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ENGINEERING CONTROLS OPERATION AND MAINTENANCE MANAGEMENT PROGRAM

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LIST OF ABBREVIATIONS AND ACRONYMS

AHU	air handling unit
AIHA	American Industrial Hygiene Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
CAV	constant air volume
CFH	chemical fume hoods
cfm	cubic feet per minute
EC	engineering control
EH&E	Environmental Health & Engineering, Inc.
EH&S	Environmental Health and Safety
fpm	feet per minute
HVAC	heating, ventilating, and air-conditioning
O&M	operation and maintenance
Phoenix	Phoenix Control System
Program	Management Program
Wellesley	Wellesley College
VAV	variable air volume

1.0 INTRODUCTION

An engineering control (EC) eliminates or reduces exposure to a hazardous material or physical hazard through the use or substitution of engineered machinery or equipment. The use of proper ECs is necessary to prevent exposure to hazardous materials generated in the laboratory setting. In order to ensure that the ECs are working properly, this Engineering Controls Operation and Maintenance (O&M) Management Program (Program) has been developed for Wellesley College (Wellesley).

The purpose of this document is to provide guidelines to the departments of Wellesley when conducting O&M activities associated with the ECs located throughout the laboratories at Wellesley.

ECs are placed at the point of the hazard generation, along the path of the hazard, and/or at the worker's location. The following ECs are being used at Wellesley:

- Bench Ventilation for Dissections
- Biological Safety Cabinets
- Canopy Hoods
- Constant Air Volume (CAV) Chemical Fume Hoods (CFH)
- Variable Air Volume (VAV) CFH
- Fume Exhaust Connections

This Program doesn't include biological safety cabinets since O&M is handled by an outside subcontractor.

2.0 RSIK IDENIFICATION

When working on ECs, it is important to understand the potential risks associated with the work. This section will identify the risks associated with conducting O&M activities on an EC. Depending on the hazard(s), the risk will vary from EC to EC.

NOTE: If there is a potential hazard or a person is unsure about the hazards when conducting O&M work associated with an EC, the Facilities Department will notify the Wellesley Environmental Health & Safety (EH&S) Office and a hazard assessment will be performed by the Wellesley EH&S Office.

2.1 ELECTRICAL, MECHANICAL, AND PHYSICAL HAZARDS

The following are the potential hazards associated with the work when conducting O&M activities on an EC. The examples do not include all of the hazards.

- Electrical hazards (e.g., frayed wires, improper wiring).
- Mechanical hazards (e.g., pinch points, unguarded parts, moving parts, plumbing).
- Physical hazards (e.g., noise, cuts, confined space).

2.2 HAZARDOUS MATERIALS

In a laboratory setting, a person not only has to think about the electrical, mechanical, and physical hazards associated with an EC but the hazards associated with hazardous materials, which were used within the EC. Personnel working in a laboratory setting at Wellesley may be working with the following hazardous materials in an EC:

- Biological Materials
- Hazardous Chemicals
- Radioactive Materials

As a result, it is important that the laboratory staff associated with the EC is notified of the O&M schedule prior to conducting O&M work on an EC. The laboratory staff will be responsible for ensuring that the experiments being performed in the applicable EC(s) are shut down, the working areas associated with the EC has been properly cleaned, and that there is no potential for exposure to hazardous materials while conducting the O&M work. Refer to Appendix A for the checklist to ensure that laboratory staff is properly cleaning and shutting down ECs prior to having the Facilities Department (Facilities) working on them.

2.3 Rooftop Operations

When conducting O&M activities on ECs, there may be risks associated with the duct work and exhaust outlets, which are located on rooftops. These risks may include the following. This list is not inclusive.

- Exposure to a hazardous material because someone uses the EC while O&M activities are being performed on an EC.
- A fall hazard when working on the roof top due to work height or instability of roof material.
- Exposure to extreme weather.
- Slip, trip, and fall hazards associated with walking on a rooftop.

Wellesley EH&S Office has prepared the following programs to address these risks:

- Fall Protection Program.
- Extreme Weather Policy.
- Slip, Trip, and Fall Policy.
- EC Lockout/Tagout (refer to Section 3.2)

Please refer to these program or policies for details on how to eliminate or address these risks.

3.0 RESPONSIBITIES

A key component of an O&M Program is that the departments associated with the Program are aware of their responsibilities associated with the Program. These responsibilities are outlined below.

