UNIVERSITY OF CONNECTICUT
HEALTH CENTER

GUIDELINES FOR THE LABORATORY USE OF CHEMICAL CARCINOGENS

4/09

1.0 INTRODUCTION

The University of Connecticut Health Center (UCHC) Guidelines for the Laboratory Use of Chemical Carcinogens recommends procedures and safeguards that are applicable to the laboratory workplace for minimizing exposure of laboratory personnel to chemical substances that pose a carcinogenic risk. The guidelines are also intended for in vivo used chemical carcinogens with lab animals. They apply to the use of chemical substances for which standards have been promulgated by the Occupational Safety and Health Administration (OSHA) in 20 CFR 1910.1001-1045, chemical substances for which OSHA promulgates standards in the future in accordance with 29 CFR Part 1990, and other chemical substances which, in the judgment of the UCHC Office of Research Safety pose a carcinogenic risk to laboratory personnel.* The safeguards recommended in the Guidelines consist of good laboratory practices and engineering and administrative controls that are useful in minimizing exposures of personnel and the environment to carcinogenic agents that are used in the laboratory.

In the general policy adopted by OSHA (29 CFR 1990) for the identification and regulation of physical and chemical substances that pose a potential occupational carcinogenic risk to humans, a "potential occupational carcinogen" is defined as. "any substance, or combination or mixture of substances which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance which is metabolized into one or more potential occupational carcinogens by mammals." The Office of Research Safety will consider this definition in its selection of chemical substances used at UCHC that pose a carcinogenic risk to laboratory personnel.

Their application to a specific laboratory activity must be based on the judgment of the principal investigator who is responsible for the safety of operations under his/her supervision involving chemical, carcinogens. In selecting appropriate safeguards, the principal investigator must give specific attention to (i) the quantity of the chemical carcinogen to be used, (ii) the physical and chemical properties of the agent, (ii), the comparative carcinogenic potency, (iv) the type of experimental procedures that will be involved in the proposed use of chemical carcinogens, and (v) the engineering controls available in the laboratory for prevention of exposures.

There are some chemical carcinogens and experimental procedures that, if not adequately controlled, may pose a significant risk to employees. The principal investigator who may wish to conduct a potentially high risk operation must obtain approval from the Office of Research Safety and Employee Health Service prior to initiating the operation. Specific chemical carcinogens and conditions of use for which prior approval is required are determined by the Office of Research Safety and Employee Health Service. The approval process for the use of chemical carcinogens at UCHC are given in Appendix B.

2.0 POLICY AND RESPONSIBILITIES

2.1 Policy

The use of chemical carcinogens within the UCHC facilities shall be planned and performed in a manner to ensure that a safe and healthful environment is maintained. The objective of this policy is to reduce employee and environmental exposures to chemical carcinogens used in UCHC laboratories to the lowest practicable level. If a specific chemical is reported by an OSHA Standard, those requirements must be followed.

2.2 Responsibilities of the UCHC Animal Care Committee/Institutional Biosafety Committee/Radiation Safety Committee/Institutional Review Board

These committees approve various protocols specific to their areas of expertise. On occasion, a protocol may involve a chemical carcinogen. In such cases, the protocol must not be approved until the use of the chemical carcinogen has been evaluated by the Office of Research Safety.

2.3 Responsibilities of the Office of Research Safety

The responsibilities of the Office of Research Safety Office are: (1) assisting the Principal Investigator in the selection of laboratory practices and engineering controls; (2) providing technical guidance to personnel at all levels of responsibility on matters pertaining to laboratory safety; (3) inspecting laboratories at least annually to assess compliance with policies for the safe conduct of work involving chemical carcinogens; (4) investigating all reported accidents which result in the exposure of personnel or the environment to a chemical carcinogen and recommending corrective action to reduce the potential for recurrence; (5) supervising decontamination operations where accidents have resulted in significant contamination of laboratory areas; and (6) developing and conducting appropriate training and information programs to promote methods for the safe handling of chemical carcinogens. The Office of Research Safety should consult with the medical director of Employee Health Service, and with knowledgeable scientists who have broad experience in chemical carcinogens to determine whether there are practical procedures for detecting evidence of employee exposure to particular chemical carcinogens used in UCHC laboratories. When practical methods are available, consideration should be given to employing these methods for surveillance of those employees who use the particular carcinogen on a regular basis. Evidence of employee exposure is a clear signal calling for examination, identification, and possible revision of the laboratory practices that may have contributed to employee exposure.

