MSE General Laboratory Facilities – Standard Practices for Work

All laboratory users, whether employees or students, should be familiar with all sections of the Virginia Tech university chemical hygiene plan [CHP] relevant to their work. Copies of the CHP are posted in each laboratory room, and are also available online at http://www.ehss.vt.edu/programs/HCM_program_online.php.

In addition to the information conveyed in the CHP, which applies to all university facilities, ***MSE departmental laboratory users should be especially aware of the following policies and practices that relate to their work. NOTE that this document is not intended to be a comprehensive listing of all work rules, but only an overview of some main issues.*** Failure to adhere to appropriate work practices, as partially enumerated here, may result in suspension or revocation of laboratory use privileges. Any questions should be referred to the Laboratory Manager, Prof. Tom Staley (tstaley@vt.edu).

Laboratory Access

• Currently, access to departmental facilities is managed by formally approved use of access codes available to faculty and graduate students only. Codes are available only to personnel who have filled out MSE Access forms attesting to their training in safety and emergency procedures. These forms are available on the MSE Facilities webpage under MSE Lab Access Requirements.

• Undergraduate students may work in the laboratories only under supervision and are not allowed independent knowledge of codes.

• Approved users must NOT SHARE access codes with anyone else, or allow anyone else into the labs with the code unless they are under their direct supervision. Such action can lead to revocation of access privileges.

User Training for Specific Equipment

• No one should use equipment on which they have not been appropriately trained. For some simpler items (*e.g.*, polishers, mounting presses, hardness testers, *etc.*), this may be accomplished by following an already trained user through the procedures on the device. Formal training on more sophisticated devices (such as X-ray diffractometers, analytical microscopes, rheometers, or thermal analysis instruments) is also available through the MSE department. Explicit use instructions may also be available in the laboratory or online for some equipment. If in doubt about proper procedures or set up of any equipment, users should contact the laboratory manager or other supervisory personnel.

Sign Up Procedures for Restricted Use Equipment

• Use of certain high-demand and complex instrumentation, including the departmental X-ray diffractometer, dilatometers, and 3D printer, must be scheduled using an online system (FACES) managed by departmental personnel. Access to this equipment and the registration system requires formal training and approval. Please contact the laboratory manager or other supervisory personnel if you require use of this equipment.

• Currently, use of thermal analysis and rheology instruments in our Polymer Analysis laboratory is scheduled directly through the laboratory manager by advance email request and is subject to prior formal training. Please contact the laboratory manager if you require use of this equipment.

Equipment Use Logs

• Effective immediately, any use or maintenance of powered equipment in departmental facilities must be documented in writing by filling out the Log Sheet provided in each laboratory.

• In most laboratories, a single log sheet is used for all equipment in that location. The main exception is the furnace room (150 Randolph), in which multiple log sheets are posted for each piece of major equipment and an additional log sheet is used for the remaining portable units.

• Users must sign in with a brief description of their process (including any relevant operating conditions for programmable units and any use of consumable supplies) at the beginning of work and sign out – noting the final condition of the equipment – when their activity is complete. Failure to document activity may result in suspension or revocation of access privileges.

Experimental Protocol Form for Synthesis & Other Chemical Processing Work

• All experimental work intended, or otherwise expected, to result in significant chemical changes to the materials involved must be preapproved by submission of an experimental protocol ("Laboratory Use Approval") form available on the MSE Facilities webpage.

• This includes any **synthesis or other chemical or thermal processes** that may involve generation of new chemical species, evolution of solvents or other vapors, combustion of reactants, or significant unknown changes to the state or composition of the materials involved, as well as processes involving strong acids or bases, flammables, or other especially aggressive chemical components.

Set Up & Supplies for Laboratory Equipment

• Equipment should only be used when set up appropriately for the specific process involved. Use of malfunctioning, poorly maintained, improperly set, or inappropriate equipment is a violation of laboratory policy and may result in suspension or revocation of laboratory access privileges.

• Some pieces of equipment in the MSE facilities (for example, cutoff saws and some analytical instrumentation) require a variety of specialized accessory components specific to particular processes. Such equipment should only be used after the user is certain the device is appropriately configured for the process.

• The MSE department maintains a limited stock of supplies for general use of equipment. Extensive use of departmental equipment for purposes beyond teaching and training is not supported and consumable supplies for such purposes must be supplied by the users themselves.

Thermal Hazards: Hot & Cold Equipment

• Many pieces of equipment in the MSE facilities operate under hot or cold conditions that may be hazardous to human contact or proximity. These include furnaces, hot presses, cryogenic containment or cooling systems, and other instruments and devices that operate at elevated or reduced temperature.

• Appropriate protective equipment – including hot or cold gloves, aprons, face shields, durable footwear, *etc.* – must be used or worn at all times when working with components or equipment that may present thermal hazards.

• In addition, contact with hot or cold equipment should be avoided by use of appropriate tools (tongs, forceps, *etc*.) when moving specimens or actively controlling experiments, and proper physical arrangement of work stations to avoid tipping or other uncontrolled movement of hot or cold substances *in situ*.

