic effects and the potential for developing sensitivity to this irritant). A short term exposure limit (STEL – based on a 15-minute exposure) was established by OSHA to ensure no employee is exposed to an airborne concentration of formaldehyde exceeding two parts formaldehyde per million parts of air (2 ppm). Serious acute (response/symptom is immediate or within a day/week) effects begin around 10 ppm and IDLH concentrations, according to OSHA, begin at 20 ppm. Some individuals may experience adverse effects in concentrations as low as 0.1 ppm. Some people are very sensitive to formaldehyde, whereas others have no reaction to the same level of exposure. Individuals with pre-existing respiratory conditions or those with a history of exposure to formaldehyde may have a more immediate and/or severe response to low concentrations. An existing condition of asthma is not necessarily associated with increased sensitivity to formaldehyde.

An action level of 0.5 parts formaldehyde per million parts of air (0.5 ppm) calculated as an eight-hour TWA was established by OSHA to ensure that individuals with repeated workplace exposures to this level of formaldehyde are monitored closely for potential adverse effects. Employees exposed to this level need personnel monitoring every six months and must be enrolled in the medical surveillance program. See the Medical Surveillance and Monitoring section of this document for additional information.

Formaldehyde Signage and Labeling

The following signs and labels must be employed where formaldehyde is used at locations represented by this guidance document.

Containers

The following wording should be included on the manufacturer's packaging and container labels for all mixtures, gases, and solutions containing formaldehyde at greater than 0.1%, or capable of releasing formaldehyde at concentrations of greater than 0.1 ppm. If it is not, place the following wording on containers of formaldehyde solutions:

DANGER
MAY CAUSE CANCER
CAUSES SKIN, EYE, AND RESPIRATORY IRRITATION
AUTHORIZED PERSONNEL ONLY
[chemical manufacturer name]



When chemical solutions are removed from their original packaging/containers, the secondary containers used must, at minimum, have the name of the product or chemical of concern and the nature of the hazard presented by the product. If the material will be used up in the same work shift, labeling is not required, but is very strongly recommended. When the containers are used by more than one worker, this exemption does not apply at the Anschutz Campus. The following are examples of how to communicate the name and hazard presented:

Contains Formaldehyde
Carcinogen
Causes skin, eye, & respiratory irritation

or

Formaldehyde



Carcinogen
Causes skin, eye, & respiratory irritation

Work Areas

The OSHA Formaldehyde Standard requires signage for regulated areas, which includes an area where the formaldehyde concentration exceeds either the TWA or the STEL. At a minimum signage must contain the following language:

DANGER
FORMALDEHYDE
MAY CAUSE CANCER
CAUSES SKIN, EYE, AND RESPIRATORY IRRITATION
AUTHORIZED PERSONNEL ONLY

Signage with the aforementioned wording must be posted at entrances to areas where formaldehyde solutions are used or stored, including entrance to SAB cadaver preparation room, the cold storage room, and where containers of contaminated clothing or equipment are kept. This signage may be posted in other areas, such as teaching or research laboratories, where formaldehyde solutions are stored. EHS has created a sign as follows (and also included as Appendix C) for posting:



FORMALDEHYDE

MAY CAUSE CANCER

CAUSES SKIN, EYE, AND RESPIRATORY IRRITATION
AUTHORIZED PERSONNEL ONLY

Flammable vapor concentrations possible.

PPE may be recommended or required depending on the task being performed.
For additional information contact EHS (303-724-0345).

Work Practices

Work practices must be implemented to reduce the source of exposure or minimize the potential for formaldehyde, other chemicals, and pathogens to become airborne whenever possible. Additionally, the following work and sanitary practices will reduce the potential of exposure.

General Precautions

Chemical and biological contaminants can be ingested due to poor work practices; lack of, or improper use of personal protective equipment; and inadequate sanitation protocol. To avoid ingesting contaminants:

- Do not eat or drink where formaldehyde or embalming solutions are handled, processed, or stored.
- Use face shields (or full face respirators if applicable) when chemical splash to the face is possible or when gross dissection presents the potential for tissue particles to splatter or become air borne (e.g., use of electric bone saw, etc.).
- Wear gloves whenever working in areas where formaldehyde or embalming fluids are stored or handled.

Contaminated clothing must be removed upon exiting areas where chemicals, biological samples or cadavers are stored or processed such as the prep room, cold room, or classroom.



Laboratory coats, aprons, coveralls (e.g., Tyvek), gowns, scrubs or disposable gowns/over clothing worn for protection in these areas should not be worn outside of the laboratory.

- Remove gloves and wash hands before leaving areas where work with formaldehyde is performed.
- Wash hands before eating, drinking, taking medications, smoking, and prior to using the computer, phone, or other frequently touched surfaces outside the area in question.
- Avoid eating in office spaces in formaldehyde work areas.
- Post shift showering is recommended after extensive handling of cadavers (e.g., SAB and morgue employees).

Cadaver Preparation Areas

Review the PPE section of this document for information on the types of personal protective equipment that must be worn within the SAB cadaver preparation room (prep room) and the University Hospital Morgue.

- No food or drinks will be taken into the SAB prep room or morgue.
- Strive to keep embalming fluids and/or formaldehyde from spilling on the floor. This not only creates a slip hazard, but it increases significantly the airborne concentration of formaldehyde, phenol and methanol. Apart from employing careful work practices, placing fluid capture devices below locations of possible fluid release is strongly recommended. Mop up liquids routinely throughout the work day or after each process. Avoid the use of permeable mat materials as they can absorb aromatics used in the prep room.
- Do not block exhaust ducts (i.e., drawdown table surface intakes or exhaust duct near floor as applicable). Do not place equipment, containers, or other items directly in front of exhaust intakes. Maintain a clear area around these systems (e.g., no obstruction between work area and exhaust intakes). *Do not cover intakes located on the surface of the cadaver table (cadaver and sheets can partially block and/or hinder exhaust intakes on the drawdown table).*
- In the SAB, introduction of embalming fluids into cadaver (including brain) must only be conducted on the downdraft table and only when the downdraft table is connected to the exhaust system. Since there is only one connection for the downdraft table, only one cadaver may be embalmed at one time. Additionally, prep work involving volatile chemicals should not be conducted while another cadaver is being embalmed.
- Keep chemical containers closed at all times except when adding or dispensing chemicals. In the SAB, the embalming fluid receptacle (reservoir of embalming fluid during cadaver embalming procedure) must be covered. When dispensing volatiles materials, if possible, use closed lid containers with small openings (spout) and use funnels or dispensing hoses to transfer liquids. Whenever not in use, all chemical containers should remain tightly closed. Transfer of embalming fluids to embalming units should occur with use of closed line system in place for this reason (equipped with auto shut off).
- Except during embalming, keep processed cadavers covered.
- Store volatile chemicals inside flammable cabinets.



