

CF PAMPHLET
NO. 215-1

STATE OF FLORIDA
DEPARTMENT OF
CHILDREN AND FAMILIES
TALLAHASSEE, August 14, 1998

SAFE PRACTICE GUIDELINES FOR
OPERATING AND MAINTAINING DEPARTMENT FACILITIES AND GROUNDS

This pamphlet provides guidance to department employees in their daily duties towards the safe operation and maintenance of departmental facilities and grounds. There appears to be no limit to the progress possible through the application of universally accepted safety techniques of education, engineering and enforcement on which these guidelines are based. It shall be the objective of all department employees to become familiar and practice these guidelines. The basic document for the department safety program is CFOP 215-1.

CONTENTS

<u>Section</u>	<u>Page</u>
1. Building and Grounds	1
2. Hospital, Clinical and Laboratory Facilities	4
3. Food Service Facilities and Equipment.....	10
4. Laundry Facilities and Equipment.....	14
5. Safety Practices in Warehouses and Other Storage Areas	15
6. Boiler Operation Safety.....	19
7. Sewage and Water Treatment Plants	22
8. Refrigeration and Air Conditioning Equipment.....	25
9. Ladders and Scaffolding	27
10. Painting Practices	29
11. Electrical Safety	30
12. Color Coding and Signs	32
13. Office Safety	33
14. Health Hazards and Protection	34

BY DIRECTION OF THE SECRETARY:

(Signed original copy on file)

DENNIS L. CROFT
Assistant Secretary for
Administration

This pamphlet supersedes HRSP 215-1 dated November 1, 1979.

OPR: ASG

DISTRIBUTION: X(electronic distribution): OSES; OSLs; ASG; ASGGS; DMAS(1-15); DASGS(1-15); district institutions, if applicable. Paper copies available upon request to ASGGS.

Introduction

Chapter 440.56, Florida Statutes, requires that every employer, of which the State of Florida is the largest, shall furnish employment which shall be safe for the employees therein; furnish and use safety devices and safeguards; adopt and use methods and processes reasonably adequate to render such employment and place of employment safe; and do every other thing reasonably necessary to protect the life, health and safety of such employees.

Both management and labor have long agreed that safety and health on the job is a management responsibility. But, while each employee is obligated to comply with all guidelines and standards, final responsibility for compliance with safety requirements remains with management. Management thus shall take all necessary action to assure employee compliance with the promulgated guidelines and standards and establish within their safety system a means whereby they become aware of situations where employees are not complying with applicable guidelines and standards.

While top management has the ultimate responsibility for safety, it delegates authority for safe operations all the way down through all management levels. The supervisor is the key person in a safety program because he/she is in constant contact with employees. The safety professional acts in a staff capacity to help administer policy, to provide technical information, to help train and to supply program material.

Therefore, the guidelines and practices contained in this pamphlet are consistent with the U.S. Department of Labor's Occupational Safety and Health Standards, the State of Florida's Department of Labor Industrial Safety Regulations, the State of Florida Fire Marshal's Rules and Regulations and the National Safety Council's Accident Prevention Manual for Industrial Operations.

SUMMARY OF REVISED, DELETED, OR ADDED MATERIAL

This pamphlet has been updated to reflect the department's current organizational structure and current industry practices.

SAFE PRACTICE GUIDELINES FOR
OPERATING AND MAINTAINING DEPARTMENT FACILITIES AND GROUNDS

1. Buildings and Grounds. Unsafe conditions in buildings and on grounds are hazardous to employees, clients and visitors. Unsafe conditions can be eliminated if responsible personnel make continuous inspections of the facilities to detect hazardous areas and make prompt recommendations for correction, and insure that such corrections are made on a timely basis.

a. Fire Prevention and Control. Fire prevention will be in accordance with NFPA Standards and Rules and Regulations of the State Fire Marshal.

b. Building Maintenance. When making preventive maintenance inspections in buildings, any evidence of structural failure or deterioration shall be reported and the defects repaired at once if funds are available. If funds are not available and a condition dangerous to employees and clients still persists, the matter shall be referred in writing immediately to higher authority until a positive reply or other guidance is received.

(1) Storm Damage. Inspect for structural and exterior damage after violent storms, such as high winds, floods or other natural causes of damage.

(2) Roofs. Keep free of refuse and note potential leaks and repairs.

(3) Trusses. Inspect for loose bolts, slippage or fatigue and repair as soon as possible.

(4) Floor Joists. Floor joists that show signs of being overloaded, particularly in warehouses, shall be braced or repaired at once.

(5) Doors. Each building door shall open outward. Doors may be hinged so they will be double acting and open both outward and inward. Double acting doors shall have a see through panel.

