APPENDICES TO MIOSHA STANDARD
HAZARDOUS WORK IN LABORATORIES
R 325.70101-R 325.70114

The following appendices (A-D) are provided as nonmandatory guidelines and information to assist employers and employees to understand and comply with provisions of the standard. Appendix A is similar to the comparable appendix to 29 CFR §1910.1450 which is the Federal OSHA standard from which these rules were derived.

APPENDIX A--CHEMICAL HYGIENE IN LABORATORIES

The material in this appendix outlines concerns and recommendations for effectively dealing with chemical hazards in the laboratory environment. Naturally, not all items are appropriate for all laboratories. In most situations a study of this appendix and the provisions of Rule 6(3) will be sufficient to enable an effective chemical hygiene plan to be written.

The following table indicates the part of this appendix which are most pertinent to each of the subdivisions of Subrule (3) of Rule 6.

Subdivision of Rule 6(3)	Relevant Appendix A Section
(a) SOP for working with hazardous chemicals	C., D., E.
(b) Control measures	D.
(c) Laboratory fume hoods	C. 4. (b)
(d) Information and training	D. 10.
(e) Approval of operations	E. 2. (b), E. 4. (b)
(f) Medical consultation/exams	D. 5., E. 4. (f)
(g) Chemical hygiene officer	B.
(h) Special precautions	E. 2., 3., 4.

A. General Principles for Work with Laboratory Chemicals

1. It is prudent to minimize all chemical exposures. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for

particular chemicals. Skin contact with chemicals should be avoided as a cardinal rule.

2. Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

3. Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices.

4. Institute a chemical hygiene program. A mandatory chemical hygiene program designed to minimize exposures is needed; it should be a regular, continuing effort, not merely a standby or short-term activity. Its recommendations should be followed in academic teaching laboratories as well as by full-time laboratory workers.

5. Observe the PELs, TLVs. The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded.

B. Chemical Hygiene Responsibilities

Responsibility for chemical hygiene rests at all levels including the:

1. Chief executive officer, who has ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene.

2. Supervisor of the department or other administrative unit, who is responsible for chemical hygiene in that unit.

3. Chemical hygiene officer(s), whose appointment is essential and who must:
   (a) Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices;
   (b) Monitor procurement, use, and disposal of chemicals used in the lab;
   (c) See that appropriate audits are maintained;
   (d) Help project directors develop precautions and adequate facilities;
   (e) Know the current legal requirements concerning regulated substances; and
   (f) Seek ways to improve the chemical hygiene program.

4. Laboratory supervisor, who has overall responsibility for chemical hygiene in the laboratory including responsibility to:
   (a) Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided;
   (b) Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;
   (c) Know the current legal requirements concerning regulated substances;
   (d) Determine the required levels of protective apparel and equipment; and
   (e) Ensure that facilities and training for use of any material being ordered are adequate.

5. Project director or director of other specific operation, who has primary responsibility for chemical hygiene procedures for that operation.

6. Laboratory worker, who is responsible for:
   (a) Planning and conducting each operation in accordance with the institutional chemical hygiene procedures; and
   (b) Developing good personal chemical hygiene habits.

C. The Laboratory Facility

1. Design. The laboratory facility should have:
   (a) An appropriate general ventilation system (see C.4. below) with air intakes and exhausts located so as to avoid intake of contaminated air;
   (b) Adequate, well-ventilated stockrooms/ storerooms;
   (c) Laboratory hoods and sinks;
   (d) Other safety equipment including eyewash fountains and drench showers; and
   (e) Arrangements for waste disposal.

2. Maintenance. Chemical-hygiene-related equipment (hoods, incinerator, etc.) should undergo continuing appraisal and be modified if inadequate.

3. Usage. The work conducted and its scale must be appropriate to the physical facilities available and, especially, to the quality of ventilation.

4. Ventilation
   (a) General laboratory ventilation. This system should: Provide a source of air for breathing and for input to local ventilation devices; it should not be relied on for protection from toxic substances released into the laboratory; ensure that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the working day; direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building.
   (b) Hoods. A laboratory hood with 2.5 linear feet of hood space per person should be provided for every two workers if they spend most of their time working with chemicals; each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. If this is not possible, work with substances of unknown toxicity should be avoided or other types of local ventilation devices should be provided.
   (c) Other local ventilation devices. Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed. Each canopy hood and snorkel should have a separate exhaust duct.
   (d) Special ventilation areas. Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment before release into the regular exhaust system. Cold

rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure.