- Remove contaminated expendable materials frequently (place material into appropriate containers that prevent or lessen the release of vapors). Wipe surfaces routinely and after each procedure. Place used or waste permeable materials such as wipes, cleaning cloths, sheets, scrubs, etc. into flammable material receptacles (similar to used shop rag container) or bags that will contain vapors.
- Do not wear protective clothing and equipment outside of the prep room or morgue. Doff personal protective equipment (PPE) upon exiting work area.
- In the SAB, the cold room (where cadavers are stored) doors to the SAB prep area and hallway should remain closed at all times unless actively transferring cadavers or equipment or when working inside the cold room.
- The temperature in the SAB cadaver preparation room will be maintained at or below the range of 64 to 68 degrees Fahrenheit.
- Staff will wash hands and remove PPE upon exiting the area. Wash hands with anti-bacterial soap, rubbing together all surfaces of lathered hands before completely rinsing hands under a continuous stream of water (pointing fingers downward). Process should take ~30 seconds. Avoid touching sink surface or facet handles.
- Contact EHS to request a pick-up of any hazardous waste generated (unspent embalming fluid, concentrated formaldehyde, etc.). Please see hazardous chemical waste management procedures on the EHS website under chemical management and the [Hazardous Materials Management Plan](#). Embalming fluid leaking from cadavers is not being managed as hazardous waste at this time.

SAB Cold Room

The cold room has an exhaust ventilation system. If the ventilation system is off, high airborne concentrations of formaldehyde can accumulate within the cold room. To aid in reducing exposure, ensure that the ventilation exhaust intake remains clear and is functioning.

- No food or drinks will be taken into the cold room.
- Keep floors clean and free of standing liquids. Clean floor at least once daily or as needed to remove standing liquids.
- Preserved cadavers must remain in sealed/closed body bags during storage.
- The doors to the SAB prep room and hallway should remain closed except when entry is necessary.
- Use of respiratory protection is recommended for entry into the cold room. Use of respiratory protection is required for entries to the cold room that will last 4 hours (total) or more in a day. It is important to ensure that continued personnel monitoring occurs for SAB employees that work routinely in the prep area and enter the cold room daily or weekly in the execution of their work activities. Respiratory protection must be approved by EHS, the employee must be medically approved to wear respiratory protection, and must be fit tested to the exact model and size respirator to be used.
- Personal and area sampling within the cold room demonstrate that formaldehyde levels are below the STEL, but could reach the PEL and action level depending on unanticipated conditions or the length of time spent in the area. Unless subsequent testing demonstrates that levels are consistently below these regulated levels, staff



entering this space must don appropriate/approved respiratory protection when work activities within the cold room **total 4 hours** or more within one day. Employees routinely entering these spaces (i.e., SAB staff) must be enrolled in the Formaldehyde Surveillance program with EHS Occupational Health.

- For daily and extended entries to cold room (4 or more hours per day), don proper respirator prior to entry, equipped with appropriate chemical cartridge. See respirator section for additional information. A full face respirator or Powered Air Purifying Respirator (PAPR) is the recommended respiratory protection for this area. If a half face respirator is used, chemical splash goggles must be worn. See more information under Personal Protective Equipment (PPE) section.
- If non-SAB staff must enter:
 - Inform the SAB staff of the planned activity.
 - Review the guidance and observe the PPE requirements
 - Determine the length of planned activities and don respiratory protection as defined herein as applicable.
- If planned activity requires that the cold room ventilation is shut off, inform EHS prior to the planned work activity (when advance notice is possible) and wear approved respiratory protection while performing work in the cold room along with other specified PPE.
- Do not block the exhaust duct in the cold room. Keep this area clear.
- Staff will remove PPE (gloves and respirator as applicable) and wash hands upon exiting the area. Wash hands with regular or anti-bacterial soap, rubbing together all surfaces of lathered hands for 15-30 seconds before rinsing completely under running stream of water with fingers pointed downward.

Anatomy Classrooms

The University has renovated classrooms and invested in specially designed downdraft tables to ensure the comfort, safety and health of Faculty, staff, and students. When the systems are used as designed, odors and the level of exposure to formaldehyde, and other chemicals, are greatly minimized (to well below permissible occupational exposure levels). Additionally, the methods by which classroom activities are conducted can also greatly lower potential for formaldehyde exposure. The following procedures should be employed to further reduce potential exposures to formaldehyde and to the less likely potential of exposure to human pathogens. Additionally, review the PPE section of this document for information on the types of personal protective equipment that must be worn within the anatomy classrooms.

- Prior to the beginning of the anatomy course (semester start) and as needed throughout the semester, staff will drain all excess liquids from the cadaver tables (humidors). Cadaver bags should also be drained prior to work with cadavers.



- Cadaver downdraft tables must be connected and plugged in to the provided exhaust ducts in the anatomy classrooms (Figure 1) prior to any work with cadavers. Look for the green light as an indication that ventilation is on (Figure 2). Double check to ensure that air is flowing and the system functioning.

Figure 1 - Exhaust Duct Connection

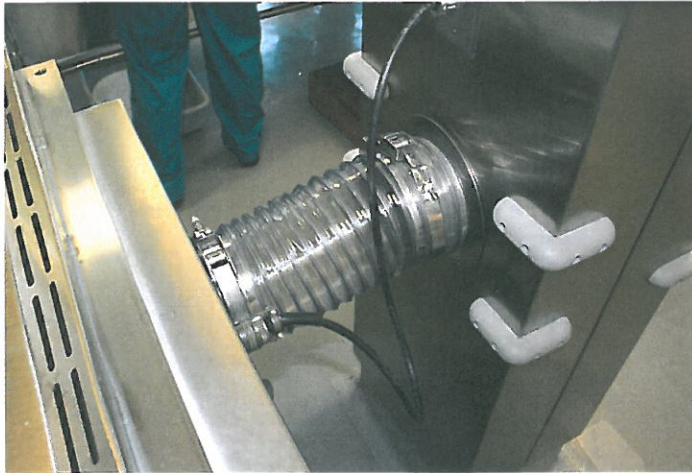
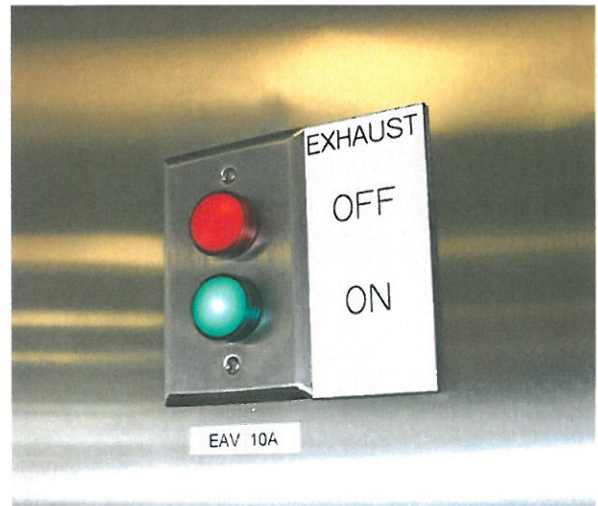