3.1 LABORATORY STAFF

The laboratory staff is responsible for maintaining a clean working surface within the EC and ensuring there are no open containers left unattended in the EC prior to the Facilities Department conducting O&M activities. All laboratory experiments in the EC must be overseen by laboratory staff. Once an experiment is completed, laboratory staff will use the appropriate cleaner, disinfectant, or other material to clean the EC so there is no potential exposure to hazardous materials used in the experiment.

When working in a CFH, laboratory staff should adhere to the CFH Safe Work Practices outlined in Section 4.3.3 of this document. This will help ensure that the CFH is providing the appropriate protection when working with hazardous materials within the CFH.

When O&M work is required for an EC, the laboratory staff will be required to fill out paperwork stating that the EC is prepared for O&M work. Refer to Appendix A for a form to ensure that ECs are properly cleaned by laboratory staff.

In addition, if the laboratory staff becomes aware of any problems or alarms associated with the EC, they must shut down the EC (in the case of a CFH, close the sash window) then post a sign on the EC indicating that the EC is not working properly and cannot be used until Facilities has signed off that the EC has been fixed and is operable. Then, the laboratory staff will notify Facilities immediately and request an evaluation using Wellesley's work order system. The laboratory staff will not operate the EC until Facilities has indicated that the EC is operable. Appendix B provides a sign to be posted on ECs for this procedure.

3.2 FACILITIES

Facilities will ensure the ventilation system, including ductwork, fans, baffles, and other components associated with ECs are in proper working order. In addition, any repairs that may need to be made will be conducted in a timely manner.

Facilities will not conduct any work on an EC until the proper paperwork has been completed by the laboratory staff to ensure no hazards are present in the EC. See Appendix A.

Prior to working on an EC, Facilities personnel will ensure that the following programs are implemented prior to conducting the work, if applicable:

- Confined Space
- Electrical Safety
- Lockout/Tag Out
- Hot Work Permit

Please refer to the individual programs for details on the implementation.

If a member of Facilities is unsure about the hazards or how to avoid the hazards when conducting O&M activities, (s)he will notify the Wellesley EH&S Office prior to conducting the O&M activities.

Once the O&M activities are completed, Facility personnel will sign the appropriate paperwork and notify laboratory personnel that the EC has been repaired and that they are able to conduct work in the EC. Refer to Appendix B.

3.3 ENVIRONMENTAL HEALTH AND SAFETY

The EH&S Office will ensure that ECs are certified annually. Certifications will be conducted in accordance with the America Industrial Hygiene Association (AIHA) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard recommendations. Testing requirements will be outlined under Maintenance in this document (Section 5).

In addition, the Wellesley EH&S Office will perform hazard assessments if requested by Facilities to ensure they are not exposed to any hazards during O&M activities.

Lastly, the Wellesley EH&S Office will provide guidance to the laboratory staff on how to properly clean, disinfect, or remove hazardous materials used with an EC.

4.0 OPERATION

To identify which ECs are present in a laboratory at Wellesley, below are brief descriptions of how each EC is used at Wellesley.

4.1 Bench Ventilation Enclosures for Dissections

Bench ventilation for dissections consists of Plexiglas® bins with slotted backs to direct exhaust airflow away from the users. The inlet velocity of these enclosures is 60 feet per minute (fpm) to provide capture of emissions associated with dissection work.

4.2 CANOPY HOODS

Canopy hoods are horizontal enclosures having an open central duct suspended above a work bench or other area. Canopy hoods are most often used to exhaust areas that are too large to be enclosed within a fume hood. The major disadvantage with the canopy hood is that the contaminants are drawn directly past the user's breathing zone. Exhaust velocities for canopy hoods range from 500 to 2,000 fpm and the air intake should not be located more than 12 inches from the generation source. The effectiveness of the canopy hood is dependent directly upon the proximity of the work area to the hood face.

A canopy hood system typically consists of the hood, an exhaust fan, and a controller. Using these components, a designated velocity is chosen for the canopy hood. Once the designated velocity is chosen, the velocity will be recorded in a database.

Canopy hood systems should not be used when working with flammable or corrosive materials unless the system is specifically designed to work with these materials.

