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Public Safety and Compliance

Chemical Hygiene Technical Manual

For 5.24.2.4

Minnesota State

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The following individuals assisted in the development of this technical manual:

Chandler Holland, Safety Administrator
Al Breuer, Safety Administrator
Jon Hanson, Safety Administrator
Richard Marsolek, Safety Administrator
Amy Hruska, Safety Administrator

David Rauzi, Safety Administrator
Anne Butler Ricks, Faculty

Anita Mujumdar, OSHA Specialist
Ken Auer, Environmental Specialist

Mike Larson, Industrial Hygienist

System Safety Administrators

MSU, Mankato
MSU-Moorhead
Normandale Community College
Bemidji State University
Minneapolis Community and
Technical College
Northeast Higher Education District
Bemidji State University

System Office
System Office

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5.24.2.4 Chemical Hygiene Technical Manual

Part 1. Purpose

To establish a framework for chemical hygiene programs at system colleges and universities.

Part 2. Annual Review

The chemical hygiene program must be reviewed at a minimum at least annually and updated as necessary whenever changes in processes, chemicals, practices, policies, personnel or equipment is implemented. A Chemical Hygiene Plan (CHP) must be facility specific and assist in promoting a culture of safety to protect workers from exposure to hazardous chemicals. The plan must be written so that users clearly know how, by who, where, and when specific tasks will be accomplished. The annual review must be done by knowledgeable staff such as the chemical hygiene officer, campus safety administrator, science department administration, science faculty and lab techs/assistants. (Chemical Hygiene Committee) Updates in the CHP must be implemented in all affected laboratories.

Part 3. Regulatory Standard

Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1450, 'Occupational Exposure to Hazardous Chemicals in Laboratories' or Laboratory Standard. The standard's intent:

- Ensure that laboratory personnel are aware of the hazards of chemicals in their work area
- Appropriate work practices and procedures are implemented to protect laboratory personnel from chemical health and safety issues
- Safety and training programs are implemented to promote the safe handling of chemicals from ordering to disposal
- Foster basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities

Part 4. Responsibilities

Persons responsible for chemical hygiene include, but are not limited to, the following:

Subpart A. Upper Level Administration (President, Provost, Vice Presidents, etc.)

- Ultimate responsibility for chemical hygiene within the institution
- Provides the necessary staffing and resources for maintaining an effective Chemical Hygiene Program
- Supports a broad-based laboratory safety/chemical hygiene program
- Ensures that employees assigned laboratory safety responsibilities are provided adequate time and recognition to carry out their responsibilities
- Promotes the importance of safety in all laboratory activities



Subpart B. Facilities Director

- Primary responsibility of maintenance of the campus facility and laboratories
- Assist with the proper disposal of all hazardous waste generated as applicable

Subpart C. Dean of Sciences (If applicable otherwise the responsibility of upper level Administration)

- Assigns the Chemical Hygiene Officer (CHO) responsibilities to a qualified individual
- Ensures that the CHO has the authority to act to instruct/direct campus employees to implement the Chemical Hygiene Program
- Supports safety in laboratories and helps provide the resources as needed to ensure the faculty, staff and student safety
- Ensures timely actions are taken to address safety concerns in laboratories and protect personnel and facilities
- Ensures the Science Department remains in compliance with all applicable codes, regulations and system/institution safety policies
- Provides budgetary arrangement to ensure the health and safety of departmental personnel, students and visitors in the laboratories
- Assists the CHO in selecting qualified individuals to serve on the Chemical Hygiene Committee
- Ensures that employees assigned laboratory safety responsibilities are provided adequate time and recognition to carry out their responsibilities
- Ensures that adequate time and resources are provided for proper training of all laboratory users

Subpart D. Campus Safety Director/Administrator

- Coordinates with the Facilities Director, Dean of Sciences, CHO and Faculty in promoting safety throughout the facility and all laboratories
- Ensures that there is a written and implemented Chemical Hygiene Plan (CHP) for the facility
- Ensures the appointment of Chemical Hygiene Officer (CHO)
- Ensures that the CHP is reviewed annually and updates are made as needed
- Participates on the Chemical Hygiene Committee

Subpart E. Chemical Hygiene Officer (CHO)

- Ensures that the CHOs' Supervisor has given the necessary authority to act to instruct/direct the campus employees to implement the Chemical Hygiene Program
- Implements appropriate safety policies and procedures in accordance with the CHP
- Works with the Campus Safety Director, faculty and other employees to develop and implement appropriate chemical hygiene policies and procedures
- Monitors procurement, use, storage, and disposal of chemicals used in the lab
- Ensures all laboratory inspections (e.g. eyewash, etc.) are conducted and documented