Figure 2 - Exhaust Control for Downdraft Tables



- No food or drink will be taken into or consumed within the anatomy classrooms.
- Doors to the hallway **MUST** remain closed at all times except during entry and exit.
- Students and staff should take as few personal belongings into the classroom as possible.
- During anatomy classes, waste items contaminated with formaldehyde will be kept in appropriate waste containers that will remain closed except during material disposal.
- Ideally, students should rotate roles associated with exploration of the cadaver so that one student is not closely working with the cadaver during the entire class.
- When practical, students and staff should attempt to keep their face at least a foot away from the cadaver and limit the amount of time that they are in close proximity to open cadaver cavities (e.g., abdomen, brain, and chest cavity).
- Upon the initial opening of a cadaver abdomen, brain, or chest cavity, the students and or instructor will step *at least* one foot way from the cadaver table for a period of ~60 seconds prior to proceeding to allow vapors to dissipate (be evacuated by the exhaust system).
- If symptoms are experienced during activities within the anatomy classroom, the person should leave the classroom and move to an area of fresh air. Seek follow up medical advice or care as appropriate to the symptoms experienced and their persistence. For additional information, contact EHS (at the Anschutz Campus 303-724-0345, or 3030-556-6779 at the Denver Campus, during business hours). For any medical emergencies, seek immediate care at an ER or urgent care facility.
- Students, staff and faculty will wash hands and remove PPE upon exiting the area. Wash hands with anti-bacterial soap, rubbing together all surfaces of lathered hands for at least 15 seconds before completely rinsing hands under a continuous stream of water (pointing fingers downward) for an additional 15 seconds. Dry hands completely with



paper towel and use the towel to shut off faucet. Consider all surfaces of the sink, faucet and faucet handles as contaminated. It is a good idea to wash face and arms as well (particularly prior to eating or final daily departure from the class).

- Any intrusive processes on preserved cadavers (cutting/dissection, close examination of student work on cadavers, cavity openings) should be conducted on properly exhausted downdraft tables. Specimens removed from cadavers should also only be examined within areas equipped with proper local exhaust. For additional information or questions related to activities that must be performed outside of the anatomy classrooms, contact EHS for guidance (303-724-0345 and ask for the industrial hygienist group).

Research and Teaching Laboratories

Review the PPE section of this document for information on the types of personal protective equipment that must be worn during work with formaldehyde in laboratories located on the University of Colorado Anschutz Medical Campus, Denver Campus, and the University Hospital Morgue. During your work, pay particular attention to the formaldehyde product being used as the concentration of formaldehyde (per the SDS) plays an important part in determining risk.

- No food or drinks are allowed into laboratories.
- If possible, perform all work with formaldehyde and formaldehyde solutions within a chemical fume hood.
- Strive to keep formaldehyde and formaldehyde solutions from splashing and spilling. This significantly increases the airborne concentration of formaldehyde. Wipe surfaces routinely and following the completion of activities.
- Respiratory protection is not usually required during typical laboratory activities involving formaldehyde and formaldehyde solutions. However, voluntary use of respiratory protection is encouraged. If respiratory protection is worn it must be approved by EHS, the employee must be medically approved to wear respiratory protection, and must be fit tested to the exact model and size respirator to be used.
- Wash hands upon exiting the area with anti-bacterial soap, rubbing together all surfaces of lathered hands before completely rinsing hands under a continuous stream of water (pointing fingers downward). Process should take ~30 seconds. Avoid touching sink surface or faucet handles.

Tissue Dumping

Review the PPE section of this document for information on the types of personal protective equipment that must be worn during tissue dumping activities at locations on the University of Colorado Anschutz Medical Campus and the University Hospital Morgue. Tissue dumping has been shown to generate high concentrations of formaldehyde in some instances and as such, careful attention to these work practices as well as wearing the required PPE is critical.

- No food or drinks shall be allowed into areas where tissue dumping occurs.
- Strive to keep embalming fluids from splashing and spilling on the floor. This not only creates a slip hazard, but it significantly increases the airborne concentration of formaldehyde, phenol and methanol. Mop up liquids routinely throughout the work day or



after completion of the tissue dump. Avoid the use of permeable mat materials as they can absorb aromatics used in tissue dump areas.

- Do not block exhaust ducts (i.e., exhaust duct near floor or prep tables/sinks as applicable). Do not place equipment, containers, or other items directly in front of exhaust intakes. Maintain a clear area around these systems (e.g., no obstruction between work area and exhaust intakes).
- Wipe surfaces routinely and following the completion of the tissue dump. Place used or waste permeable materials such as wipes, cleaning cloths, sheets, scrubs, etc. into flammable material receptacles (similar to used shop rag container) or bags that will contain vapors.
- In most circumstances, use of respiratory protection is required during tissue dumping activities at the University. It is important to ensure that continued personnel monitoring occurs for employees that performing tissue dumping activities. Respiratory protection must be approved by EHS, the employee must be medically approved to wear respiratory protection, and must be fit tested to the exact model and size respirator to be used.
- Do not wear protective clothing and equipment outside of the tissue dump area. Doff personal protective equipment (PPE) upon exiting work area.
- Staff will wash hands and remove PPE upon exiting the area. Wash hands with anti-bacterial soap, rubbing together all surfaces of lathered hands before completely rinsing hands under a continuous stream of water (pointing fingers downward). Process should take ~30 seconds. Avoid touching sink surface or facet handles.

Personnel Protective Equipment (PPE)

Individuals working in areas where they come in contact with hazardous materials such as formaldehyde must wear appropriate PPE consistent with type of exposure, chemical compounds and activities they conduct.

The following provides basic guidance developed for the specific work practices and activities EHS observed during site visits. If new activities or practices will be employed, these should be re-assessed to ensure that the recommended PPE is still protective for the revised activities. If chemical formulations are changed, re-assess that the PPE is still appropriate and protective.

Protective equipment and clothing that has become contaminated with formaldehyde or other hazardous materials must be cleaned or laundered before its reuse. Respirators, goggles, glasses, and face shields that will be shared must be sanitized after each use. Disposable gloves may not be re-used.

Cadaver Preparation Areas

To prevent incidental exposures from off gassing of permeable materials, no contaminated materials should be removed from the cadaver prep area until cleaned or contained. Because scrubs are permeable it is recommended that scrubs not be worn into offices or outside of the cadaver prep area. Remove contaminated garments and PPE and bag or decontaminate (e.g., respirator) prior to leaving the work area. Contaminated protective clothing and equipment must



be properly cleaned prior to reuse. Respirators, goggles, and similar reusable equipment may be cleaned with warm soapy water. No contaminated clothing should be taken home. Individuals and vendors who launder, clean or repair clothing and equipment shall be notified of formaldehyde's potentially harmful effects and procedures to prevent exposure and safely handle contaminated equipment.

Eyes

Work with formaldehyde solutions requires eye protection (chemical splash goggles must be worn unless a PAPR or other full face respirator is worn) when there is potential for splashes to face or high vapor concentrations. Chemical splash goggles, face shield, full face respirator, or PAPR must be worn at all times during active cadaver processing and when handling liquid chemical solutions to protect the eyes. Where a face shield is worn, chemical safety goggles are also required if there is a danger of formaldehyde reaching the eye. When a respirator is not used, a surgical mask or similar is recommended to protect the mouth from splashes, sprays or flying particles that can contain chemicals or human pathogens. These processes include, but are not limited to:

- initial introduction of embalming fluid to cadaver
- preservation of brain
- processes that expose preserved cavities
- puncturing or piercing of cadaver parts
- any use of bone saws or drills
- mixing, dispensing, transferring, or transporting (open) chemicals

Regular goggles or safety glasses may be used during handling of dry materials and when not processing cadavers with embalming liquids or when activities do not have a potential for splashes to face.