2.4 Responsibilities of the Principal Investigator

The Principal Investigator has the primary responsibility for: (1) acquiring the knowledge and information needed to, recognize and control chemical hazards in the laboratory; (2) selecting and employing laboratory practices and administrative and engineering controls that reduce the potential for exposure to chemical carcinogens to the lowest practicable level; (3) obtaining approval, when required, from the appropriate committee or department to conduct a high risk operation involving chemical carcinogens; (4) informing those employees, for whom the investigator is responsible, of the potential hazards associated with the use of chemical carcinogens, and instructing them in the use of laboratory practices, engineering controls and administrative procedures for dealing with accidents involving chemical carcinogens; (5) supervising the safety performance of, his/her staff to ensure that the required laboratory practices and engineering controls are employed; (6) arranging for immediate medical attention and reporting to the Office of Research Safety any accident that results in (a) inoculation of chemical carcinogens through cutaneous penetration, (b) ingestion of chemical carcinogens, (c) inhalation of. chemical carcinogens, or (d) any incident resulting in overt exposure of personnel

or danger of environmental contamination by chemical carcinogens; (7) assisting representatives of the Office of Research Safety in investigating accidents; and (8) investigating and reporting to the Office of Research Safety any problems pertaining to operation and implementation of laboratory practices and engineering controls.

2.5 Responsibilities of the Employee

Each employee is responsible for: (1) knowing and complying with safety guidelines, regulations and procedures required for the task assigned; (2) reporting unsafe conditions to the Principal Investigator, immediate investigator or the Office of Research Safety, and (3) reporting to the Principal Investigator any exposure condition that may necessitate a specific medical surveillance program,

2.6 Responsibilities of the UCHC Employee Health Service

The Employee Health Service should ensure that the following information is included in each employee's medical record: (a) reports of accidents that have resulted in (i) inoculation of chemical carcinogens through cutaneous penetration, (ii) ingestion of chemical carcinogens, (iii) inhalation of chemical carcinogens, and (iv) any incident resulting in overt exposure of the employee to chemical carcinogens; (b) results of any surveillance procedures employed; and (c) results of environmental measurements of chemical carcinogens that may have been made within the employee's work environment. The Employee Health Service will assist the Office of Research Safety in the evaluation of the proposed use of a chemical carcinogen.

3.0 EMPLOYEE EDUCATION

All employees working with, or who may be potentially exposed to, chemical carcinogens should receive sufficient information and training that will enable them to work safely and to understand the relative significance of the potential hazards as they relate to them personally. All employees directly involved or associated with areas in which chemical carcinogens are used should be periodically advised about (1) the possible sources of exposure, (2) adverse health effects (carcinogenic and other) associated with exposure, (3) laboratory practices and engineering controls in use and being planned to limit exposure, (4) the use and purpose of any recommended environmental and medical monitoring procedures, and (5) their responsibilities for following proper laboratory practices to help protect their health and provide for the safety of themselves and fellow employees. This information should be provided by persons qualified by training and experience, including their supervisors, Principal Investigator(s) and representatives of the Office of Research Safety.

4.0 LABORATORY PRACTICES AND ENGINEERING CONTROLS

The laboratory practices and engineering controls recommended in this section detail general safeguards that should be observed when working with chemical carcinogens in the laboratory. These safeguards will provide protection to the laboratory worker from exposure to chemical carcinogens in the majority of situations. There are instances, however, when the physical and chemical properties, the proposed use, the quantity of chemical carcinogens needed for a particular use or the carcinogenic or other toxic hazard of a chemical carcinogen may be such that either additional or fewer controls might be needed to protect the laboratory worker (see Section 5.0). Professional judgment is, therefore, essential in the interpretation of these recommendations.

4.1 Personnel Practices

4.1.1 Protective Clothing:

Laboratory clothing that protects street clothing, such as a fully fastened laboratory coat or a disposable jumpsuit, should be worn when chemical carcinogens are being used. Laboratory clothing used for this purpose must not be worn outside of the laboratory area. Clothing overtly contaminated by chemical carcinogens should be removed immediately and disposed of in hazardous waste. When methods for decontaminating clothing are unknown or not applicable, disposable protective clothing should be worn. Gloves which are appropriate to the task and chemicals in use should be worn when handling a chemical carcinogen. Disposable gloves should be discarded as chemical waste after each use and immediately after overt contact with a chemical carcinogen.

4.1.2 Eye Protection:

Devices to provide appropriate protection for the eyes should be available and used in the laboratory work area. The type of device used will depend upon the hazard presented by the operation and chemical in use. Contact the Office of Research Safety (x2723) for guidance.