- Ensures that inspection, personnel training, and inventory records are kept and located in a central location and available for regulatory inspection
- Assists laboratory supervisors in developing and maintaining adequate facilities
- Determines potential exposure to chemicals
- Seeks ways to improve the chemical hygiene program
- Ensures that chemical waste is managed properly
- Ensures that the SDS is available for all chemicals used in the laboratory

Subpart F. Department Chairperson (If applicable otherwise the responsibility of the CHO)

- Ensures that all work performed within their departments complies with applicable health and safety regulations
- Ensures personnel engaged in laboratory operations follow the standard operating procedures for laboratory safety
- Provides assistance to faculty and staff engaged in the laboratory use of hazardous chemicals
- Provides the CHO with the support necessary to implement and maintain the CHP
- Meets with laboratory supervisors to discuss laboratory inspection report, cited issues and to ensure timely actions to protect trained laboratory personnel and facilities

Subpart G. Campus Safety Committee and/or Chemical Hygiene Committee

- Reviews accident reports in timely manner and makes appropriate recommendations regarding proposed changes in the laboratory procedures
- Monitors and advises on policies, procedures, equipment and work practices to protect laboratory users from health hazards
- Conducts periodic laboratory inspections to identify any issues that may result in non-compliance with any applicable federal, state, system, campus or departmental rules or regulations

Subpart H. Faculty/Laboratory Supervisor

- Ensures that laboratory personnel comply with the CHP
- Ensures personal protective equipment (PPE) is available and meets the requirements of the chemical's Safety Data Sheet
- Follows all pertinent safety rules when working in the laboratory to set an example
- Collaborates with Safety Director, CHO and others to identify effective means to implement CHP in the laboratory
- Assumes responsibility for all students and visitors to ensure all provisions of the laboratory rules are followed
- Maintains and implements safe laboratory practices
- Monitors the facilities and the chemical fume hoods to ensure that they are maintained and function properly
- Conducts hazard analysis and reviews applicable Safety Data Sheets before assigning



- work activities to other laboratory personnel
- Ensures regular, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment

Subpart I. Laboratory Personnel/Users: includes faculty, staff, technicians, research associates and assistants, teaching assistants, graduate and undergraduate students.

- Reads, understands, and follows all safety rules and regulations that apply to the work area
- Plan and conduct each operation in accordance with the chemical hygiene safe lab practices
- Promote good personal housekeeping and chemical hygiene practices
- Notify the supervisor of any hazardous conditions or unsafe work practices in the work area
- Use PPE as appropriate for each lab operation that involves hazardous chemicals
- Complete all applicable annual safety training
- Be familiar with procedures of what to do in the event of an emergency situation
- Be familiar with how to access CHP and SDS

Part 5. Chemical Hygiene Plan (CHP)

The OSHA Laboratory Standard defines a CHP as “a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace.” (29 CFR 1910.1450(b)).

The Laboratory’s CHP must be readily available to all laboratory personnel. Ensure that employees know where and how to access the plan. Ensure that the plan is capable of protecting lab users from health hazards and minimizing exposure.

Include the following topics in the CHP:

- Individual chemical hygiene responsibilities
- Standard operating procedures
- Personal protective equipment, engineering controls and apparel
- Laboratory equipment
- Safety equipment
- Chemical management
- Housekeeping
- Emergency procedures for accidents and spills
- Chemical waste
- Training
- Safety rules and regulations
- Laboratory design and ventilation
- Exposure monitoring



- Compressed gas safety
- Medical consultation and examination

***The CHP only applies to hazardous chemicals. It should be noted that the nature of laboratory work may necessitate addressing biological safety, radiation safety, laser safety and security issues. These would be addressed in other plan documents.