Dermal

Scrubs do not provide skin protection from liquids. Additional protective outerwear must be worn to avoid dermal exposures.

At a minimum, gloves, protective clothing, non-permeable apron, and over boots must be used when processing cadavers, managing chemical containers, or working around potentially chemically contaminated equipment and surfaces. Long sleeved, chemical-resistant clothing (and/or impermeable gauntlet style gloves or arm covers) should be worn in conjunction with impermeable apron. Protective articles should include:

- Impermeable non-slip over boots
- Impermeable disposable sleeves
- Long sleeved, chemical-resistant clothing (and/or gauntlet style gloves with disposable sleeve covers) should be worn in conjunction with impermeable apron. No exposed arm skin.
- Long pants (legs and feet must be protected; therefore, shorts or open toe shoes and sandals are not acceptable).
- Gloves



- Gloves must fit properly. Select gloves in the right size for each worker.
- Consult with glove manufacturer's permeation and glove selection guide charts to ensure proper glove selection.
- Disposable inner surgical style glove (Nitrile)
- Outer work glove (Butyl)

Butyl gloves are recommended when handling 37% or greater concentration of formaldehyde mixed with phenol, or when immersion of the hands is anticipated. Flexible, reusable Butyl gloves are available that provide improved dexterity. Disposable Nitrile gloves (8 mils thick) can be used when solely handling lower concentrations of formaldehyde solutions (and may be used as an inner glove under heavier impermeable work gloves) or when high dexterity is needed. Impermeable gloves must be worn at all times in the prep room. Disposable gloves should be changed frequently when working for extended periods with embalming solutions and should never be re-used. Once the disposable glove has been removed, it must be discarded.

Face/Mouth

A surgical mask and face shield (if a respirator is not required) must be worn during any intrusive manipulation of the brain or spinal cord. This includes any activity with the potential to generate an aerosol or cause flying debris such as sawing, drilling, homogenization of tissue, or similar activity.

Respiratory

Specific activities conducted within the cadaver prep areas pose a respiratory hazard. Staff will wear respiratory protection when:

- Hand mixing or transferring large volumes of chemicals in open systems or containers (e.g., pouring chemicals into containers by hand)
- Cleaning spilled solutions of volatile chemicals used or stored in the prep room, cold room or classroom. [For large scale spills or releases contact University Police at 303-724-4444 and request EHS response].
- Work within the cold room (walk in freezer) for extended periods or under the following conditions and/or activities:
 - If work within the cold room will last 4 hours or more.
 - If multiple entries to the cold room will result in, or approach 4 hours or more aggregate for one day.
 - When cold room ventilation is off, malfunctioning, in the event of a power outage or damage to unit operation.
 - Anytime the exhaust system to the cold room is blocked.
 - During floor cleaning activities and/or when entire floor is covered in cadaver or embalming fluids.
 - During any other activity that has the potential to aerosolize or increase the airborne concentrations of embalming chemical vapors.

Respiratory protection will include either a full face respirator or PAPR equipped with formaldehyde cartridge recommended for use with phenol and methanol (organic vapors).



Unless instructed otherwise by EHS, air purifying respirator filters/cartridges and PAPR cartridges that do not have an end-of-service-life indicator approved by the National Institute for Occupational Safety and Health (NIOSH) must be changed out at the end of each work-shift. If the cartridge contains a NIOSH approved end-of-service indicator to show when breakthrough occurs, then employees can use that indicator to determine when change out is necessary. Additionally, cartridges should be changed out anytime odors are detected while wearing the respirator. If odors are detected while wearing the respirator, contact [EHS](#).

See additional information under Respirator Use and Medical Surveillance and Monitoring.

SAB Cold Room

Dermal and Eye Protection

Some form of eye protection is recommended for any entry. The nature of the eye protection is selected based on the activities conducted.

Where there is a danger of liquid formaldehyde solutions splashing or dripping into eyes splash goggles (chemical safety goggles) are required or a face shield with goggles. When a face shield is worn, chemical safety goggles must also be worn under the shield.

For routine maintenance activities performed by Facilities Management staff, safety glasses with side shields or goggles should be worn for working within the cold room and other areas where formaldehyde is used. Tight fitting chemical splash goggles are recommended for work within the cold room unless a full face respirator, PAPR, or SCBA will be worn.

SAB staff and other employees conducting work activities for extended periods (4 hours or more total in a day) inside the cold room must use a full face respirator or PAPR equipped with appropriate chemical cartridge.

Gloves appropriate to the work activity should be worn by all employees entering the cold room. Facilities Management staff should consider the nature of the work activity when selecting the glove type. If heavy work gloves will be needed for the planned work activity, latex or Nitrile disposable gloves should be worn under the work gloves if there is a risk of coming in contact with contaminated surfaces or liquids. A more substantial Butyl or Nitrile glove can be substituted for work gloves if there is no danger of puncture or tearing and there is a concern of coming in contact with formaldehyde. If heavy gloves are not required for the work activity, disposable Nitrile gloves are appropriate (dispose of gloves upon exiting the cold room).

Disposable shoe covers are recommended for Facilities Management staff when entering the cold room (these should be removed upon exit). SAB staff should wear impermeable over boots when cleaning floors of spilled or residual embalming liquids and/or if there is a possibility of splashing liquids on feet. Any employee conducting work with the potential for standing in embalming fluids or splashing onto feet, should wear impermeable footwear or over boots.

All employees will remove any permeable clothing that becomes wet with liquid solutions and immediately wash off affected areas of skin. See emergency procedures for additional information. Facilities Management staff should consider the nature of the work activity and area



conditions when selecting proper work clothing for use in the cold room. If there is a need to sit on potentially contaminated or wet surfaces, a disposable coverall that is moisture resistant is recommended.

SAB staff will also follow guidelines provided under the SAB Cadaver Prep area for PPE requirements when handling formaldehyde.

Respiratory

Respiratory protection is required for staff that will enter the cold room for a total of 4 hours or longer in a day. Respiratory protection is optional and recommended for entries lasting less than 4 hours, especially for workers that enter the area routinely or have other formaldehyde exposures as part of their work or other activities.

Respiratory protection will include a half face respirator, full face respirator, PAPR, or self-contained breathing apparatus (SCBA) depending on need and activity. The latter is required only for emergency responders. Additional information on the change out schedules for respirator cartridges (filters) and respiratory protection program enrollment is provided under the Respirator Use section of this document.

As indicated under the Work Practices cold room section of this document, the following procedure will be employed if entries into the cold room will be for a total of 4 hours or longer in a day:

Don proper respirator prior to entry into cold room. Wear respiratory protection (equipped with appropriate chemical cartridge) while working in the cold room and doff respirator after leaving the cold room to avoid exposure and contamination of the respirator interior. If a half face respirator is used instead of a full face respirator or PAPR, chemical splash goggles should also be worn.