4.1.3 Eating Drinking, and Smoking:

There shall be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics or storage of utensils, food or food containers in laboratory areas where chemical carcinogens are used or stored.

4.1.4 Pippeting:

Mechanical pipetting aids should always be used for all pipetting procedures. Under no circumstances should oral pipetting of chemical carcinogens be permitted.

4.2.1 Work Area Identification:

Each work area, where exposure to a chemical carcinogen is possible should have affixed to it a sign with the following warning:

CAUTION - POTENTIAL CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

Locations where such signs should be placed include:

- Door to the room where chemical carcinogens are used or stored
- Designated work area – e.g., chemical fume hood
- Animal cafes and animal rooms
- Secondary storage container inside storage area
- Designated storage area – e.g., refrigerator or cabinet

4.2.2 Access Control:

Work areas where chemical carcinogens are being used or stored should be entered only by persons authorized by the Principal Investigator or his/her designee. Maintenance and emergency personnel should be advised of the potential, problems and hazards that they may encounter before they are called on to enter the laboratory. Access doors to work areas should be kept closed while experiments involving chemical carcinogens are in progress.

4.2.3 Work Surfaces:

All work surfaces on which chemical carcinogens are used should be covered with stainless steel or plastic trays, dry absorbent plastic backed paper or other impervious material. The protective surfaces should be decontaminated or disposed of after the procedure involving a chemical carcinogen has been completed.

4.2.4 Use of Primary Containment Equipment:

Procedures involving volatile chemical carcinogens and those involving solid or liquid chemical carcinogens that may result in the generation of aerosols should not be conducted on the open bench; they should only be conducted in a chemical fume hood, a Class I Biological Safety Cabinet vented to the outside, a glove box or other suitable containment equipment. Examples of aerosol producing procedures are: the opening of closed vessels; transfer operations; preparation of feed mixtures; blending; open vessel centrifugation; and the application, injection or intubation of a chemical carcinogen into experimental animals. Tissue culture and other biological procedures involving chemical carcinogens may be conducted in a Class II, type B Biological Safety Cabinet. A Class II, type A Biological Safety Cabinet may also be used if the cabinets exhaust air is discharged to the outdoors. The Principal Investigator should obtain guidance from the Office of Research Safety on the selection and use of a Class II Biological Safety Cabinet for procedures involving chemical carcinogens.

4.2.5 Use of Analytical Instrumentation:

Vapors or aerosols produced by analytical instruments, when used with chemical carcinogens, should be captured through local exhaust ventilation at the site of their production or be vented into a chemical fume hood, or a Class I Biological Safety Cabinet that is vented to the outside. When a sample containing a chemical carcinogen is removed from an analytical instrument, it should be placed in a tightly stoppered sample tube or otherwise safeguarded from contaminating the laboratory, Analytical equipment that becomes overtly contaminated should not be used until it has been decontaminated.

4.2.6 Use of Respirators as Personal Protective Devices:

A respirator use program should be provided for all personnel, including emergency and maintenance personnel, who enter areas where the environment is contaminated with carcinogenic chemicals that pose the risk of an inhalation chemical exposure. This program should meet the requirements of the OSHA Safety and Health Standards for respiratory protection as detailed in 29 CFR 1910.134. The respirator type should be approved by the Office of Research Safety prior to its selection. Details of the “UCHC Respirator Program for Selection and Use of Respirators”.

4.2.7 Storage and Identification of Stock Quantities:

Stock quantities of chemical carcinogens should be stored in a designated storage area or cabinet. It is possible that such a storage area or cabinet might be located within the laboratory work area. The storage area or cabinet should have affixed to it a sign with the following warning:

CAUTION POTENTIAL CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

The person responsible for the storage area should maintain a listing of stock quantities of chemical carcinogens acquired and the dates of acquisition. Storage vessels containing stock quantities should have affixed to them labels with the following warning:

CAUTION--POTENTIAL CANCER HAZARD

Additional storage precautions may be required for certain compounds based upon other properties (i.e., affixed to them labels with the following warning:

CAUTION—POTENTIAL CANCER HAZARD

4.2.9 Laboratory Transport:

Storage vessels containing chemical carcinogens that are to be removed from one site to another within the same building (e.g. storage area to work area) should first be placed in a durable spill proof outer container. Contaminated materials which are to be disposed should be placed in a closed plastic bag or other suitable impermeable and sealed primary container and put in a hazardous waste container. The primary container should be placed in a durable outer container before being transported. The outer container should be labeled with both the name of the chemical carcinogen and the following warning:

CAUTION--POTENTIAL CANCER HAZARD

Call the Office of Research Safety for waste pick-up.