(a) Glass doors shall have a conspicuous design, either painted or have decals attached, about four and a half feet above the floor and centered on the door so that people will not walk into them. Install safety glass in such doors.

(b) Solid doors that open directly into a passage way shall be conspicuously marked to alert persons exiting into the passageway to "open door slowly." In addition, the door shall be of the side-hinged, swinging type that will swing in the direction of exit travel and not restrict the effective width of the passageway at any point during its swing to less than 1/2 the required width specified.

(c) When systems of weights are attached to doors by ropes, cables or chains over pulleys, the weights shall be enclosed in a suitable guard or boxing for the entire length of travel.

(6) Windows. Windows designed to be opened shall be kept in good operating condition to prevent sticking. Repair or replace broken windows as soon as possible.

(7) Stairs. Falls suffered by personnel on stairs are the most common of all building accidents. Falls are usually caused by undue haste, carrying things, poor stair illumination, items on stairs and defective and improperly designed steps. A stairway shall not be constructed less than 30 degrees or more than 50 degrees from the horizontal. Where an existing slope is less than 30 degrees, a ramp shall be installed. A tread width of not less than 9 1/2 inches and one-inch nonslip is recommended. The riser height shall be no more than 8 nor less than 5 inches, and it shall be constant for each flight. All stairs, landings and platforms shall be of sufficient strength to sustain safely a live load of at least 300 pounds per square foot.

(a) Keep stairs and steps clean and free of obstacles or slippery substances at all times.

(b) Posters, bulletin boards and other objects that could distract a person's attention shall not be placed in stairwells.

(c) Stair surfaces shall be kept in good repair. Loose boards, insecure, torn or worn treads shall be repaired or replaced immediately. Slippery or worn treads shall either be replaced or made safer by coating them with nonslip surfacing materials.

(d) Treads and risers shall be of uniform size. The use of open risers shall be avoided when possible.

(e) Stair nosing shall be securely fastened and rounded or beveled to prevent personnel from catching their heels on the treads.

(f) Handrails shall be provided on all stairs having four or more risers. Place rails at both sides of stairs wider than 44 inches. In addition to end rails, a center railing shall be installed on stairs wider than 88 inches. All stair railings shall be strong enough to withstand a thrust of 200 pounds at any point along the top of the rail. Where stairwells are open, an intermediate railing between stairs and handrail shall be installed.

(g) Handrails will be smooth surfaced the full length of the stairwell. Place rails so the top of the rail is from 30 to 40 inches above the treads.

(h) Where there is less than 7 feet of headroom over stairs, suitable warning signs shall be posted or the overhead obstacle clearly painted in contrasting colors.

(i) Both interior and exterior stairways shall be clearly visible.

(j) Each ramp shall be made of nonslip construction or surfaced with nonslip materials.

(8) Floors. Slippery floors are sources of personnel injury and shall either be repaired or covered with nonslip materials to make them safe.

(a) The maximum allowable loading per square foot shall be prominently displayed in all storage areas. The weights of hoist and other equipment suspended from under a floor, shall be considered when determining the floor's safe load limit.

(b) Floor openings shall be guarded by railings and toeboards unless fully protected by other means.

(c) Loose or defective flooring shall be repaired and objects that could trip a person and cause a fall shall not be allowed to accumulate on floors.

(9) High Obstructions. Chimneys, water towers and other high obstructions, that violate airspace criteria shall be painted in the proper color code and equipped with appropriate warning lights. Lightning protection systems will be provided on each high object. Chimneys and stacks shall be inspected frequently for corrosion and other defects that could cause them to collapse. Wire braces and guy wires will be properly placed and kept under proper tension. The vertical clearance between guy wires and surfaces where vehicles may travel shall be a minimum of 18 feet.

c. Grounds. Roads and walkways at facilities shall be kept clear, in good repair and well defined. Lighting shall be provided where necessary for pedestrian and vehicle safety.

(1) All construction work on facility grounds shall be clearly identified by signs and protected by barriers suitably marked with reflective materials and illumination for easy sighting after dark.

(2) Electric lines, wires and similar obstructions strung less than seven feet above the ground shall be clearly marked. Normally, low hanging wires will be of a temporary nature only and shall never be located over roads or walkways. If it is necessary to have such temporary low hanging obstructions, particular care will be taken to avoid their being touched by passing vehicles or personnel. Electric lines will be elevated enough to clear traffic or be buried underground.

(3) Open drainage ditches near employee housing, school areas and other locations where children may be present, shall be guarded by fences or other protective devices to prevent children from accidentally falling in. Closed drainage is preferred and shall be provided when possible. All open ditches that present any kind of hazard will be effectively illuminated at night, identified by day or suitably guarded.