(e) Modifications. Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate.

(f) Performance. Rate: 4-12 room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control.

(g) Quality. General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas; airflow into and within the hood should not be excessively turbulent; hood face velocity should be adequate (typically 60-100 lfm).

(h) Evaluation. Quality and quantity of ventilation should be evaluated on installation, regularly monitored (at least every 3 months), and reevaluated whenever a change in local ventilation devices is made.

D. Components of the Chemical Hygiene Plan

1. Basic Rules and Procedures
(Recommendations for these are given in section E, below)

2. Chemical Procurement, Distribution, and Storage
   (a) Procurement. Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved. No container should be accepted without an adequate identifying label. Preferably, all substances should be received in a central location.
   (b) Stockrooms/storerooms. Toxic substances should be segregated in a well-identified area with local exhaust ventilation. Chemicals which are highly toxic or other chemicals whose containers have been opened should be in unbreakable secondary containers. Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity.
   Stockrooms/storerooms should not be used as preparation or repackaging areas, should be open during normal working hours, and should be controlled by one person.
   (c) Distribution. When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used if possible.
   (d) Laboratory storage. Amounts permitted should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to the storeroom/stockroom.

3. Environmental Monitoring
   Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices or when a highly toxic substance is stored or used regularly (e.g., 3 times/week).

4. Housekeeping, Maintenance, and Inspections
   (a) Cleaning. Floors should be cleaned regularly.
   (b) Inspections. Formal housekeeping and chemical hygiene inspections should be held at least quarterly for units which have frequent personnel changes and semiannually for others; informal inspections should be continual.
   (c) Maintenance. Eye wash fountains should be inspected at intervals of not less than 3 months. Respirators for routine use should be inspected periodically by the laboratory supervisor. Safety showers should be tested routinely. Other safety equipment should be inspected regularly. (e.g., every 3-6 months). Procedures to prevent restarting of out-of-service equipment should be established.
   (d) Passageways. Stairways and hallways should not be used as storage areas. Access to exits, emergency equipment, and utility controls should never be blocked.

5. Medical Program
   (a) Compliance with regulations. Regular medical surveillance should be established to the extent required by regulations.
   (b) Routine surveillance. Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical should consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable.
   (c) First aid. Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be nearby.

6. Protective Apparel and Equipment--should include for each laboratory:
   (a) Protective apparel compatible with the required degree of protection for substances being handled;
   (b) An easily accessible drench-type safety shower;
   (c) An eyewash fountain;
   (d) A fire extinguisher;
   (e) Respiratory protection, fire alarm and telephone for emergency use should be available nearby; and
   (f) Other items designated by the laboratory supervisor.

7. Records
   (a) Accident records should be written and retained.
   (b) Chemical Hygiene Plan records should document that the facilities and precautions were compatible with current knowledge and regulations.
   (c) Inventory and usage records for high-risk substances should be kept as specified in sections E.3.(e) below.
   (d) Medical records should be retained by the institution in accordance with the requirements of state and federal regulations.

8. Signs and Labels
   Prominent signs and labels of the following types should be posted:
   (a) Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers;

(b) Identity labels, showing contents of containers (including waste receptacles) and associated hazards;
(c) Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption and storage are permitted; and
(d) Warnings at areas or equipment where special or unusual hazards exist.

9. Spills and Accidents
(a) A written emergency plan should be established and communicated to all personnel; it should include procedures for ventilation failure, evacuation, medical care, reporting, and drills.
(b) There should be an alarm system to alert people in all parts of the facility including isolation areas such as cold rooms.
(c) A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting.
(d) All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit.

10. Information and Training Program
(a) Aim: To assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs.
(b) Emergency and Personal Protection Training: Every laboratory worker should know the location and proper use of available protective apparel and equipment.
Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures.
Such training as well as first aid instruction should be available to and encouraged for everyone who might need it.
(c) Receiving and stockroom/storeroom personnel should know about hazards, handling equipment, protective apparel, and relevant regulations.
(d) Frequency of Training: The training and education program should be a regular, continuing activity--not simply an annual presentation.
(e) Literature/Consultation: Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources.