4.2.10 General Clean-Up Procedures:

General housekeeping procedures which suppress the formation of aerosols such as the use of a wet mop or a vacuum cleaner equipped with a high efficiency particulate air (HEPA) filter to remove particulates should be used. Dry sweeping and dry mopping should not be used because of the hazard of aerosol formation. In those instances where a chemical carcinogen or contaminated material is spilled, special clean up procedures developed for the individual compound should be employed.

4.2.11 Protection of Vacuum Lines:

Each vacuum service, including water aspirators, should be protected (e.g. with an absorbent or liquid trap and a HEPA filter) to prevent entry of any chemical carcinogen into the system. When using a volatile carcinogen, a separate vacuum pump should be used. This device should be placed within or vented into chemical fume hood.

4.2.12 Packaging and Shipping:

Chemical carcinogens should be securely packaged to withstand shocks, pressure changes, and any other conditions which might cause the leakage of contents incident to ordinary handling during transportation. **Do not transport any chemical carcinogen off-site without first contacting the Office of Research Safety.** Severe penalties may result from violations of DOT regulations.

4.2.13 Decontamination:

Contaminated materials should either be decontaminated by procedures that decompose the chemical carcinogen to produce a safe product or placed in an appropriate hazardous waste container.

4.2.14 Disposal:

Prior to the start of any laboratory activity involving a chemical carcinogen or any hazardous substance, plans for the handling and ultimate disposal of contaminated wastes and surplus amounts of the carcinogen should be completed. The Principal Investigator must obtain guidance from the Office of Research Safety in selecting the best methods available that are in compliance with Federal, State and local codes and ordinances.

4.3 Personal Safety Controls

4.3.1 Handwashing Facility:

A handwashing facility should be available within the work area. This need not be a facility used exclusively for handwashing. The use of liquid soap is recommended. When new facilities are installed, foot or elbow operated faucets should be provided.

4.3.2 Eyewash Facility:

An emergency eye wash facility should be located in each laboratory. It should be designed to wash both eyes at the same time with a continuous stream of potable water. It should be tested frequently.

4.3.3 Exhaust Air from Primary Containment Equipment:

The exhaust air from glove boxes should be treated by filtration, reaction, absorption, adsorption, electrostatic precipitation or incineration. The need for and type of treatment of exhaust air from other primary containment equipment, including open face laboratory-type hoods, should be determined by the Office of Research Safety in consultation with the Principal Investigator. Treatment systems that remove chemical carcinogens from the exhaust air by collection mechanisms such as filtration, absorption and adsorption should be operated in a manner that permits maintenance so as to avoid direct contact with the collection medium. All exhaust air from primary containment equipment should be discharged to the outdoors so that the possibility of entry into the supply air intake of any building is minimized. This directional air flow may be achieved by a common building exhaust system provided that the exhaust air is not recirculated to any other areas of the building. In buildings where directional air flow is not provided, the use of chemical carcinogens should be restricted to lower risk activities (See Section 5.2). The exhaust air

from laboratory areas should be discharged outdoors so that the possibility of entry into the supply air intake of any building is minimized. Exhaust air from laboratory areas that is not derived from primary containment equipment can be discharged to the outdoors without being treated.

4.4 Additional Recommendations for Animal Experimentation

In selecting specific safeguards for animal experimentation with chemical carcinogens, careful attention should be given to animal care and housing methods, bulk chemical storage and disbursement procedures, dosage preparation and challenge procedures, waste management and disposal practices, and personnel protection requirements. The ACC must approve all animal experimentations.

5.0 SITUATIONS REQUIRING' SPECIAL CONSIDERATIONS

The purpose of this section is to generally describe situations involving chemical carcinogens where either more or less stringent safeguards might be considered in providing protection to laboratory personnel. No specific definitions for such situations can be provided; an attempt to do so would be misleading. Any modification to the laboratory practices and procedures described in Section 4.0 should be carefully considered by the Principal Investigator.

The risk of exposure to a chemical carcinogen used in the laboratory is related among other things to the quantity and physical properties of material used and the nature and complexity of the experimental procedure. There is greater risk of exposure if, under the same procedural conditions, 100 mg of material is used instead of 1 mg of material. Similarly, when the same quantity of material is used, the potential for exposure is greater for operations such as blending, preparation of dry feed mixtures or the manipulation of powders than it is for operations such as the preparation of aliquots of stock solutions. Compounds with high vapor pressures generally present a greater risk of exposure than nonvolatile compounds. Also, the toxicity and carcinogenic potency of the material are important factors to consider when selecting safeguards.