4.3 CHEMICAL FUME HOOD

Laboratory fume hoods minimize chemical exposure to laboratory workers. They are considered the primary means of protection from inhalation of hazardous vapors, mists and particulate matter. It is, therefore, important that all potentially harmful chemical work be conducted inside a properly functioning fume hood.

A fume hood structure comprises a cabinet, with an open side (or sides) for access to the interior of the hood. A transparent, movable sash, allows the user to restrict or enlarge the fume hood opening. The hood is connected, via ductwork, to an exhaust fan, usually located on the roof of the building in which the hood is located. The exhaust fan draws air from the room through the fume hood opening via connecting ductwork. A fume hood is an integral part of the building air handling system.

The face velocities for CFH should be chosen based on the following factors:

- Hazardous materials being used in the CFH.
- Protecting the user from exposure to hazardous materials.
- The CFH meets the requirements of applicable standards. Refer Section 4.6 for details.

Typically, CFH are adjusted to maintain a 100 fpm face velocity. Once the face velocity is determined, the face velocity is maintained in a database.

The following sections outline the operations of the various ECs being used at Wellesley relative to chemical fume hoods.

4.3.1 Constant Air Volume CFH

4.3.1.1 Principle

Because the amount of exhausted air is constant, the face velocity of a constant air volume (CAV) hood is inversely proportional to the sash height. That is, the lower the sash, the higher the face velocity. CAV hoods can be installed with or without a bypass provision which is an additional opening for air supply into the hood.

4.3.1.2 CAV Hoods without Bypass

Some conventional hoods do not have a provision for a bypass. Essentially, they consist of an enclosed cabinet with a connection for an exhaust duct and a movable sash on the front. A sash stop or sash sticker will designate the appropriate location of the sash to ensure optimum operation and prevent the sash being opened all the way resulting in insufficient face velocities.

4.3.1.3 CAV Hoods with Bypass

The bypass fume hood is an improved variation on the conventional fume hood. The bypass is located above the sash face opening and protected by a grille which helps to direct air flow. The bypass is intended to address the varying face velocities that create air turbulence leading to air spillage. The bypass limits the increase in face velocity as the sash nears the fully closed position, maintaining a relatively constant volume of exhaust air regardless of sash position.

4.3.2 Variable Air Volume CFH

4.3.2.1 Principle

Variable air volume (VAV) hoods differ from CAV hoods because of their ability to vary air volume exhausted through the hood depending on the hood sash position. VAV hoods reduce the total quantity of supply and exhaust air to a space when not needed, thereby reducing total operating costs.

4.3.2.2 VAV CFH

A VAV chemical fume hood maintains a constant face velocity regardless of sash position. To ensure accurate control of the average face velocity, VAV hoods incorporate a closed loop control system. The system continuously measures and adjusts the amount of air being exhausted to maintain the required average face velocity. The addition of the VAV fume hood control system significantly increases the hood’s ability to protect against exposure to chemical vapors or other contaminants. Many VAV hoods are also equipped with visual and audible alarms and gauges to notify the laboratory worker of hood malfunction or insufficient face velocity.

4.3.3 Safe Work Practices

Properly functioning fume hoods help eliminate the hazards of chemical vapors and other harmful airborne substances. It is important to remember that a fume hood is not a storage area. Keeping equipment and hazardous materials unnecessarily in the hood may cause airflow blockage. The following are some work practices recommended to ensure the proper function of a CFH.

Conventional Hoods

Each employee is expected to promote safety in the workplace and practice safe work procedures. Fume hood users should be able to answer the following questions before using a fume hood:

1. *Is the hood certified*? Check the certification card on the front panel of each hood.
2. *Is the face velocity adequate*? Check the certification card posted on the face of the fume hood for the most recent evaluation data. If an airflow alarm is installed, check for alarm light. Check to see that the audible alarm has not been disabled. Do not rely on noise from the fume hood to indicate proper operation (blower motor noise may persist even if a fan belt breaks).
3. *Is the work six inches back from the sash*? Setting work back six inches from the plane of the sash reduces influence of drafts from people, doors, air supply diffusers, etc.
4. *Is housekeeping well*? Materials (supplies, equipment, etc.) in the fume hood typically reduce hood efficiency. Therefore, it is prudent to remove all materials not required for the task at hand.
5. *Does the sash slide easily*? The fume hood safety-glass sash protects the user in case of fire or explosion as well as from fumes during routine operations. A sash that is difficult to move will not likely be set at optimal working heights.
6. *Is the sash at the proper height*? The fume hood sash should be kept at or below the level indicated on the inspection sticker. If your hood does not have this sticker, please call EH&S. Sash openings of less than 12 inches may cause undesirable drafts in the fume hood.