(4) Grass Cutting. During the growing season, frequent lawn mowing and edging is necessary to keep facility grounds in good and attractive condition. For convenience and efficiency, power mowers and edgers are used to a great extent. The safe procedures for using different types of power lawn mowers and edgers are as follows:

(a) Before any power mower or edger is used, it shall be inspected to determine its safe operating condition. Mowers and edgers in need of repair shall not be used. Only trained personnel shall be permitted to operate power mowers and edgers without supervision. On-the-job training may be used to train operators if a qualified and experienced operator supervises the training.

(b) Mower blades shall be adjusted to cut grass high enough above the ground to avoid hitting unseen objects that could damage the power mower or injure the operator or other persons nearby. Never set mower blades lower than 1 1/2 inches above the ground. Mower blades shall not extend below the bottom edge of the housing.

(c) Adjustments or repairs shall never be attempted while the mower or edger is running. Operators attempting adjustments or repairs shall be careful to prevent accidentally starting the engine. They shall:

1. Disconnect the ignition wires as the engine could start if the blades are turned while the engine is hot.

2. Take no chances and keep guards installed. If the mower is not equipped with adequate safety skirts around the blades, shop modifications shall be authorized to provide these guards.

(d) When operating power mowers, street type shoes will be worn. Sandals, thongs, etc., will never be worn when performing maintenance duties. Power mower and edger operators are always susceptible to flying rocks, dirt and so forth. Eye protection such as safety goggles, glasses or shields shall always be worn.

(e) Be sure the mowing area is clear of all debris. Because of the clearance needed between the mower housing and the ground for satisfactory operation, the suction effect caused by the blades is sufficient to pick up debris and hurl it outward.

1. Mow in a forward direction at all times, if possible. When it is necessary to mow backward, operators shall not lift the rear of the mower.

2. Take particular care when mowing or edging over uneven ground.

(f) Gasoline for lawn mowers and edgers shall be kept in safety cans plainly lettered "gasoline." A maximum of five gallons shall be allowed on hand during cutting operations and shall be kept isolated from all sources of ignition or flammable materials. Re-fuel gasoline powered mowers and edgers outside buildings after the mower has had time to cool. All sources of ignition shall be kept clear during fueling. Never smoke while handling gasoline!

(g) The power cable operating electric lawn mowers and edgers must be three-conductor equipped with an effective low-resistance ground wire connected between the housing and the bonding or neutral ground point. This type of mower or edger shall not be used when the ground is wet or damp. Electric mowers or edgers shall not be stored in damp areas.

d. General Housekeeping. Good housekeeping is essential to accident prevention. This is the responsibility of all department personnel. The quality of cleanliness and orderliness reflects the overall efficiency of an organization. In addition to being accident and health hazards, poor housekeeping also contributes to fires. Supervisors are responsible to insure that subordinate employees maintain high standards of orderliness and housekeeping in their respective areas.

(1) Suitable metal containers shall be used to store scraps and waste as they accumulate. These containers shall be emptied at least once daily or removed to safer locations outside buildings for scheduled pickups.

(2) Plainly marked metal containers with self-closing lids shall be provided for the disposal of combustible wastes, rags and other flammable materials. Rags and other flammable materials shall never be deposited in direct-fired space heaters. The same type of properly marked containers shall be used for storing clean rags and the disposal of noncombustible wastes.

(3) Oil, grease and other substances spilled on floors are not only fire hazards but are also slipping hazards. When spills do occur, clean them up immediately with approved cleaning materials. Only approved, noncombustible absorbents shall be used to dry up spills of flammable materials.

(4) Never clean floors with flammable liquids! When toxic cleaning agents are used, adequate ventilation shall be provided to remove vapors.

(5) Appropriate nonskid wax or non-slip materials shall be used in any location where slipping is prevalent.

(6) Electric buffers shall be equipped with a three-wire grounding cord and three-prong plug.

(7) Keep projections to a minimum. Ceilings shall be kept in good repair, free of loose plaster and paint that could fall.

(8) All aiseways shall be clearly defined and free of hazardous obstructions.

(9) Badly lighted areas are breeding grounds for poor housekeeping and accidents. Machinery, workbenches, aisles, stairways and rooms shall be adequately lighted. If fluorescent

lighting fixtures do not contain a tube locking device, they shall be provided with shields or clamps to prevent tubes from falling.

(10) Suitable waste receptacles shall be provided where electrically-operated vending machines are located. Electrically-operated vending machines shall always be grounded by using a three-conductor power cable with grounding plug and shall not be installed in areas where explosive gases or vapors are present, unless the equipment is designed for such purposes.

(11) Personnel clothing lockers shall be made of metal, adequately ventilated and kept in a clean and orderly condition. Clothing or materials that are contaminated with flammable substances shall never be placed in lockers because spontaneous combustion may occur.