• Very high temperature processes such as ceramic firing and glass processing may emit UV radiation that can damage eyesight. Use of appropriate eye protective glasses is required when conducting such processes.

• Some equipment includes components (such as halogen lighting systems in microscopes, platens or radiators in presses, or cold control flanges in analytical instruments) that may present **non-obvious thermal hazards**, either by direct contact or as a fire source if they are put into proximity with flammable materials. Researchers should always be conscious of possible dangers presented by hot or cold components of equipment systems, even if the primary purpose of the device is not to heat or cool.

Chemical Hazards

• The possible chemical hazards that may be presented to researchers in MSE facilities are too numerous and unpredictable to itemize. Researchers are responsible for developing – and disseminating to others as appropriate --- specific knowledge about the dangers of any chemical they work directly with, using resources such as the university Chemical Hygiene Plan & posted Materials Safety Data Sheets [MSDS's] to assist them. ***Updated MSDS books listing all chemicals that are typically present are provided in each laboratory.***

• Hazardous chemicals may not be left out in MSE departmental laboratories when not in use. Acid and flammables storage cabinets are available in 122 Holden, and limited quantities of other materials can be stored by individual arrangement in the 123 Holden chemical storeroom. Otherwise, researchers are expected to remove all materials to their own facilities when done with their experimentation.

• Some specific hazards to be conscious of during experimental work include inhalation of volatile substances & particulates; contact with acids, bases, or other strong reagents; flammability of solvents & other substances; & long-term exposure risks for materials with carcinogenic, mutagenic, or radioactive characteristics.

• Appropriate protective equipment – including gloves, facemasks, laboratory coats, and other items – should be worn at all times as dictated by the process being conducted.

• In addition, some personnel may need to be aware of individual sensitivities and allergies that may be presented by some common laboratory substances. Researchers are advised to be conscious of their own health requirements at all times, & to advise MSE supervisory personnel of any specific issues they may expect.

Mechanical Hazards

• Many pieces of equipment in the MSE facilities present mechanical hazards from moving parts, pinch points, high pressures or loads, sharp components, *etc.* Users of equipment are advised to be conscious of such hazards at all times, to wear appropriate protective gear as appropriate, and never to disengage or circumvent protective systems (such as saw enclosures) when using mechanical equipment.

• Pressure vessels (gas cylinders, *etc.*) present special hazards ranging from asphyxiation to physical trauma if valves or containers are damaged. Pressure vessels must always be secured in place in use, and capped and secured when being moved, to avoid such risks.

Electrical Hazards

• Many pieces of equipment in the MSE facilities operate under conditions of high voltage or high current that may be hazardous to direct contact. Researchers are advised never to open electrical systems or touch exposed wiring, and to avoid areas that may have become wet in proximity to electrical equipment.

Radiation Hazards: X-Ray Diffraction Equipment

• The X-ray diffractometers housed in 124 Holden generate significant levels of radiation that can be both acutely and chronically hazardous to health. Users of this equipment must have training in Radiation Safety prior to approval, and must avoid contact with areas inside the units that may present direct radiation hazards. Protective systems to contain radiation must never be circumvented and any malfunction of these systems should be reported immediately to supervisory personnel.

Gas Lines

• Some MSE facilities include gas lines connected to equipment from either gas cylinders or built-in pneumatic supplies. These lines should never be tampered with, and valves should be shut off at all times when equipment is not in active use, except as explicitly noted on particular devices requiring constant gas flow. Any leaks noted should be reported to supervisory personnel immediately. Gas flows into the environment from devices such as enclosed furnaces must be properly vented into hood spaces or other outlets.

Waste Disposal

• Chemical waste must always be disposed of appropriately according to procedures established on the MSDS for the substance in question. Improper disposal of waste down drains or in general trash may result in suspension or revocation of laboratory access privileges.

• Containers for common waste categories such as inorganic and organic acids, organic solvents, and alkaline/basic fluids are maintained by the MSE department in 122 Holden (Sample Prep Laboratory). Users should always note on the container what has been added, and should never mix wastes inappropriately. Acid and base containers should never be located together. Supervisory personnel should be notified when waste containers are full, for scheduling of disposal with EHSS.

Water Supplies to Equipment

• Many pieces of equipment (polishers, saws presses, diffractometer, *etc.*) in the MSE facilities include water supplies and outlets from either plumbing systems or individual sump units. ***With the exception of systems required for continuous safe operation (such as cooling pumps to x-ray units),*** water flow should always be turned off when not in use to avoid accidental flooding (which can also result in electrocution hazards). Any leaks, clogs, failures in pumping systems, or other maintenance issues, should be reported to supervisory personnel immediately.

Emergency Equipment

• All MSE lab facilities are equipped with standard ABC-class fire extinguishers and first-aid kits. Additional equipment including spill kits, an eyewash and safety shower, and a telephone (to call 911, if necessary) are located in 122 Holden. A second safety shower is located in the rear hallway of Holden Hall. A portable defibrillator is available in a wall box in the front main corridor of Holden.