7. *What do I do if a fire occurs in my hood*? Be certain you know where your fire extinguishing equipment is located and that it is appropriate for the materials being used. Dial 911 if you are not confident that you can safely extinguish a fire. Contact the EH&S Office for additional information.

8. *Is the fume hood baffle properly set*? Some fume hoods have multiple baffle settings. Under most conditions, your fume hood will be most effective set in the "average" or "heavier than air" positions. The "lighter than air" setting should be used only for hot operations or when fumes are known to be less dense than air.

Other prudent practices relating to laboratory fume hood usage are listed below. All personnel should review the following prior to fume hood use:

- Do not put your head in the hood when contaminants are being generated.
- Hoods should not be routinely used as a waste disposal mechanism for volatile materials (evaporation is prohibited). If a flammable storage cabinet is not available, the hood may be used to store volatile waste waiting to be picked up by EH&S. The volatile waste must be in proper containers, closed and have proper labeling.
- Do not store chemicals or apparatus in the hood. Store hazardous chemicals in an approved safety cabinet.
- Place any heat generating equipment in the rear of the hood to minimize the effect of convection currents on the airflow in the hood.
- Keep the slots in the hood baffle free of obstruction by apparatus or containers.
- Place large apparatus to the rear of the hood and raise it off the surface with two to three inch blocks to allow airflow under the object and into the lower rear baffle.
- Minimize foot traffic past the face of the hood.
- Keep laboratory doors and windows closed.
- Do not position fans or air conditioners in a manner that will direct airflow across the face of the hood and interfere with containment.
- Do not block air supply vents or exhausts in the room.
- Do not remove the hood sash or panels except when necessary for apparatus setup. Replace sash or panels before operating.

- Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood unless approved by the manufacturer.

Perchloric Acid Hoods

In addition to the prudent practices for standard fume hoods, the following additional procedures should be implemented when using perchloric acid:

1. Use perchloric acid only in perchloric acid hoods. Perchloric acid salts are unstable and may explode with impact. Primarily for this reason, perchloric acid may not be used in standard fume hoods, which lack automatic wash down systems. Any exceptions to this should be approved by EH&S.

2. Use perchloric acid hoods exclusively for perchlorate work. Never use organic materials in a hood designed specifically for perchloric acid. Perchlorates are considered to be fire and explosive hazards when associated with carbonaceous material or finely divided metals. They react violently with benzene, charcoal, olefins, ethanol, sulfuric acid and reducing materials. If perchlorates have accumulated in the perchloric acid fume hood, use of organics may create fire and explosion hazards.

3. Use the perchloric acid hood water wash down regularly, preferably after each use. Inspect hood for any salts that may accumulate (even where automatic wash down is employed). Remove deposits with water.

4. Do not leave unnecessary organic materials in hood. Fires and explosions may occur when perchloric acid contacts rags, sawdust, alcohol, cellulose, etc.

5. Be particularly cautious when using perchloric acid with strong dehydrating agents, for example, acetic anhydride or sulfuric acid. Under some conditions, particularly when using hot, concentrated materials, these agents may form dangerously explosive anhydrous perchloric acid.

6. Apparatus used in perchloric hoods should be free of organic coatings and lubricants.

7. Spark producing apparatus (including electrical outlets) should not be used inside a perchloric acid hood.

8. Before maintenance on hood baffle, duct, fan, or other hood system components, have EH&S check for presence of perchlorates.
9. Perchlorate hoods, ductwork and fans should be labeled with caution labels.
10. Use no more perchloric acid than necessary.

Radioisotope Hoods

Along with the work practices for standard fume hoods, the following additional procedures should be implemented when using radioisotope hoods:

1. Use radioisotopes only in hoods designed for that purpose. The Wellesley EH&S Office recommends radioisotope hoods have stainless steel interior surfaces.
2. Label hood, ductwork and fan with radiation caution labels available through Wellesley EH&S Office.