(12) Good housekeeping practices also shall be observed for operations performed outdoors.

(a) Do not store materials under or piled against buildings, door or exits or under stairways.

(b) Do not permit extraneous plants and weeds to grow excessively or to accumulate near buildings. Such growths greatly increase the possibility of fire.

(c) Keep areas under loading docks free of waste materials, scrap paper and other windborne debris.

(d) Keep walks clear of obstructions that could cause tripping or be a slipping hazard.

2. Hospital, Clinical and Laboratory Facilities. The complexity of the hazards associated with some of the treatment techniques, diagnostic methods and specialized equipment has resulted in a substantial number of related safety problems within a hospital facility. The task of providing a safe environment for the patient, medical staff and visitors is not a simple one. Specific standards for various hospital departments are in this section. These are minimum standards and are not to be considered a complete list. These standards shall be supplemented locally, giving consideration to individual operations.

a. Fire Protection. Persons physically or mentally disabled are entitled to receive the highest degree of fire protection possible. Therefore, fire prevention programs in health care facilities must receive appropriate emphasis. Fire prevention in all department institutions will comply with the National Fire Protection Association (NFPA) Life Safety Code 101 and Rules and Regulations of the State Fire Marshal.

b. Electrical Safety.

(1) The use of extension cords shall be minimized in patient care areas. If extensions are necessary, they will be heavy duty, three-conductor cable with UL approved fittings. Two-wire extension cords are prohibited in any patient care area. Extension cords of any type are prohibited in areas designated for use as anesthetizing locations.

(2) Three to two-prong electrical adapters and multiple plug adapters are prohibited except when used by qualified electronic or electrical technicians in the performance of essential test and maintenance procedures.

(3) All electrical equipment used in patient care areas shall be appropriately grounded.

(4) Damaged plugs, receptacles and power cords shall be immediately removed from use.

c. Piped Oxygen and Nitrous Oxide. Piped oxygen and/or nitrous oxide systems will be installed in accordance with National Fire Protection Association Standards. Key requirements that shall be periodically checked are as follows:

(1) Doors or gates to enclosures for the gas supply systems shall be locked.

(2) Enclosures for gas supply systems shall never be used for storage purposes other than for cylinders containing the nonflammable gases which are to be distributed through the pipeline. Storage of empty cylinders disconnected from the supply equipment is permissible. Empty cylinders shall be segregated and identified. Full cylinders not in use shall be capped and secured in a vertical position by a chain or similar device. Cylinders connected to a manifold shall also be secured. Plumbing (tubing and so forth) to the manifold will not suffice for this purpose.

(3) Smoking is prohibited in the gas supply system enclosure. Post "No Smoking" signs in appropriate places.

(4) Operations and emergency alarm systems and pressure gauges shall be located to assure continuous responsible surveillance. Each signal and gauge will be appropriately labeled. Write and post local operating instructions for actions required to be taken upon activation of these alarms.

(5) The gas content of pipelines shall be readily identifiable by appropriate labeling with the name of the gas contained. Labels shall appear on exposed pipe at intervals not less than 20 feet and at least once in each room and story traversed by the pipeline.

(6) A pressure relief valve set at 50 percent above normal pipeline pressure shall be located downstream of the pressure regulating valve and ahead of any shut-off valves in the central oxygen system.

(7) Piping systems for gases shall not be used as a grounding electrode.

(8) Each oxygen shut-off valve accessible to other than authorized personnel shall be labeled as follows:

CAUTION - OXYGEN VALVE
DO NOT CLOSE EXCEPT IN EMERGENCY
THIS VALVE CONTROLS OXYGEN SUPPLY TO _____.

(9) Each station outlet for oxygen or nitrous oxide shall be equipped with either a manually-operated or automatic shut-off valve labeled with the name of the gas.

(10) Each pressure gauge and manometer for oxygen, including gauges applied temporarily for testing purposes, must be those manufactured expressly for the gas and labeled: OXYGEN - USE NO OIL.

d. Autoclaves and Sterilizers.

(1) Steam autoclaves and sterilizers may be found in various locations within a medical facility. The following safety rules apply.

(a) Accomplish preventive maintenance strictly on schedule.

(b) Maintain safety relief valves and sealing gaskets in good condition.

(c) Do not open sterilizers until steam pressure has dropped to zero. Never use steam pressure to blow open a stuck door.

(d) Restrict use of autoclaves to trained personnel.