11. Waste Disposal Program.
(a) Aim: To assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals.
(b) The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations.
(c) Discarding Chemical Stocks: Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened.
Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage.
(d) Frequency of Disposal: Waste should be removed from laboratories to a central waste storage area at least once per week and from the central waste storage area at regular intervals.
(e) Method of Disposal: Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste.
Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.
Hoods should not be used as a means of disposal for volatile chemicals.
Disposal by recycling or chemical decontamination should be used when possible.

E. Basic Rules and Procedures for Working with Chemicals

The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.

1. General Rules/Recommendations
The following should be used for essentially all laboratory work with chemicals:
(a) Accidents and spills--Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.
Ingestion: Encourage the victim to drink large amounts of water.
Skin Contact: Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.
Clean-up. Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal.
(b) Avoidance of "routine" exposure: Develop and encourage safe habits; avoid unnecessary exposure to chemicals by any route.
Do not smell or taste chemicals. Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices.
Inspect gloves and test glove boxes before use.
Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres.
(c) Choice of chemicals: Use only those chemicals for which the quality of the available ventilation system is appropriate.
(d) Eating, smoking, etc.: Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present; wash hands before conducting these activities.
Avoid storage, handling or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations.
(e) Equipment and glassware: Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass

apparatus; shield or wrap them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.

(f) Exiting: Wash areas of exposed skin well before leaving the laboratory.

(g) Horseplay: Avoid practical jokes or other behavior which might confuse, startle or distract another worker.

(h) Mouth suction: Do not use mouth suction for pipeting or starting a siphon.

(i) Personal apparel: Confine long hair and loose clothing. Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers.

(j) Personal housekeeping: Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation or at the end of each day.

(k) Personal protection: Assure that appropriate eye protection is worn by all persons, including visitors, where chemicals are stored or handled.

Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls, inspecting the respirator before use.

Use any other protective and emergency apparel and equipment as appropriate.

Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken.

Remove laboratory coats immediately on significant contamination.

(l) Planning: Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.

(m) Unattended operations: Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation

(n) Use of hood: Use the hood for operations which might result in release of toxic chemical vapors or dust.

As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm.

Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made; keep materials stored in hoods to a minimum and do not allow them to block vents or air flow.

Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off".

(o) Vigilance: Be alert to unsafe conditions and see that they are corrected when detected.

(p) Waste disposal: Assure that the plan for each laboratory operation includes plans and training for waste disposal.

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan.

Do not discharge to the sewer concentrated acids or bases; highly toxic, malodorous, or lachrymatory substances; or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow.

(q) Working alone: Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous.

2. Working with Allergens and Embryotoxins

(a) Allergens (examples: diazomethane, isocyanates, bichromates): Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.

(b) Embryotoxins (examples: organomercurials, lead compounds, formamide): If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.

Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.

Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

3. Work with Chemicals of Moderate Chronic or High Acute Toxicity

Supplemental rules to be followed in addition to those mentioned above:

(a) Aim: To minimize exposure to these toxic substances by any route using all reasonable precautions.

(b) Applicability: These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities.

(c) Location: Use and store these substances only in areas of restricted access with special warning signs.

Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 60 linear feet per minute) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance; trap released vapors to revent their discharge with the hood exhaust.

(d) Personal protection: Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.

(e) Records: Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved.

(f) Prevention of spills and accidents: Be prepared for accidents and spills.

Assure that at least 2 people are present at all times if a compound in use is highly toxic or of unknown toxicity.

Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.

If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment.

(g) Waste: Thoroughly decontaminate or incinerate contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion.

Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles half-filled with vermiculite).

4. Work with Chemicals of High Chronic Toxicity
(Examples: dimethylmercury and nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, other human carcinogens or substances with high carcinogenic potency in animals.)

Further supplemental rules to be followed, in addition to all these mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance).

(a) Access: Conduct all transfers and work with these substances in a "controlled area": a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions.

(b) Approvals: Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor.

(c) Non-contamination/Decontamination: Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area.

Decontaminate the controlled area before normal work is resumed there.

(d) Exiting: On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.

(e) Housekeeping: Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.

(f) Medical surveillance: If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of regular medical surveillance.

(g) Records: Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.

(h) Signs and labels: Assure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.

(i) Spills: Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available.

(j) Storage: Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.

(k) Glove boxes: For a negative pressure glove box, ventilation rate must be at least two volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood.

(l) Waste: Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel.