Part 6. Chemical Procurement, Distribution and Storage

Subpart A. Chemical Procurement

The CHP must contain at a minimum the following:

- Information on proper handling, storage, and disposal must be known before a hazardous chemical is received
- Only containers with adequate identifying labels must be accepted
- Ideally, a central location should be used for receiving all chemical shipments
- Shipments with breakage or leakage must be refused
- Only the minimum amount of the chemical needed to perform the planned work should be ordered
- Hazardous chemicals must be reviewed and approved by CHO prior to purchase
- Proper protective equipment and handling and storage procedures must be in place before receiving a shipment

Subpart B. Chemical Storage

The CHP must contain at a minimum the following:

- Chemicals must be separated and stored according to hazard category and compatibility
- SDS and label information must be followed for storage requirements
- Maintain existing labels on incoming containers of chemicals and other materials
- Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings
- The contents of all secondary chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, in use longer than one lab session must be properly identified with the identity of the hazardous chemical and the hazards present
- Ensure the container lids or caps are secured and tightly closed
- Chemical shipments must be dated upon receipt and stock rotated
- Peroxide formers must be dated upon receipt, again dated upon opening, and stored away from heat and light with tightfitting, nonmetal lids. Once open they must be periodically tested for peroxides (i.e. peroxide test strips.)
- Open shelves used for chemical storage must be secured to the wall and contain 3/4-inch lips. Secondary containment devices must be used as necessary



- Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal
- Oxidizers, reducing agents, and fuels must be stored separately to prevent contact in the event of an accident
- Fume hoods should not be used for storage of chemicals, unless they are part of the experiment being conducted in the fume hood at that time. The exception is storage in a fume hood, which is specifically designed for that storage, and where experimental procedures are not carried out. Chemicals should not be stored on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight
- Hallways must not be used as storage areas for chemicals
- Laboratory-grade, flammable-rated refrigerators and freezers must be used to store sealed chemical containers of flammable liquids that require cool storage. These refrigerators and freezers must be labeled “Flammable Liquids Only” “Do not store food or beverages”
- Hazardous chemicals must be stored in a well-ventilated and secure area designated for that purpose
- Flammable chemicals must be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding must be used to prevent static charge buildups when dispensing solvents from large metal containers
- Chemical storage and handling rooms must be controlled-access areas. They must have proper ventilation, appropriate signage, diked floors, and fire suppression systems

Subpart C. Chemical Handling

The CHP must contain at a minimum the following:

- A risk assessment must be conducted prior to beginning work with any hazardous chemical for the first time. The assessment must be done by knowledgeable staff such as the chemical hygiene officer, campus safety administrator, science department administration, science faculty and lab techs/assistants. (Chemical Hygiene Committee)
- All SDS and label information must be read before using a chemical for the first time
- Trained laboratory users must ensure that proper engineering controls such as chemical fume hoods are working properly and PPE are in place. This assessment must be done by knowledgeable staff such as the chemical hygiene officer, campus safety administrator, science department administration, science faculty and lab techs/assistants. (Chemical Hygiene Committee)
- Inspect glassware for chips or cracks before using for chemical handling or storage
- A checkout process must be in place for hazardous chemicals



Subpart D. Chemical Inventory

The CHP must contain at a minimum the following:

- A qualitative chemical inventory must be done of all hazardous chemicals used

Subpart E. Transporting Chemicals

The CHP must contain at a minimum the following

- Secondary containment devices must be used when transporting chemicals
- Ensure the container lids or caps are secured and tightly closed
- High-traffic areas should be avoided while transporting chemicals

Subpart F. Transferring Chemicals

The CHP must contain at a minimum the following:

- Use adequate ventilation (such as a fume hood) when transferring even a small amount of a hazardous chemical
- While drum storage is not appropriate for laboratories, chemical stockrooms may purchase drum quantities of hazardous chemicals used in high volumes. Ground and bond metal drums and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup. Drums must be placed on a spill pallet that is designed to contain 10% of the total volume of the chemicals or 100% of the largest container whichever is greater or be stored in a spill containment area designed to control hazardous chemical spills
- Transfer and storage of flammable chemicals should not be in an area where a spill of liquid could block an exit from the room. Exit routes must be free of obstructions and available for immediate use at all times
- If chemicals from commercial sources are repackaged into transfer vessels for storage and not as a secondary container, the new containers must be labeled with all essential information as shown on the original container

Part 7. Waste Management

A waste management plan and how to access that plan must be in place before work begins on any laboratory activity. The plan should utilize the following hierarchy of practices:

Subpart A. Waste Management Plan

The CHP must contain at a minimum the following:

- Reduce waste generation-Encourage and use prudence in ordering new chemicals. This will ensure that excess chemical will not be subject to disposal as hazardous waste. The best approach to minimize waste generation is by reducing the scale of operations, reducing its formation during operations, and, if possible, substituting less hazardous chemicals for a particular operation
- Reduce surplus materials-Only the amount of material necessary for an experiment should be purchased, and, if possible, materials should be reused