(2) Ethylene oxide sterilizers present both toxic and fire hazards and will be operated only by personnel well trained in their use. Aeration of sterilized materials for a period adequate to reduce residual ethylene oxide contamination is of critical importance. Aeration cabinets designed for this purpose shall be utilized. Personnel responsible for conducting ethylene oxide sterilization/aeration shall be thoroughly familiar with recommended minimum aeration time for various materials. Maintain a copy of the manufacturer's recommended aeration time schedule in the immediate area of the sterilizer. Sterilizers utilizing 100 percent ethylene oxide shall be vented to the exterior of the building. Venting of these units to the interior of the building (for example, into a moistened sponge) is unacceptable. Ethylene oxide sterilizers shall be located so as to minimize the length of exterior vent lines. In no case may vent lines deviate from the manufacturer's recommended specifications for vent line diameter, length, vertical rise or material.

e. Laboratory Safety.

(1) Personnel Practices.

(a) Eating, drinking, smoking and the application of cosmetics within the laboratory is prohibited.

(b) The use of a pipette for measuring and transferring infectious or toxic fluids by mouth is prohibited.

(c) Wrist, jewelry, watches and rings shall not be worn when handling infectious materials.

(d) Avoid hand-to-hand motions, when working with infectious or toxic materials.

(e) Contact lenses shall not be worn in the laboratory.

(2) Procedures and Equipment. The following safety practices shall be followed by laboratory employees when working with laboratory materials and equipment:

(a) Work with flammable or toxic materials shall be conducted in exhaust, ventilation hoods. The nature of the work being done will determine the type of hood required. In general, the hood exhaust system shall operate independently of the general ventilation system and have its own air supply. Fume hoods will meet the following requirements:

(b) Hoods shall be located away from doors and windows in areas of minimum air turbulence.

(c) Glazing will be of laminated safety glass.

(d) Fume hoods shall be designed to prevent backflow of contaminants into the room. The ventilation system shall provide a minimum face velocity of 100 feet per minute. For new installations, a design face velocity of 125 feet per minute shall be specified.

(e) Shut-off valves for services, including gas, air, vacuum and electricity, shall be located outside the hood enclosure.

(f) Exhausts from hoods in which highly infectious materials are processed shall pass through high efficiency (99.7%) filters before discharging to the atmosphere.

(g) Eyebaths and emergency showers, or equivalent devices, shall be located within the laboratory convenient to work stations utilizing corrosive liquids (acids, and so forth). Minimum requirements for the shower can be met with a simple hand held spray device permanently connected to a water supply. Floor drains shall be provided in the area. Do not locate electrical devices near the drainage area so as to exclude an electrical shock hazard to anyone using the shower.

(h) Supplies of hazardous chemicals within the laboratory shall be kept to a minimum. A week's supply or the smallest unit container stocklisted is considered reasonable. All containers shall be clearly labeled. Separate hazardous chemicals from nonhazardous materials. Take care to segregate chemicals that react violently when mixed together, such as the following:

1. Ammonia and mercury.
2. Chromic acid and certain organics.
3. Nitric acid aniline, organics.
4. Chlorine and ammonia, hydrogen, metal powders.
5. Oxidizers with most metal powders, flammable liquids.
6. Alkali metals and water.

(i) Keep storage levels of flammable or combustible liquids to a minimum. Not more than 10 gallons or one week's supply (whichever is less) of flammable and/or combustible liquids (aggregate capacity) shall be maintained within the laboratory. These liquids will be used from and stored in the manufacturer's original container or an approved safety can and properly labeled. Laboratory storage areas for small quantities of these liquids shall be ventilated and away from all heat sources. Wooden or metal cabinets may be used. Flammable liquids shall never be stored in refrigerators as a means of preventing waste through evaporation. If refrigeration is necessary to control reaction rates or other similar operations, and no convenient alternative exists, storage of liquids in well-sealed containers is permissible in explosion-proof refrigerators. Each refrigerator shall be labeled on the outside of its doors to denote whether or not flammable liquids are being or may be stored. If more than 10 gallons of flammable or combustible liquids must be maintained within the laboratory, an approved storage cabinet shall be provided.

(j) Use of flammable gases in conjunction with laboratory equipment such as flame photometers shall be according to NFPA Standards.

(k) Centrifuges shall be covered when operated. Centrifuge tubes will fit the metal buckets and be free of defects or cracks. Cushions at the bottom of the cups shall be in good condition.

(l) Dewar flasks shall be taped to guard against breakage.

(m) Bunsen burners shall not be left burning unattended. They shall never be used to heat flammable liquids. Heavy tubing shall be used to connect the burner with the gas jet. Thin-walled rubber (surgical) tubing shall not be used since it is easily collapsed by a sharp bend or weight.

(n) Microtomes shall never be left unattended with blades in place. When not in use, store blades in appropriate containers. When in use, exposed blade edges other than the actual

cutting surface shall be guarded. Simple guards can be locally constructed from segments of rubber tubing slit lengthwise.

(o) All electrical heating equipment shall be equipped with over-temperature shut-off controls.