Respiratory protection is required in the cold room for the following conditions:

- If work within the cold room will last 4 hours or more.
- If multiple entries to the cold room will result in, or approach 4 hours or more aggregate for one day.
- When cold room ventilation is off, malfunctioning, in the event of a power outage or damage to unit operation.
- Anytime the exhaust system to the cold room is blocked.
- During floor cleaning activities and/or when entire cold room floor is covered in leaked or spilled embalming fluids.
- During any other activity that has the potential to aerosolize or increase the airborne concentrations of embalming chemical vapors.
- When chemicals (other than embalming fluids) will be used in the cold room, for example when maintenance or renovation activities will require the use of solvents or other volatile chemicals/products.
- When welding, cutting or other activities with the potential to alter the environment, generate fumes, etc.



- For initial entry into the cold room after extended periods of shut down. [Let the ventilation run for a period of 30 minute or more prior to entry or use respiratory protection.]

Important: When hot work or other activities are performed in this enclosed space (particularly when the ventilation system is down/off in the cold room) there is the potential to displace oxygen. In this event the use of filtering respirators may not be protective. When such activities will be performed, oxygen should be monitored in the space to ensure that it remains at 20.9%. If the percent of oxygen is more or less than this, additional consultation is required and respirator use is inadequate protection. Contact EHS (303-724-0345) for guidance and monitoring. Additionally, when the ventilation system is off, the exhaust intake is blocked, or the system is malfunctioning, vapors within the space can accumulate to levels that may reach combustible levels. A hot work permit may be required for this activity. Contact Facilities Management, Fire and Life Safety to coordinate hot work activities.

Anatomy Classrooms

Dermal, Face, and Eye Protection

- Safety glasses with side shields or goggles should be worn for observatory procedures and should be donned upon entering the anatomy classroom.
- Splash goggles or face shields are *recommended* for intrusive exploratory procedures with the cadaver, but are not required unless the individual will work with liquid solutions.
- Surgical mask and face shield should be worn during extensive manipulation of the brain or spinal cord, especially if aerosols or flying debris are possible (e.g., during sawing, drilling, or homogenization of tissue, etc.)
- Gloves will be worn by all students, staff and faculty at all times during the anatomy class.
 - Don and doff gloves upon entering and exiting the classroom.
 - Gloves must fit properly. Select gloves in the right size for each person.
 - Consult with glove manufacturer's permeation guide charts to ensure proper glove selection for use with alcohols, phenol, and formaldehyde.
 - Disposable surgical style glove (of latex or Nitrile) will suffice for most anatomy class activities. Work with chemical solutions or brain cavity may require use of Butyl glove or outer second glove.
 - Surgical style gloves are not cut or puncture resistant. Frequently inspect gloves for cuts, punctures, or wear (change when texture, thickness or shape are altered). Change disposable gloves frequently and remove when leaving the anatomy classroom.
 - Do not re-use disposable gloves.
- Disposable shoe covers are recommended to limit tracking of debris and chemicals outside of the classroom. These should be removed upon exiting the anatomy classroom.



- Disposable scrubs, cloth scrubs, or lab coats are recommended for use by students and instructor when working with cadavers. Disposable scrubs will be removed and disposed upon exiting the classroom (do not re-use). It is important to note that lab coats and cloth scrubs are permeable and do not provide protection from splashes or liquids. If an individual's scrubs, clothing or skin become contaminated with formaldehyde (enough to wet skin), remove the contaminated articles and wash off affected skin areas. For immersion or splash to skin or eyes, proceed to the emergency shower/eyewash (see additional instructions under the emergency procedures section of this document). Lab coats should not be worn outside of the lab areas. Ideally, scrubs should be changed prior to leaving the laboratory. A change of clothing is recommended.

Respiratory

No respiratory protection is required while working in the Anatomy classrooms as long as the general ventilation system is on and the downdraft cadaver tables are connected and fully functioning as described in the Work Practices, Anatomy Classroom section of this document. The downdraft tables must be connected to the exhaust ducts and the green light. Figure 3 illustrates an example of an unconnected table.

Students and Faculty should follow the guidelines defined under the Anatomy Classroom portion of the Work Practices section of this document. Area sampling results indicate that the levels within the ambient air are acceptable in the classrooms. Personnel monitoring indicates that during normal classroom activities exposures are below the OSHA PEL and STEL during active dissection. Intrusive procedures conducted on the preserved cadavers during class may represent higher exposures than other less intrusive operations. Individuals in close proximity to the cadaver (or to those performing the intrusive procedures on the cadavers) are at increased exposure levels. To lessen exposure, these activities should be performed following the prescribed procedures in this document (Anatomy Classroom portion of the Work Practices section) and under the close supervision of the instructor.

Figure 1- Do Not Use Downdraft Cadaver Table When it is Not Connected



Research and Teaching Laboratories

Dermal, Face, and Eye Protection

Eye protection is recommended when working with formaldehyde and formaldehyde solutions if there is potential for splashes to face or high vapor concentrations. Chemical splash goggles, face shield, full face respirator, or PAPR should be worn.

At a minimum, gloves must be worn during work with formaldehyde or formaldehyde solutions. Butyl gloves are recommended when handling 37% or greater concentration of formaldehyde mixed with phenol, or when immersion of the hands is anticipated. Flexible, reusable Butyl gloves are available that provide improved dexterity. Disposable Nitrile gloves (8 mils thick) can be used when solely handling lower concentrations of formaldehyde solutions (and may be used as an inner glove under heavier impermeable work gloves) or when high dexterity is needed. Disposable gloves should be changed frequently when working for extended periods with formaldehyde and should never be re-used. Once the disposable glove has been removed, it must be discarded.

Additional protective clothing, such as a non-permeable apron and over boots must be used when potential splashes may occur. Potential splashes may occur during: liquid change out of tissue processing equipment, managing chemical containers, or working around potentially contaminated equipment and surfaces. Protective articles should include:

- Impermeable non-slip over boots



- Impermeable disposable sleeves
- Long sleeved chemical-resistant clothing (and/or gauntlet style gloves with disposable sleeve covers) should be worn in conjunction with impermeable apron. No exposed arm skin.
- Long pants (legs and feet must be protected; therefore, shorts or open toe shoes and sandals are not acceptable).
- Gloves
 - Gloves must fit properly. Select gloves in the right size for each worker.
 - Consult with glove manufacturer's permeation and glove selection guide charts to ensure proper glove selection.
 - Disposable inner surgical style glove (Nitrile)
 - Outer work glove (Butyl)

Respiratory

Respiratory protection is typically not required for work with formaldehyde in teaching and research laboratories. This is due to the smaller volume of formaldehyde used in these applications, which results in low (and in some cases non-detect) concentrations of formaldehyde in air. As such, the potential for exposure is low and does not necessitate respiratory protection. However, there are some instances where respirator use may be necessary (e.g., sensitized individuals); additionally, voluntary use is encouraged. For additional questions on respiratory protection, please contact EHS (303-724-0345).

Tissue Dumping

Dermal, Face, and Eye Protection

Work with formaldehyde solutions requires eye protection as there is potential for splashes to face and high vapor concentrations. Chemical splash goggles, face shield, full face respirator, or PAPR must be worn at all times.