- Recycle waste-If waste generation cannot be prevented or minimized, the organization should consider recycling chemicals that can be safely recovered
- Dispose of waste properly-Disposal of hazardous wastes and chemicals in laboratory sinks is not recommended without prior approval. Proper waste disposal methods include incineration, treatment, neutralization and or dilution for sewerage purposes and lastly land disposal. The campus Hazardous Waste Coordinator and/or CHO should be consulted in determining which disposal methods are appropriate for different types of waste

Subpart B: Collection and Storage of Waste

The CHP must contain at a minimum the following:

- Chemical waste should be accumulated at or near the point of generation, under the control of laboratory supervisors. Chemical waste will be collected in compliance with satellite accumulation requirements. Satellite accumulation (SA) is a waste management method which allows for the slow accumulation of waste over an extended period of time. The container must be labeled with the following information: "Satellite Accumulation" "Hazardous Waste", "Start Date (date when the first drop of waste was added)" and a general description of the waste (i.e. Sulfuric Acid solution, etc.). If multiple waste streams are to be accumulated in this area, each container must be labeled separately as listed above. This area must be included in the weekly hazardous waste inspection whenever waste is in storage. Once container is full, remove the satellite accumulation label and replace it with a Hazardous Waste shipping label. Once the container is full or no longer needed, the waste disposal timeline will be based on the campus hazardous waste generator designation. Each waste type must be stored in a compatible container pending transfer or disposal
- Incompatible waste types must be kept separated to ensure that heat generation, gas evolution, or another reaction does not occur
- Waste container storage areas must be designated, and these areas included on weekly hazardous waste inspection checklist whenever waste is in storage
- Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types
- Waste containers must be clearly labeled and kept sealed when not being actively filled. Labels must include the accumulation start date and hazard warnings as appropriate
- Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers must be used in the central waste accumulation area to minimize fire and explosion hazards from flammable waste. Fire suppression systems, specialized ventilation systems, and dikes must be installed in the central waste accumulation area



- Waste management workers must be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained laboratory users most familiar with the waste should be actively involved in waste management decisions to ensure that the waste is managed safely and efficiently. Engineering controls should be implemented as necessary, and personal protective equipment must be worn by workers involved in waste management

(See System Procedure 5.24.1-Hazardous Waste Management and Donated Materials)

Part 8. Inspection Program

The laboratory program must include all elements: routine evaluations, self-audits, program audits, peer inspections, Environmental Health and Safety (EHS) inspections, and inspections by external entities. The CHP must contain at a minimum the following elements of an inspection:

- Inspectors should use a checklist to ensure that all compliance issues are covered and a camera to document issues that require correction
- Conversations with laboratory personnel should be encouraged during the inspection, as critical information will be shared. This dialogue provide inspectors an outreach opportunity to educate the employees
- All issues resolved during the inspection must be documented
- An inspection report containing all findings and recommendations must be available for management and lab personnel
- Management must conduct a follow-up inspection in a timely manner. It must be ensured that all identified non-compliant items in the inspection report are rectified

Part 9. Training and Information

The purpose of information and training is to ensure that all individuals at risk are adequately informed about the work being performed in the laboratory, associated hazards and the actions to be taken to protect themselves during normal operations as well as emergencies. This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training should be determined by the campus safety administrator. Laboratory personnel must be trained on:

- The facility's specific CHP – Review of components and implementation
- Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as periodic monitoring, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released)
- Determining the physical and health hazards of chemicals in the work area and means to protect themselves from these hazards. Specific procedures to provide protection including engineering controls, work practices and PPE
- Explanation of safety data sheets and container labeling



- How to obtain and use chemical hazard information
- Laboratory users must know shut-off procedures in case of an emergency
- How to obtain copies of OSHA Lab Standard
- The location and availability of Campus CHP
- Accessibility and availability of SDS of all chemicals used in the work area, lab and facility

Part 10. Medical Consultation and Examination

Campuses must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory. If an employee encounters a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee must be provided an opportunity for a medical consultation by a licensed physician. The identity of the hazardous chemical, a description of the incident, and any signs and symptoms that the employee may experience must be relayed to the physician. Ensure that all Minnesota data privacy rules are followed.