(p) Asbestos gloves, beaker and crucible tongs and test tube holders shall be available for handling hot items.

f. Radiology. All x-ray facilities and equipment (including dental) shall be maintained by qualified personnel.

(1) Collimation of the useful beam to the smallest size necessary for the diagnostic procedure shall be enforced by the person in charge. Collimators shall be checked for accurate beam size control and alignment during routine safety inspections. X-ray technicians can easily accomplish this check by exposing a single film with the beam size limited to less than the film size and centered. A simple comparison of the image produced against that which was desired will indicate accuracy. Facilities utilizing collimators with beam defining lights shall have the capability to dim the overhead lighting to allow accurate alignment of the light field.

(2) Leaded aprons and gloves shall be in good condition. Provide racks to hang aprons when not in use. Aprons shall not be folded as sharp creases result in cracks.

(3) Positioning locks and motion limiters for x-ray equipment shall be maintained in good working condition. Malfunctioning locks and limiters shall be reported to medical maintenance immediately.

(4) Counter-balance systems (weights, pulleys, cables and springs) shall be checked on a semiannual basis by medical maintenance personnel.

(5) Overhead movable x-ray equipment and cables shall be positioned out of the way when not in use.

(6) Doors, leading to x-ray exposure rooms shall be labeled "X-RAY EXPOSURE ROOM, KNOCK BEFORE ENTERING." Keep doors closed during exposure.

(7) Leaded drapes and the bucky slot shield on fluoroscopy units shall be maintained in good condition. Leaded drapes shall be easily positioned and the bucky shield shall effectively cover the entire slot.

(8) Good housekeeping is especially essential since a considerable amount of work is done under low levels of illumination.

(9) Portable x-ray equipment shall be stored to prevent unauthorized use. A leaded apron for the operator shall be kept with the machine. When the machine is transported, the tube head shall be in a lowered position.

g. Surgery. Locations employing inhalation anesthetics (flammable and non-flammable) shall conform with National Fire Prevention Association Standards. Key requirements that shall be checked on a periodic basis during safety inspections shall include, but not limited to, the following:

(1) The relative humidity in anesthetizing locations shall be maintained above 50 percent.

(2) An isolated electric power supply shall be provided for each anesthetizing location.

(3) Conductive flooring shall be provided in each flammable anesthetizing location. The electrical conductivity must be checked frequently. The resistance of conductive floors shall be less than 1,000,000 ohms and more than 25,000 ohms as measured between two electrodes placed 3 feet apart. No single location shall have a resistance of less than 10,000 ohms or greater than five megohms. Records of these tests shall be maintained.

(4) Conductive footwear shall be worn in anesthetizing locations. Resistance of the footwear shall not exceed 500,000 ohms.

(5) Silk, wool, synthetic textile materials, blends of synthetic textile materials with unmodified cotton or rayon, or non-woven materials shall not be permitted in anesthetizing locations unless such materials have been tested and found antistatic.

(6) Portable electrical equipment used in flammable anesthetizing locations shall be "explosive-proof." Furniture shall be constructed of electrically-conductive material and grounded.

(7) Flammable anesthesia equipment shall not be covered. Covers may confine leaks, producing an explosive atmosphere that could ignite when the cover is removed.

h. Pharmacy.

(1) Drugs stored within the pharmacy and throughout the hospital, shall be under the supervision of the pharmacy supervisor. Areas where stored shall be clearly identified and posted with signs indicating the limited access or secure nature of such locations.

(2) Each drug preparation area shall be well lighted. An illumination level of at least 50-foot candles shall be maintained on working surfaces.

(3) Disinfectants and drugs for external use shall be stored separately from internal and injectable medications. Also, poisons shall be segregated from therapeutic agents.

(4) All drugs shall be labeled including the addition of appropriate accessory or cautionary statements, as indicated. No unidentified or outdated substances shall be permitted in the pharmacy.

(5) Supplies of flammable liquids shall be kept as small as possible. If more than 10 gallons (aggregate total) must be maintained, a storage cabinet, shall be provided.

(6) Heavy and/or bulky items shall be stored on lower shelves. If storage space above six feet is utilized, suitable step ladders shall be provided. Chairs, boxes and so forth, shall not be used as substitutes for ladders.

i. Nursing Units.

(1) Good housekeeping is essential; spills shall be wiped up immediately.

(2) Patients shall always wear shoes or slippers when walking.

(3) Side rails on beds shall be used judiciously. Use in conjunction with the following types of patients is considered good practice:

(a) Newly operated patients.

(b) Confused/disoriented or senile patients.

(c) Children.

(d) Patients that have received a sedative, narcotic or barbiturates.

(4) Adjustable beds shall be maintained in the low position unless otherwise needed. Bed wheels shall be locked.