4.4 FUME EXHAUST CONNECTIONS

Fume exhaust duct connections, commonly called snorkels, elephant trunks or flex ducts, are designed to be somewhat mobile allowing the user to place it over small area needing ventilation. However for optimal efficiency, these connections must be placed within six (6) inches of an experiment, process, or equipment. These funnel-shaped exhausts aid in the removal of contaminated or irritating air from a point source to the outside.

The following components are associated with these ECs:

- Arm
- Exhaust fan
- Manual damper
- Manifold exhaust system

4.5 PHOENIX CONTROL SYSTEM

The Phoenix Control System (Phoenix) for Fume Hood Monitors control and signify the operation of the fume hood exhaust systems. Each monitor provides a signal displaying airflow to a Phoenix valve or drive and a constant face velocity is maintained by adjusting the exhaust airflow as the sash position changes. In addition, the Phoenix Controls provide a continuous display of normal versus alarm hood condition by the use of green or red light emitting diode (LED) lights, there are also audible alarms. Below are descriptions on how the supply and exhaust are managed by Phoenix:

4.5.1 Exhaust Air

Laboratory exhaust fans draw air through the Phoenix control valves that are connected to the fume hoods, and the general laboratory exhaust. The Phoenix control valves modulate to maintain the design exhaust airflow in each space as dictated by the fume hood sash height.

4.5.2 Supply Air

An air handling unit (AHU) provides 100 percent outside air for service to the building's laboratory spaces. No air is recirculated in the laboratory supply system. The AHU supply fan varies its speed to maintain static pressure in the supply air duct. Supply air flow from the AHU may vary based on the position of the laboratory supply air valves. These valves are typically controlled to maintain an air flow offset from the laboratory exhaust air valve. The supply and exhaust air flow valves are representative of many throughout the building.

4.6 APPLICABLE STANDARDS

4.6.1 ASHRAE

ASHRAE has developed a testing standard to determine the performance of laboratory fume hoods. This standard defines a method of testing laboratory fume hoods that is reproducible; the standard also addresses cross-drafts, work procedures, internal obstructions, the hazards involved with procedures being performed, thermal challenges and the rate of response for VAV fume hoods. There are many factors that should be considered when testing fume hoods and ASHRAE begins to consider these many factors when evaluating the safety value of a fume hood.

4.6.2 AIHA

The AIHA has also developed a standard for a comprehensive set of guidelines for laboratory ventilation, including CFHs. While the standard does set forth some exact requirements, it is intended to be used as guidance for users to develop their own testing methods.

As a result, this O&M Program has been developed largely based on the recommendations set forth in both the ASRHAE and ANSI standards.

5.0 MAINTENANCE

In order to ensure proper function of the ECs, Facilities is expected to perform scheduled and preventive maintenance on all aspects of the ventilation system that tie into the ECs. The sections below outline the recommendations for scheduled and preventive maintenance for each EC.

5.1 BENCH VENTILATION ENCLOSURES FOR DISSECTIONS

On an annual basis, Facilities or a subcontractor will test the bench ventilation enclosure for dissection to determine whether or not a 60 fpm face velocity is maintained. Results will be recorded using a form. Refer Appendix C for an example of the form.

If results of the testing indicate that 60 fpm is not obtainable, then Facilities will inspect the ductwork and fans associated with the EC to ensure that they are working appropriately. Appendix D provides a checklist for inspecting these components.

5.2 CANOPY HOODS

On an annual basis, Facilities or a subcontractor will test the canopy hoods to evaluate whether or not the designated velocity is being maintained at the hood. Results will be recorded using a form. Appendix C provides an example of the form.

If results of the testing indicate that the designated velocity is not obtainable, then Facilities will inspect the ductwork and fans associated with the EC to ensure that they are working appropriately. Refer to Appendix D for a checklist for this inspection.

5.3 CHEMICAL FUME HOODS

5.3.1 Certification Process

Upon installation and annually thereafter, the CFHs located at Wellesley will be certified by Facilities or a subcontractor to ensure proper operation. The following paragraphs outline the procedures to conduct these tests:

- The face of the CFH should be divided into equal sized imaginary grids no greater than one foot square and velocity measurements should be taken with a calibrated anemometer fixed at the center of each grid space. The anemometer should be held perpendicular to the opening.
- Per ANSI/AIHA Z9.5, it is recommended to keep an inflow velocity of 80-120 feet per minute (fpm). Velocity shall not be below 80 fpm or exceed 120 fpm with the sash at 18 inches.
- A sash height of approximately 18 inches is also recommended as this is approximately 2 inches below the average breathing zone. This may vary if the manufacturer requires a different height for proper operation.