Part 11. General Safety Procedure

The main goal of Chemical Hygiene Program is to minimize the potential for employee exposure. OSHA and other organizations have set occupational exposure limits on airborne chemical exposure. Permissible Exposure Limits (PELs) can be found on OSHA website. Threshold Limit Values (TLVs) are established by American Conference of Governmental Industrial Hygienists (ACGIH) are usually available on the SDS. Irrespective of the established exposure limit for a particular chemical, employees must focus efforts to minimize chemical exposure via all routes of entry.

Three methods are used to limit employee chemical exposure. In priority order:

- **Engineering Controls:** Whenever possible, substitution of less hazardous chemical should be used as a primary method of preventing adverse effects due to chemical exposure. An example would be properly exhausted fume hoods are effective at reducing exposures when handling gases, vapors or powders. Ensure that on-going and routine fume hood inspection schedule is established
- **Administrative Controls:** These are work procedures such as safety policies, rules, supervision and training in order to reduce the duration, frequency and severity of chemical exposures. An example would be limitation in night time lab access and avoiding working alone with particularly hazardous chemicals or procedures
- **Personal Protective Equipment:** These are used to minimize chemical exposure if other exposure control methods are unavailable or to supplement them. An example would be chemical splash goggles for eye protection



Part 12. Emergency Planning

Laboratory personnel must be familiar with established campus policies and procedures regarding emergency situations. Topics may include, but are not limited to:

- Evacuation procedures-when it is appropriate and alternate routes
- Emergency shutdown procedures-equipment shutdown and materials that should be stored safely
- Communications during an emergency-what to expect, how to report, where to call or look for information
- How and when to use a fire extinguisher
- Security issues-unauthorized access
- Protocol for absences or illness
- Safe practices for power outage
- Shelter in place-when it is appropriate
- Handling suspicious mail or phone calls
- Laboratory-specific protocols relating to emergency planning and response
- Handling violent behavior in the workplace
- First-aid and CPR training, including automated external defibrillator training if available

***Everyone is responsible for understanding and following all chemical safety rules and regulations that apply to the lab areas. If at any time an unsafe condition, practice, or incident is identified all efforts will be made to correct it. In the event that it cannot be immediately corrected, ANYONE has the authority to stop activities until the issue has been addressed. In the event that activities are suspended the CHO, the CHC, and the appropriate Dean will be contacted and the reason will be investigated.*

Part 13. Emergency Procedures

The CHP must contain the following information:

- Fire alarm-most organizations use fire alarms whenever a building needs to be evacuated for any reason. When a fire alarm sounds in the facility, evacuate immediately. Check on and assist others who may require help evacuating. If possible stop any experiment in progress, shut off gas, etc.
- Emergency safety equipment-the following safety elements should be met:
 - A written emergency action plan has been provided to laboratory users
 - Fire extinguishers, eyewash units, and safety showers are available and tested
 - First-aid equipment, fire alarms, and telephones are available and accessible
- Chemical spills-workers should contact the CHO or safety administrator for instructions before cleaning up a chemical spill. All SDS and label instructions should be followed, and appropriate PPE should be worn during spill cleanup
- Accident procedures-in the event of an accident, immediately notify appropriate personnel and local emergency responders. Provide an SDS of any chemical involved to



the attending physician. Complete an accident report and submit it to the appropriate office or individual within 24 hours

- Signs-prominent signs of the following types should be posted:
 - Emergency telephone numbers of emergency personnel/facilities, supervisors, etc.
 - Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits
 - Warnings at areas or equipment where special or unusual hazards exist

Part 14. Laboratory Security

Laboratory security reduces the likelihood of some emergencies and assisting in preparation and response for others. Most security measures are based on the laboratory's vulnerability.

Risks to laboratory security include, but are not limited to:

- Theft or diversion of chemicals, biologicals, and radioactive or proprietary materials mission-critical or high-value equipment
- Threats from activist groups
- Intentional release of, or exposure to, hazardous materials
- Sabotage or vandalism of chemicals or high-value equipment
- Loss or release of sensitive information
- Rogue work or unauthorized laboratory experimentation

Security systems in the laboratory are used to detect and respond to a security breach, or a potential security breach, as well as to delay criminal activity by imposing multiple layered barriers of increasing stringency. A good laboratory security system will increase overall safety for laboratory personnel and the public, improve emergency preparedness by assisting with preplanning, and lower the organization's liability by incorporating more rigorous planning, staffing, training, and command systems and implementing emergency communications protocols, drills, background checks, card access systems, video surveillance, and other measures. The security plan should clearly delineate response to security issues, including the coordination of institution and laboratory personnel with both internal and external responders.