5. Animal Work with Chemicals of High Chronic Toxicity

(a) Access: For large scale studies, special facilities with restricted access are preferable.

(b) Administration of the toxic substance: When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar air flow directed toward HEPA filters.

(c) Aerosol suppression: Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood).

(d) Personal protection: When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed because of incomplete suppression of aerosols, other apparel and equipment (shoe and head coverings, respirator).

(e) Waste disposal: Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products; otherwise, package the waste appropriately for burial in an EPA-approved site.

APPENDIX B--DEFINITIONS OF PHYSICAL HAZARDS

Following are the definitions of physical hazards as used in R 325.70103(l). All definitions except that for pyrophoric are those used in the comparable Federal OSHA standard 29 CFR 1910.1450.

(a) "Combustible liquid" means any liquid having a flashpoint at or above 100°F (37.8°C), but below 200°F (93.3°C), except any mixture having components with flashpoints of 200°F (93.3°C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

(b) "Compressed gas" means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or

(ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.

(c) "Explosive" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

(d) "Flammable" means a chemical that falls into one of the following categories:

(i) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening:

(ii) "Gas, flammable" means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) "Liquid, flammable" means any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in §1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

(e) "Flashpoint" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79))--for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100°F (37.8°C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79))--for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

(f) "Organic peroxide" means an organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

(g) "Oxidizer" means a chemical other than a blasting agent or explosive as defined in §1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

(h) "Pyrophoric" means any liquid or solid that will ignite spontaneously in air at about 130°F (54.4°C).

(i) "Unstable (reactive)" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shock, pressure, or temperature.

(j) "Water-reactive" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

APPENDIX C--DEFINITION OF SELECT CARCINOGEN

Following is an exact copy of the definition of select carcinogen from paragraph (b) Definitions of 29 CFR §1910.1450:

"Select carcinogen" means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(iii) It is listed under Group 1 "carcinogenic to humans" by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonable anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(a) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3,

(b) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(c) After oral dosages of less than 50 mg/kg of body weight per day.

APPENDIX D--REFERENCES

The following references are provided to assist employers in the development and implementation of a chemical hygiene plan. References listed here do not imply specific endorsement or approval of the material. Other references may better meet the needs of a particular laboratory situation.

A. References for Development of the Chemical Hygiene Plan.

1. American Chemical Society.
(a) Safety in Academic Chemistry Laboratories, fourth edition, 1985.

(b) Developing a Chemical Hygiene Plan, 1990., ACS, Distribution Office Dept. 404. P.O. Box 57136, West End Station, Washington, DC 20037 (phone 800-227-5558).

2. Fawcett, H.H. and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd edition, John Wiley & Sons, One Wiley Drive, Somerset, N.J. 08875-9977, 1982.
3. Flury, P.A., Environmental Health and Safety in the Hospital Laboratory, Charles C. Thomas Publisher, Springfield, IL, 1978.
4. Hearn, L.C., et al, OSHA Laboratory Standard Implementation Guide, Lewis Publishers, Inc., 2000 Corporate Blvd., NW, Boca Raton, FL 33431, 1991.
5. National Institute of Health, NIH Guidelines for the Laboratory Use of Chemical Carcinogens, NIH Pub. No. 81-2385, GPO, Washington, DC 20402, 1981.
6. National Research Council.
   (a) Prudent Practices for Disposal of Chemicals for Laboratories, 1983.
   (b) Prudent Practices for Handling Hazardous Chemicals in Laboratories, 1981. National Academy Press, Washington, DC.
7. Ouellette, R.P., et al, Safety, Health and the Lab, published in June/July 1991 issue of Environmental Lab.
8. Professional Associates in Regulatory Services, OSHA Laboratory Standard - Chemical Hygiene Plan, 1987, available from A.C.G.I.H. 6500 Glenway Avenue, Cincinnati, OH 45211-4438, phone 513-661-7881.
9. Stricoff, R.S., and D.B. Walters, Laboratory Health and Safety Handbook, John Wiley & Sons (See list No. 2), 1990.
10. Young, J.A., Ed., Improving Safety in the Chemical Laboratory, John Wiley & Sons (See list No. 2), 1987.

B. References for Hazardous Chemical Information.

1. American Conference of Governmental Industrial Hygienists.
   (a) Guide to Occupational Exposure Values.
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