Testing of the CFH should be conducted with room ventilation in full normal operation and at the recommended sash height following the steps below:

- In accordance with ANSI/ASHRAE 110-1995 *Method of Testing Laboratory Fume Hoods* face velocity should be measured with an anemometer capable of measuring with an accuracy of 5+/-% in the range of 50-400 fpm. Face velocities should be verified by averaging at least one velocity reading per square foot with a minimum of six readings. Airflow volume should be determined by measuring the velocity of air entering the hood face and multiplying this number by the square feet of the sash opening.
- The sash opening should be checked for performance by raising and lowering the sash to ensure that it glides smoothly and holds at any height without slipping.

Smoke testing shall be conducted using a bottle containing an ampoule of titanium tetrachloride or similar smoke, taking care to follow safety recommendations for that particular type of smoke.

- Make a complete traverse of the hood with the smoke source to demonstrate a positive flow of air into the hood over the entire face of the hood. No dead air spaces or reverse air flows shall be permitted.
- Smoke shall be discharged along each end and across the surface of the hood face and 6 inches inside to demonstrate that no backflow of air exists at these points.

- The operation of the air foil should be tested by running the smoke source under the air foil. Smoke should be exhausted smoothly and not be trapped in the vortex at the top of the hood.
- Smoke shall be discharged in an 8-inch diameter circle in the back of the hood to determine if there are any dead air spaces. All smoke should be carried to the back of the hood and exhausted.

All tests conducted should be documented using Appendix C and a certification shall be placed on the CFH including the following information:

- Date Inspected, Inspector’s initials, average face velocity (fpm), volume (cfm), certification expirations, CFH ID and serial number. Appendix E provides an example of this sticker.
- In addition, this information will be maintained in a database.

5.3.2 Preventive Maintenance

On an annual basis, Facilities will conduct inspections of the equipment associated with the CFHs. During these inspections, proper operation of the equipment is checked and verified. All mechanical equipment is designed to operate within certain limits.

This includes but not limited to checking baffles for proper operation, checking the exhaust monitors and alarms for proper operations, and inspections of the sash pulleys and cables to determine ease of movement.

Appendix F provides a checklist to be completed for each CFH.

5.4 Fume Exhaust Connections

To ensure the fume exhaust connections are working properly, Facilities will conduct an annual evaluation to document proper operation of components.

Refer to Appendix G for a checklist to be completed for the annual evaluation of each fume hood exhaust connection and a checklist for preventive maintenance activities for these ECs.

5.5 BREAKDOWN/RESPONSIVE

In the event that an EC is not working properly, use of that EC must be halted immediately. Follow these steps:

- Shut down the EC.
- Seal or close containers of hazardous materials located near or within the EC.
- Remove containers of hazardous materials from the area or within the EC.
- Clean the working surface underneath or within the EC using a proper cleaner, disinfectant, or other material. Contact the Wellesley EH&S Office if you are unsure which cleaner, disinfectant, or other material to use to clean the working area.
- Notify the Facilities that there is an issue with an EC via the Wellesley work order system. Please provide the following information:

Building
Room
Location
EC Identification Number
Issue with EC
Your Name
Your Department
Your Contact Information (phone number and email)

- Post a sign on the EC throughout the time period that the EC is inoperable indicating it should not be used. Appendix B provides a sign to be posted on ECs.

Repairs should be made promptly to ensure restoration of adequate laboratory ventilation.

5.6 Emergency

In the event of an emergency, conduct the following steps outlined in Section 5.3 if they can be done is a safe manner. If the area is deemed unsafe, then evacuate and follow the Wellesley Emergency Response Procedures. Refer to Wellesley's Emergency Response Procedures for details.

6.0 Contacts/References

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APPENDIX A

PRE–MAINTENANCE CHECKLIST FOR LABORATORY PERSONNEL

APPENDIX B

MAINTENANCE SIGNAGE

APPENDIX C

ENGINEERING CONTROL EVALUATION FORM

APPENDIX D

COMPONENT INSPECTION CHECKLIST FOR ENGINEERING CONTROLS

APPENDIX E

CERTIFICATION STICKER

APPENDIX F

CHEMICAL FUME HOOD INSPECTION CHECKLIST

APPENDIX G

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