5.1 Higher Risk Situations:

Careful judgment must be given in the selection of safe- guards for any proposed activity which involves a known highly potent chemical carcinogen , operations that involve large quantities of chemical carcinogens, or complex procedures having a significant potential for producing aerosols or contamination. When these or similar situations exist, the Principal Investigator must obtain approval from the Office of Research Safety before initiating the proposed requirements for certain high risk operations.

5.2 Lower Risk Situations:

Where the Principal lnvestigator in consultation with the Office of Research Safety, determines that less stringent safeguards can be used to provide protection, the safeguards selected should require at a minimum, strict adherence to good, sound laboratory practices.

The laboratory doors should remain closed at all times to maintain the correct ventilation balance and prevent contamination of the general air supply.

Operations involving volatile chemical carcinogens or the removal of chemical carcinogens from stock quantities should always be performed within a chemical fume hood, or other suitable containment equipment.

The work surfaces on which chemical carcinogens are used should be covered with stainless steel or plastic trays, dry absorbent plastic-backed paper, or other impervious material.
Stock quantities of chemical carcinogens should be the minimum quantity required for efficient use. Storage vessels containing stock quantities should have affixed to them labels with the following warning:

CAUTION--POTENTIAL CANCER HAZARD

The stock quantities should be maintained in a designated storage area when not in use. The transport of stock quantities should be done in a manner as to prevent breakage or spillage. Recommendations for decontamination and disposal as described in Section 4.0 should be followed.

APPENDIX A
GENERAL REFERENCES

American Conference of Governmental Industrial Hygienists and Biological Exposure indices. Threshold Limit Values for Chemical Substances and Physical Agents - Cincinnati, 2009. (Issued Annually)

U.S. Department of Labor, OSHA, 29CFR, Part 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories.

U.S. Department of Labor, OSHA, 29CFR, Part 1910.1003, 13 Carcinogens.

Center for Disease Control, National Institute Occupational Safety and Health (NIOSH), NIOSH Carcinogen List, http://www.cdc.gov/niosh/npotocca.html.

National Library of Medicine, Toxnet, Hazardous Substance Databank (HSDB), http://toxnet.nLm.nih.gov/cgi-bin/sis/html?HSDB or Google “TOXNET”.

Department of Health and Human Services, National Toxicology Program, Report of Carcinogens. Google “National Toxicology Program”.

Appendix B

Approval Process for the Laboratory Use of Chemical Carcinogens

There are several sources of compilations of suspected and/or confirmed human carcinogens. These include the 13 carcinogens specifically regulated by OSHA (29CFR1910.1003, Subpart Z), the NIOSH list of potential human carcinogens and the Expanded List of Select Carcinogens, 10th Edition. The OSHA 13 carcinogens are

4-Nitropbiphenyl, CAS# 92-93-3
Alpha-Naphthylamine, CAS# 134-32-7
Methyl chloromethyl ether, CAS# 107-30-2
3,3'-Dichlorobenzidine, CAS# 91-94-1
Bis-chloromethyl ether, CAS# 542-88-1
Beta-naphthylamine, CAS# 91-59-8
Benzidine, CAS# 92-87-5
4-aminodiphenyl, CAS# 92-67-1
Ethyleneimine, CAS# 151-56-4
Beta-propiolactone, CAS# 57-57-8
2-acetylaminofluorene, CAS# 53-96-3
4-dimethylaminoazo-benzene, CAS# 60-11-7
n-nitrosodimethylamine, CAS# 62-75-9

If planning to work with one of these chemicals specific OSHA standards exist as well as procedures that must be followed. Other chemicals that should be considered potential human carcinogens are the NIOSH list (http://www.cdc.gov/niosh/npotocca.html) and the list provided in the Chemical Hygiene Plan, Appendix D LINK HERE. The anticipated use of any of these chemicals, or a chemical that is not listed but is considered a potential human carcinogen needs to be evaluated by the Office of Research Safety.

Approval for use of a suspected human carcinogen is based upon the following factors:

Listed OSHA Carcinogen
Suspect Carcinogen
Mode of Use (animal, in-vitro, etc)
Quantity Used
Potential Exposure Routes
Employee Health Service Comments
Potential Exposure vs. Published Risk Data
Protective Measures Utilized by Researcher
OSHA/ACGIH Permissible Exposure Levels Available
Category in CDC Approval Levels Table LINK TO CHP
Appropriate Committee Approvals

:CarcinAppendixB