Gloves, protective clothing, non-permeable apron, and over boots must be used when dumping tissues, managing chemical containers, or working around potentially chemically contaminated equipment and surfaces, as scrubs do not provide skin protection from liquids. Protective articles should include:

- Impermeable non-slip over boots
- Impermeable disposable sleeves
- Long sleeved, chemical-resistant clothing (and/or gauntlet style gloves with disposable sleeve covers) should be worn in conjunction with impermeable apron. No exposed arm skin.
- Long pants (legs and feet must be protected; therefore, shorts or open toe shoes and sandals are not acceptable).
- Gloves
 - Gloves must fit properly. Select gloves in the right size for each worker.
 - Consult with glove manufacturer's permeation and glove selection guide charts to ensure proper glove selection.



- Disposable inner surgical style glove (Nitrile)
- Outer work glove (Butyl)

Butyl gloves are recommended when handling 37% or greater concentration of formaldehyde mixed with phenol, or when immersion of the hands is anticipated. Flexible, reusable Butyl gloves are available that provide improved dexterity. Disposable Nitrile gloves (8 mils thick) can be used when solely handling lower concentrations of formaldehyde solutions (and may be used as an inner glove under heavier impermeable work gloves) or when high dexterity is needed. Disposable gloves should be changed frequently when working for extended periods with embalming solutions and should never be re-used. Once the disposable glove has been removed, it must be discarded.

Respiratory

Tissue dumping activities pose a respiratory hazard. Staff shall wear respiratory protection when:

- Hand mixing or transferring large volumes of chemicals in open systems or containers (e.g., pouring chemicals into containers by hand)
- Dumping tissues that have been preserved in a formaldehyde solution
- Cleaning spilled solutions of volatile chemicals used or stored in the area. [For large scale spills or releases contact University Police at 303-724-4444 and request EHS response].

Respiratory protection will include either a full face respirator or PAPR equipped with formaldehyde cartridge.

Unless instructed otherwise by EHS regarding a change out schedule, air-purifying respirator cartridges must be replaced at the end of each work-shift unless the cartridge contains a NIOSH approved end-of-service indicator to show when breakthrough occurs. Cartridges should be changed out anytime odors are detected while wearing the respirator. If odors are detected while wearing the respirator, contact [EHS](#).

Respiratory Protection

University employees and affiliates (including but not limited to students, volunteers, interns, etc.) that perform tasks requiring the use of a respirator will be enrolled in the Respiratory Protection Program. Individuals with specific chemical sensitivities or anyone that has a demonstrated sensitivity to formaldehyde may have different requirements for respiratory protection. The following provides a summary of the requirements and process for enrollment into the respiratory protection program based on the type of respiratory protection used.

Respirator Guidance and Limitations

The respiratory protection identified within this document may only be used safely under normal operations and conditions in the locations identified and for the activities referenced in this document. If conditions are altered, EHS must be contacted to assess conditions.

Respirators **may not** be worn in conditions where the oxygen level is below 19.5% (oxygen levels should be at 20.9% as indicated on oxygen meters). Levels of oxygen are not anticipated



to drop below this percent under normal conditions. However, in emergency situations, altered conditions are possible. Do not enter if the air handling system was off for extended periods in these areas **and** formaldehyde was spilled and/or containers were left uncovered within these closed areas. Contact EHS for monitoring of spaces.

Respirators can never be used if conditions could reach or exceed IDLH (20 ppm). Under normal working conditions, concentrations of formaldehyde will not reach these levels.

If large volumes of embalming solution are spilled (one gallon or more), respirators recommended herein for conducting routine work activities may not provide adequate protection. EHS and/or emergency services should be called to respond. See the Emergency Procedures section of this document for additional information.

An approved change out schedule for the filter cartridge must be determined by EHS (with knowledge of the latest sampling results for the affected areas). The type of cartridge used, the anticipated ambient conditions in which the respirator will be used, and the anticipated airborne chemical concentration will be used to determine the required minimum change out schedule for the respirator filter cartridges. Alternatively, if the cartridge contains a NIOSH approved end-of-service indicator to show when breakthrough occurs, then employees can use that indicator to determine when change out is necessary. If EHS is unable to calculate the change out schedule and there is no NIOSH approved end-of-service indicator, per the OSHA standard, the respirator cartridges must be changed out at the end of each shift (8-hour period). Respirator cartridges should also be changed out anytime odor is detected while wearing the respirator. If odor is detected while wearing the respirator, leave the area and report the incidence to EHS for follow-up sampling and/or filter cartridge assessment.

Additionally, each respirator has a specific protection factor and this is different for different styles and models. The PEL, chemical concentration in air, and the protection factor of the respirator are used to calculate if the respirator will provide adequate protection. For example, a half face air purifying respirator typically provides a protection factor of 10; this number is referred to as the assigned protection factor (APF). The highest concentration that is safe for the specific respirator is called a maximum use concentration (MUC) which is calculated based on the PEL of the chemical present and the APF of the respirator used.

Negative Pressure Respirators

1. Fill out an [Initial Respirator Clearance Form](#) (employee completes Part One of form with supervisor's assistance). For each subsequent year of respirator use, complete the [Annual Respiratory Protection Clearance Form](#); then skip to step 5 of this checklist.
2. Employee independently completes the [Respirator Medical Evaluation Questionnaire](#).
3. Send both forms to EHS Occupational Health clinic (Occupational.Health@ucdenver.edu).
4. Schedule an appointment at the Occupational Health Clinic by calling 303-724-9145.
5. Employee completes "Respiratory Protection" training available online in Skillsoft for half or full face negative pressure respirators; for Skillsoft instructions, see the [Training](#) portion of the EHS website. Submit a copy of your training completion certificate to



EHSRespirator.fittest@ucdenver.edu. A fit test will not be scheduled until training is completed.

6. Employee schedules a fit test appointment with EHS by calling or emailing.
7. Employees undergoes fit testing annually, or more frequently if there have been changes to facial features or weight change of 10 or more pounds, etc. Bring respirator to fit test appointment for fit test and unit inspection by EHS.
8. Employee should ensure they receive information from EHS regarding the change out schedule for the respirator filter cartridges, which is specific for the make and model of their respirator and cartridges used (and the anticipated ambient conditions where respirator is used).
9. Follow the approved change out schedule for the filter cartridge calculated by EHS and/or discard after each work shift that respirator is used (unless otherwise approved by EHS).
 - a. Store unused cartridges in original sealed package until opened for use.
 - b. Do not use a cartridge if it has been exposed to air for extended periods (not in original unopened manufacturer packaging), if there is visible damage, or if odor is detected during use of respirator.
10. Maintain the respirator in good condition. Store in protective bag and check seal for cracks or wear prior to each use.
11. Complete training every year.

