

**Virginia Commonwealth University
Office of Environmental Health & Safety
Chemical/Biological Safety Section**

WORKING WITH CARCINOGENS

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I. PURPOSE. The purpose of this document is to inform the research community of the potential occupational health and safety hazards associated with chemical and biological agents that are known or suspected human carcinogens. This page provides researchers with the general background information, classification criteria, recommended safe work practices, and other supporting information for developing standard operating procedures (SOPs) for protocols involving carcinogens.

II. INTRODUCTION.

The Occupational Health and Safety Administration (OSHA) defines a carcinogen as a substance capable of causing cancer. Carcinogens are substances that can cause cellular damage after long-duration or repeated exposure; the related health effects may become evident only after a long latency period (National Research Council, 1995). It is estimated that approximately 20,000 deaths and 40,000 new cases of cancer are reported each year following occupational exposure to carcinogens (NIOSH, 2006). The probability of developing cancer in the United States is about 1 in 2 for men and 1 in 3 for women (ACS, 2007) and may be a result of environmental exposure (Lichtenstein et al., 2004). A person's risk of developing cancer is influenced by personal characteristics such as age, sex, and race; family history; diet and personal habits; medical conditions; and exposure to cancer causing agents in their environment and work place (OTA, 1981; IOM, 2001; Montesano, 2001).

Potential routes of exposure include: inhalation, dermal absorption, ingestion, and accidental injection. In a laboratory setting, an individual's potential for exposure is determined by the types of carcinogens in use, research procedures being conducted, and quantities involved. Due to varying exposure potentials, the investigator and/or laboratory manager must identify all points of hazard and minimize exposure by instituting specific work practices, administrative controls, engineering controls, and personal protective equipment as appropriate. Since there is no safe level of exposure for carcinogens, the goal of the laboratory should be to reduce potential for carcinogen exposure as much as possible.

III. PROCEDURES FOR HANDLING CARCINOGENS.

A. Risk Assessment. Prior to working with a known or suspected human carcinogen the principal investigator shall conduct a thorough risk assessment of the agent. The risk assessment should take into consideration the physical state of the compound, the possible routes of exposure, the quantity of material, and the experimental procedure being conducted.

B. Standard Operating Procedures. Standard operating procedures are intended to provide the laboratory personnel with general guidance on how to safely work with carcinogens. A SOP should be generated for each laboratory that handles known or suspect carcinogens. Thoroughly developed SOPs will convey the following information:

1. Training Requirements. Laboratory personnel must be specifically trained on the potential hazards associated with carcinogen use in their laboratory. Training must include a description of the hazard and the operations in which exposure may occur, information on emergency response, proper decontamination procedures, and specific information to aid the employee in recognizing situations that may result in exposure. Prior to carcinogen use and annually thereafter, employees are required to complete the [Carcinogen Safety Training Module](#) under the supervision of their PI. Copies of all training records must be maintained in the laboratory central files.

2. Engineering Controls. Whenever feasible engineering controls (chemical fume hoods, glove boxes, or isolation cabinets) must be utilized for manipulations involving carcinogens. If suitable engineering controls are not available, suitable respiratory protection (refer to Section 5) must be provided. Chemical fume hoods must be inspected prior to initial use and annually there after. Biosafety cabinets and chemical fume hoods are not the same. Biosafety cabinets should never be used to manipulate chemical carcinogens. Please contact OEHS at 828-1392 for arranging hood inspections or for other information pertaining to chemical fume hoods. A [chemical fume hood SOP](#) is available on the OEHS website.

3. Work Practice Controls. Carcinogens must be manipulated and stored in a designated area of the laboratory. Areas of designation should include hoods, bench tops, sinks, and any other locations where carcinogens are handled or stored. All work surfaces should be easily cleanable and covered with an impervious and/or disposable material. Working quantities of carcinogens and other hazardous chemicals should be kept to a minimum. Immediately upon removing gloves following the use of carcinogens, laboratory personnel should wash hands and exposed arm areas thoroughly with soap and water. Work areas should be thoroughly decontaminated with an appropriate deactivating agent (refer to MSDS sheet) following any carcinogen use. In addition to the routine cleaning procedures identified above, conducting periodic “swipe” testing may also be required when working with certain human carcinogens (cadmium, lead, arsenic, etc.).