(5) Litter straps must be used when transporting patients.

(6) Evacuation procedures shall be explained to patients. Evacuation plans must consider procedures for patients requiring assistance to be moved (e.g., patients in traction, and so forth). Checks shall be made to determine if wheelchairs and beds will pass through ward doors. These procedures must be practiced using substitutes for patients. Elevators shall never be considered a primary means of egress during fire emergencies.

(7) Personal electronic devices (heating pads, TVs, radios, shavers, and so forth) shall not be permitted in patient locations where oxygen is being administered.

(8) Hot water bottles shall be inspected for leaks before use. Hot water temperatures shall not exceed 130° F. for adults and 120° F. for children.

(9) Hot water vaporizers that produce a "hot-mist" are hazardous and shall not be used in patient care areas. Those vaporizers that are designed to keep water in the storage tank below 130° F. and produce a "cool-mist" are considered safe for use.

(10) "No Smoking" shall be strictly enforced where oxygen is used or stored.

(11) Grab bars shall be strategically located in patient bathrooms. Nonskid strips shall be installed in patient showers and bathtubs. Nurse call or panic-light systems shall be installed and appropriately identified in patient bathrooms.

(12) Light cradles/infrared lamps shall not be used unless someone is in attendance. Only 25 watt bulbs shall be used in light cradles; the bulb shall be kept at least 18 inches from the patient.

j. Medical Material.

(1) All medical supplies shall be clearly labeled.

(2) Flammable/combustible liquids and gases shall be stored in accordance with Rules and Regulations of the State Fire Marshal.

(3) The handling and storage of compressed gas cylinders is described in paragraph 5d(9).

(4) Heavy, bulky items shall be stored on lower shelves. If storage above six feet is required, appropriate ladders shall be provided. Shelves shall not be overloaded. Where possible, they shall be clearly marked or identified with load limits.

(5) Medical maintenance workshops are typical of other shops and shall conform to all applicable safety standards published throughout this pamphlet.

k. Dress Requirements for Accident Prevention. Employees involved in certain activities, particularly in those areas where the employees deal directly with aggressive or potentially aggressive clients/patients, shall wear suitable clothing to avoid possible injury or reduce the severity of the injury, should an incident occur.

(1) Hair shall be kept close to the head; braids, pony tails and other hair styles help. Wigs, hats and other head coverings will also prevent or reduce the severity of an injury from hair pulling.

(2) Employees with pierced ears shall not wear hoop or long dangling earrings.

(3) Neckties, scarves and medium to heavy necklaces shall not be worn.

(4) Clothing shall be sturdy and fit properly. Loose clothing is an advantage for the aggressor. It hinders employees from moving quickly and can be easily grabbed by the client/patient.

(5) Clogs and various type sandals shall not be worn. The type of shoes recommended are those that are sturdy, enclose the feet completely and have a flat heel with non-skid soles.

l. Miscellaneous.

(1) Many patients being treated in physical therapy units are on crutches or have difficulty in walking; therefore, floors shall have "non-skid" properties. Spills shall be wiped up immediately.

(2) Electrical wall outlets in pediatric clinics, pediatric waiting rooms and pediatric nursing units shall be of the "child-safe type" or covered when not in use.

(3) Storage cabinets in pediatric clinics containing hazardous materials, including strong cleaning agents, shall be kept locked.

(4) Toys maintained in pediatric clinics and waiting rooms shall be safe and kept in good condition. Electrical "plug-in" toys or toys which produce sparks are prohibited. Toys banned by the Consumer Product Safety Commission shall not be used.

(5) Incinerators shall be used only for their intended purpose and conform with existing pollution abatement criteria. (Check with Department of Health, Division of Environmental Health Services for approval.) Use of the incinerator shall be restricted to authorized personnel only. When not being used, the incinerator room or controls shall be locked to prevent unauthorized use.

(6) Polishing, grinding and other similar operations in dental laboratories shall be properly ventilated. Division of Environmental Health Services shall evaluate the effectiveness of ventilation systems for these operations.

(7) Food service facilities shall conform to the requirements on page 9.

(8) Soiled and contaminated linen shall be bagged at the source of use. Personnel handling contaminated linens shall wear gowns and surgical masks. These linens shall be transported in covered carts used exclusively for that purpose. Cart liners shall be laundered frequently.

(9) Local written policy shall be developed for the safe handling, storage and disposal of needles, syringes, and other sharp objects (scalpel blades, razor blades, and so forth).

(10) Occupational therapy operations shall conform to the requirements in CFP 215-2 regarding industrial practices and the use and maintenance of tools and machinery.

(11) The hot water supply shall be regulated by thermostatic control or other device so that the temperature of water commonly used by patients or visitors does not exceed 130° F. Control devices shall be inaccessible to patients and the general public.