Powered Air Purifying Respirator (PAPR)

1. If a PAPR is not already purchased, contact EHS for guidance prior to buying the PAPR unit(s).
2. Complete in-person hands-on training for PAPR use – specific to the unit that will be used.
3. With consultation of the EHS, ensure proper filter cartridges are purchased for PAPR unit(s) that will be used.
4. Fit testing is required annually only for tight fitting PAPR. Loose fitting PAPR do not require fit testing. Contact EHS if you are unsure of the type you have.
5. Employee should ensure they receive information from EHS regarding the change out schedule for the respirator filter cartridges, which is specific for the make and model of their PAPR and cartridges used (and the anticipated ambient conditions where respirator is used).
6. Refer to the EHS [PAPR User Fact Sheet](#) to proper instructions on pre-use instructions, donning, and doffing the respirator.
7. Store unused cartridges in original sealed package until opened for use.
8. Do not use the cartridge if it has been exposed to air for extended periods (not in original unopened manufacturer packaging), if there is visible damage, or if odor is detected during use of respirator.
9. Maintain the unit in good working order. Ensure the unit battery pack is plugged in for charging between uses. See the PAPR User Fact Sheet for further detail.
10. Follow the manufacturer's guidance for short and long term operation and maintenance of the headgear/hood and for information on decontamination of the unit as needed.



11. Undergo training every year. Bring unit to training for inspection by trainer.

Please note that N95/P100/N100 respirators are not considered adequate protection for restricted entry formaldehyde locations. N95s that are approved for *nuisance* removal of organic vapors are inadequate for entry in areas that have the potential to reach or exceed the PEL for formaldehyde. However, N95s with nuisance organic vapor removal may be used on a voluntary basis by students in the anatomy classrooms for comfort/odor abatement. [Contact EHS](#) for guidance prior to use.

Medical Surveillance and Monitoring

Employees may be monitored to determine their exposure to formaldehyde. Based on results, some workers may be required to enroll in the formaldehyde medical surveillance program.

Formaldehyde medical surveillance is required for employees exposed to formaldehyde at or exceeding the STEL (2 ppm) or the Action Level of 0.5 ppm (calculated as an 8-hour TWA). Exposures at or above these levels triggers the initiation of:

- Employee formaldehyde medical surveillance, including the [Formaldehyde Medical Disease Questionnaire](#), which will be completed upon initial hiring and annually thereafter
- Exposure monitoring every 6 months for employees working in areas at or above the Action Level
- Exposure monitoring every 12 months for employees working in areas at or above the STEL

Monitoring will be conducted by the EHS Industrial Hygienist or a qualified industrial hygiene consulting firm, approved by EHS. Results from any third party personnel sampling must be provided to EHS. If representative sampling of similar job tasks demonstrates no exposure is anticipated, monitoring does not need to be conducted for each employee conducting similar tasks.

Employees with repeated workplace exposures to formaldehyde should report to their supervisor and [EHS Occupational Health](#) if they experience any health symptoms they believe may be related to occupational exposures to formaldehyde. If the employer (supervisor, Occupational Health, Risk Management, or EHS) receives reports of signs or symptoms of respiratory or dermal conditions associated with formaldehyde exposure, the employer shall promptly monitor the affected employee's exposure (through the EHS Industrial Hygienist) and the employee may be required to enroll in the formaldehyde medical surveillance and/or obtain medical evaluation. Contact EHS ([Occupational Health](#) 303-724-9145) to enroll in the program or to confirm if enrollment is warranted. Note that employees experiencing acute or life threatening health symptoms should seek immediate emergency care (see Emergency Procedures for additional guidance).

The need for formaldehyde related medical assessment applies when the employee experiences or reports significant irritation of the mucosa of the eyes or of the upper airways,



respiratory sensitization, dermal irritation, or dermal sensitization attributed to workplace formaldehyde exposure. This does not apply in the case of dermal irritation or dermal sensitization when the product suspected of causing the dermal condition contains less than 0.05 percent formaldehyde [29 CFR 1910.1048(l)(8)(i)].

Employees may elect to enroll in formaldehyde medical surveillance if they work in an area(s) where formaldehyde is used. Contact Occupational Health for information on enrolling in the formaldehyde medical surveillance program (303-724-9145).

Medical *clearance* is required for employees that must wear a respirator in the performance of their job as discussed in the Respiratory Protection Use section of this document. An initial medical assessment is conducted to determine the employee's fitness to wear respiratory protection (through use of the Respirator Medical Evaluation Questionnaire or medical examination). Thereafter, the employee must self-report to [EHS Occupational Health](#) (303-724-9145) any changes to their health that could impact their ability to safely use respiratory protection. The health questions asked with the Respirator Medical Evaluation Questionnaire provide examples of conditions or symptoms that might impact employee fitness for respirator use. For additional guidance and information contact [EHS Occupational Health](#).

Emergency Procedures

Splashes to Skin or Eyes

Immediately drench affected areas with water for 15 to 20 minutes. Obtain follow-up medical assessment for significant exposure to eyes or mucous membranes.

Victims whose clothing or skin is contaminated with formalin can cause secondary contamination by direct contact or through off-gassing vapor.

Fire

Pull fire alarm and evacuate the area. Call Police Dispatch (from the Anschutz Campus, 911 on a university land line or 303-724-4444 by cell; at the Denver Campus, 911 on a university land line or 303-556-5000 by cell) and report the conditions and location of the affected area and the names and locations of any remaining and/or injured personnel.

Spills and Releases

Any large spill (greater than one gallon) of formaldehyde must be reported to University Police and Environmental Health and Safety (303-724-0345).

At the Anschutz Campus: Call University Police Dispatch by dialing 911 on a campus phone (landline) or 303-724-4444 from mobile phone.

At the Denver Campus: Call Auraria Campus Police Department by dialing 911 on a campus phone (landline) or 303-556-5000 from mobile phone.

Large spills of formaldehyde and other chemicals used and stored in the cadaver preparation areas, anatomy classrooms, and laboratories may **pose a fire hazard**. Evacuate the area with



others and call for assistance from a safe location. Do not attempt to respond to spills involving greater than one gallon of material (respiratory protection may be inadequate for the higher airborne concentrations and flammable levels can be reached).

Small spills may be handled by trained staff or faculty who have received training and/or are familiar with the product hazards and SDS if there is adequate or normal room ventilation. Wear proper PPE to clean up spills.

Report to EHS any significant releases (a release of one gallon or more of a concentrated solution within a 30-minute period) of formaldehyde or embalming chemicals into the sanitary sewer.

Ingestion

If formaldehyde is ingested, call poison control for information on immediate actions. Do not allow the exposed individual to transport themselves, either by foot or vehicle. Transport the individual to the emergency room or call an ambulance to seek emergency medical care and transport as needed.

Training

Employees with job duties requiring direct contact with unpreserved or preserved cadavers and those conducting cadaver embalming processes must receive training that covers the following. Specific instructions for accessing online Skillsoft trainings are provided on the [EHS website](#).