4. Spills and Disposal. Spills should be anticipated before they occur: suitable chemical spill kits must be maintained in the laboratory and staff must be thoroughly trained in spill response procedures. For assistance related to spills and waste disposal of carcinogens, please contact OEHS at 828-1392. Carcinogen disposal requires submission of a completed [Waste Disposal Form](#).

5. Personal Protective Equipment (PPE). Lab coat, safety goggles or face shield, and gloves are considered the minimum level of protection for working with carcinogens. Selection of glove type will depend upon the carcinogen and physical state of the compound, the product MSDS should provide information regarding suitable gloves for

handling specific agents. If indication of proper glove type is not provided on the MSDS or other credible source, OEHS may be contacted for assistance. Utilization of double gloving is recommended whenever manipulations involving carcinogens are conducted. Whenever feasible, engineering controls should be the primary means of providing worker protection. If available engineering controls alone are not sufficient for providing adequate worker protection, respirators must be provided. Any utilization of respirators for worker protection is subject to registration and approval under the university Respiratory Protection Program maintained by OEHS. Approval of respirator use is contingent upon PI's provision of a risk exposure assessment and staff participation in medical clearance, fit testing, and training. Refer to [VCU's Respiratory Protection Program](#) for further information.

6. Exposures. Employees exposed to a carcinogen must immediately report the incident to their supervisor, seek medical attention through the ER or Employee Health, and report the incident to OEHS at 828-1392 as soon as possible.

7. Inventory and MSDS. An inventory and MSDS must be maintained for all chemicals, including carcinogens, which are present in the laboratory. Material safety data sheets must be acquired for any new chemicals, and laboratory staff must be familiarized with new chemical MSDS prior to adding them to the laboratory regimen. Chemical inventories should be updated as new chemicals are added to laboratory regimen or existing chemicals are consumed or disposed.

8. Monitoring. In areas where **2-acetylamniofluorene, 4-aminodiphenyl, benzidine, bis-Chlormethyl ether, 3,3'-Dichlorobenzidine, 4-Dimethylaminoazobenzene, ethyleneimine, formaldehyde, methyl chloromethyl ether, methylene chloride, alpha-Naphthylamine, beta-Naphthylamine, 4-nitrobiphenyl, N-nitrosodimethylamine, and beta-Propiolactone** are used, OEHS must be notified for a review of operations and initial monitoring of airborne concentrations. If levels exceed occupational exposure standards, then a compliance/monitoring program is necessary with a designated amount and frequency of sampling specified along with necessary corrective actions to reduce exposures. Depending upon the nature of the carcinogen, a medical monitoring program may be needed to be established prior to the initiation of the research study. The principal investigator, in consultation with the Institutional Biosafety Committee, will designate those employees whose activities place them at sufficient risk to require inclusion in a medical monitoring program.

IV. DETERMINATION OF A CARCINOGEN. OEHS has established the following criteria for defining carcinogens: a drug or compound is considered to be a carcinogen if it is indicated on the product MSDS and/or contained in any of the following lists:

A. OSHA Regulated Carcinogen Listed: [29 CFR, 1910.1003](#)

B. National Toxicology Program (NTP):

1. [Known to be Human Carcinogens](#)
2. [Reasonably Anticipated to be Human Carcinogens](#)

C. National Institutes for Occupational Health and Safety (NIOSH): [NIOSH Carcinogen List](#)

D. International Agency for Research on Cancer (IARC):

1. [Group 1](#): carcinogenic to humans
2. [Group 2A](#): probably carcinogenic to humans
3. [Group 2B](#): possibly carcinogenic to humans

V. REFERENCES.

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