- **Annual Formaldehyde Training** is required per the OSHA Formaldehyde Standard (29 CFR 1910.1048) upon initial hire and annually thereafter. Training is available online and will be assigned by EHS to those individuals required to take formaldehyde training.
- **Bloodborne Pathogens** and **Regulated Medical Waste** training (online Skillsoft training) and supervisor led or EHS Biosafety-led on-the-job training.
- **Health Hazards and Proper Management of Chemicals** used.
 - Specific information regarding hazards of formaldehyde exposure must be communicated to employees exposed to embalming fluids. Contact EHS to schedule employee training or train-the-trainer training for supervisors.
 - **Hazard Communication** training (Skillsoft Hazcom, Skillsoft Chemical Waste Management, and/or Skillsoft Lab Safety training)
 - SDS use, including the Globally Harmonized System (GHS) of classification
 - Required signage
- **Hazardous Waste Management** as applicable (Skillsoft Chemical Waste Management) is required for:
 - Employees that generate or handle hazardous chemical waste.
 - Managers/supervisors of employees that generate or handle hazardous chemical waste.
- **Emergency Response Procedures** (partially covered in this document and also addressed in the online Skillsoft Chemical Waste Management training and Skillsoft Lab Safety training)



- Supervisor must ensure employees know:
 - evacuation procedures and routes
 - spill response, clean up, and reporting
 - emergency procedure for eye or skin contact
 - location of eye wash and drench showers
 - fire response measures and reporting
- **Proper PPE**
 - **Respiratory Protection training** as applicable. Employees using respiratory protection must complete either the online Skillssoft Respiratory Protection training or hands-on training for PAPR use.
 - Supervisor must ensure that employees understand requirements detailed in this document and (contact EHS for guidance):
 - use of PPE
 - selecting proper PPE
 - donning and doffing PPE
- **Safe Work Practices** (as defined in this document)
 - minimizing exposures
 - best management practices for chemical storage and use
 - proper sanitation
 - cleaning requirements

Faculty and staff are required to provide instruction within the classroom setting to students taking courses that require them to come in direct contact with preserved cadavers. Faculty must undergo training as listed above (where applicable) and be familiar with the requirements provided within this document in order to provide the proper instruction to students on the safe practices and use of PPE.



APPENDIX A: Additional Biological and Chemical Hazards Associated with Embalming

Biological Hazards

The [State Anatomical Board \(SAB\)](#) receives donations of human cadavers for use in education and research within Colorado. When received at the University of Colorado Anschutz Medical Campus, these cadavers are unpreserved. Embalming is performed by the SAB staff within the fifth floor of the Education 1 building prior to distribution for use in research and learning settings. Cadavers are stored in a walk in cold room that is maintained at approximately 40 degrees Fahrenheit.

Human cadavers should be considered as potentially presenting a human pathogen exposure risk as defined in the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens (BBP) standard [[29 CFR 1910.1030](#)] and the University of Colorado Denver [Bloodborne Pathogen/Other Potentially Infectious Material Exposure Control Program \(ECP\)](#). Therefore, employees handling unpreserved cadavers must follow the controls and practices and obtain initial and subsequent annual training for [Standard Precautions \(Universal Precautions\)](#) as defined in the standard. Training requirements are partially met by taking the UC Skillsoft training available online (CU: Blood Borne Pathogens/Exposure Control Training [U00069]). Instructions for accessing the training are available at the Environmental Health and Safety (EHS) biosafety training webpage. Additional on-the-job training should also be conducted that addresses the unique conditions and activities performed in these job roles and is typically provided by the supervisor. Guidance and assistance with training is available through the [EHS Biosafety](#) group or [EHS Occupational Health](#) clinic. While exposure to blood borne pathogens (BBP) risk is greatly reduced following preservation, embalmed cadavers should also be managed as potentially infectious and Standard Precautions employed during invasive procedures.

Embalming will not mitigate or eliminate the potential hazard posed by prions which might be present in human neural tissue. Personal Protective Equipment used for compliance to the BBP regulations plus the use of a surgical mask and face shield (if a respirator is not worn) should be implemented whenever human brains or spinal cords are manipulated, especially if aerosol producing procedures are used, such as sawing, drilling, homogenization of tissue, or similar activity.

Methanol

Methanol is a poison volatile organic compound that is colorless and flammable as a liquid - with an odor similar to drinking alcohol. Aqueous solutions can cause eye and skin irritation. Methanol is toxic by ingestion and as little as ten milliliters can cause damage such as blindness. It may cause systemic toxicity with acidosis.

The mechanisms for entry into the body also include absorption through the skin and inhalation. Extremely high concentrations in air need to be present to cause irreversible adverse effects by inhalation. Methanol can be absorbed through undamaged intact skin to result in toxic effects. It



can cause central nervous system depression and kidney damage and may cause respiratory and digestive tract irritation. Vapors can cause eye irritation. Exposure to eyes can result in painful sensitization to light. Methanol has been associated with adverse reproductive and fetal effects. It is not considered an OSHA carcinogen.

Phenol

In the pure form phenol is a colorless white to light pink, crystalline solid that has a sweet, acrid odor. The odor is detectable at much lower concentrations than those considered harmful and is sometimes associated with tar.

Short duration exposures to phenol in the air can cause respiratory irritation, headaches, and burning eyes. Exposure of the skin to large amounts of phenol can cause skin burns, liver damage, dark urine, irregular heartbeat, and in rare cases death. Ingestion of high concentrations of phenol can result in internal burns and death.

The International Agency for Research on Cancer (IARC) and the Environmental Protection Agency (EPA) have determined that phenol is not classifiable as to its carcinogenicity to humans.



APPENDIX B: Guidance for Pregnant or Nursing Mothers

Scientists have made many attempts to study whether formaldehyde might impact pregnancy or the reproductive system. The results have been mixed and complicated. Studies clearly show that formaldehyde does not cause birth defects. There is some uncertainty whether formaldehyde might cause spontaneous abortions and sperm damage. However, exposures in most workplaces at the university probably do not pose any significant risk to pregnancy or the reproductive system.

For nursing mothers, the most likely mechanisms of exposure for the infant would be absorbed or ingested doses; however, this does not rule out inhalation hazards. As such, exposure to contaminated materials, such as clothing, is the most immediate exposure risk for the baby – there is little evidence regarding formaldehyde exposures and infant health related to breast milk exposures. Formaldehyde does not present an obvious toxicity via this route [formalin is not 1) neutral and does not necessarily 2) collect in fatty tissue – which presents higher risk for transfer or residual within the mother post exposure, respectively]. The main concern via any of these routes of exposure is the potential for formaldehyde to cause allergic reactions in the baby, since formaldehyde can be a sensitizer. Therefore, removing contaminated clothing upon exiting formaldehyde areas and following the aforementioned work practices (practicing good hand hygiene, showering where applicable, etc.) before picking up the baby is recommended. Contaminated clothing that is transported home for laundering should be placed in a sealed bag for transfer to laundry room, as normal laundering procedures are okay. Similarly, implementing the work practices above and using PPE can help minimize the mother's exposure and reduce any other possible routes of exposure for the baby.

Additional information on general chemical exposures can be found in the [Reproductive Health Hazards](#) document.



APPENDIX C: Formaldehyde Signage



FORMALDEHYDE

MAY CAUSE CANCER

CAUSES SKIN, EYE, AND RESPIRATORY IRRITATION

AUTHORIZED PERSONNEL ONLY

Flammable vapor concentrations possible.

*PPE may be recommended or required depending on the task being performed.
For additional information contact EHS (303-724-0345).*