3. Food Service Facilities and Equipment. There are numerous hazards to which food service personnel are exposed. These include sharp handtools, specialized machines and hot materials. The use of unskilled workers as kitchen help increases the possibility of unsafe acts. Control of this factor demands constant and alert supervision on the part of responsible supervisory personnel. An effective approach to this control is proper and adequate worker instruction; thus, safety training regarding the

hazards involved in different food service operations is essential and shall be conducted on a regular schedule.

a. Sanitation. Cleanliness is of prime importance in preparing and handling food. Proper sanitation begins with kitchen and dining facility layout and design. Plans and specifications for food service facilities shall include provisions to prevent the accumulation of wastes, poisons and/or other substances that may contaminate food. Food will not be stored in food preparation areas. All cooking and eating utensils shall be stored properly to prevent their being contaminated. Floors shall be made of durable, nonabsorbent materials that can be easily cleaned. Doors and windows shall be screened.

b. Proper Housekeeping. Good housekeeping is essential to safe food service operations. Supply storage areas and facilities shall conform to pertinent specifications covering kitchen equipment storage needs.

(1) Mops, brooms, buckets and brushes shall be kept in well-ventilated, designated locations to prevent unsanitary conditions and the possibility of fire from spontaneous combustion. Mops and scrub pails shall be equipped with mechanical wringing devices to prevent scalds that can result from hand-wringing mops saturated with hot water. Mops shall be hung with head down.

(2) Floors shall be properly maintained at all times.

(a) Uncarpeted food service area floors shall be scrubbed with soap or detergent and hot water. Floors shall be cleaned in small sections to avoid large slippery areas.

(b) Carpeted floors shall be vacuumed once each shift and shall be cleaned monthly.

(c) Wood or composition floors shall be protected by frequent applications of nonskid waxes and then properly polished. Use disinfectants or germicidal cleaners as often as necessary to insure sanitation.

(3) Spills of food or other substances shall be removed immediately to prevent slippery floors.

(4) Broken glass or china shall be swept up at once and placed in special containers provided for this purpose. Do not use cracked or chipped dinnerware.

(5) Kitchen and dining area grease traps shall be cleaned frequently.

(6) Overhead exhaust ducts, room fixtures, open beams and other areas where dirt could collect shall be cleaned regularly.

(7) Metal containers shall be provided in dining facilities for storing soiled linen of all types. Do not locate drying racks for towels, hot pads and other kitchen accessories near open fires or hot surfaces.

(8) Where smoking is permitted in dining halls, ash trays or other suitable containers shall be conveniently located for disposal of cigarettes and ashes.

(9) In areas around kitchen equipment where water is spilled and for practical reasons cannot be eliminated, nonslip materials shall be used to prevent personnel from slipping.

(10) Cellulose sponges shall be used, in preference to cloths, for wiping or cleaning small areas, particularly around machinery.

(11) Standard low heel, slip resistant shoes shall be worn by all food service personnel.

c. Proper Handling of Food Containers. Kitchen personnel shall always make certain the way is clear before attempting to carry hot containers from one place to another. Use pads, potholders, or other insulated hand guards to carry hot pans and kettles.

(1) Kitchen personnel shall not attempt to carry receptacles that are too heavy. Assistance or carts shall be obtained when objects too heavy for one person are to be carried. Give due consideration to changes in the center of gravity caused by liquids shifting in containers.

(2) Never carry containers of hot liquids or foods by hand across greasy or slippery floors.

(3) Stands or tables shall be used to hold receptacles for hot foods being transferred from other containers by dipping.

(4) Frequently inspect the handles of all cooking utensils and containers for defects that could cause personnel to spill hot foods or liquids.

(5) All pots and pans with long handles shall be placed on stoves with the handles parallel to the edges of the stoves. This will prevent personnel from accidentally tipping the handles and spilling the hot contents.

(6) Each hot water and steam line entering kitchens shall be insulated to protect personnel against burns by accidental contact.

d. Food Preparation Machinery and Equipment. All electric kitchen equipment and machinery shall be effectively grounded. Wet floors in dining halls and kitchens increase both the possibility and extent of electrical shock to personnel.

(1) Machinery shall always be operated according to the manufacturer's instructions and pertinent safety codes. Control switches shall be located so operators can start or stop machines without moving or having to reach across the point of operation.

(2) Only fully trained, authorized personnel shall operate slicing, grinding, mixing or other food-processing machines.

(3) The following standards govern the guarding of slicers, cutters, choppers, meat saws and other food-cutting machinery. All kitchen equipment shall be cleaned immediately after use.

(a) On slicers that are not equipped with automatic feeds, operators shall use pusher devices to feed the machines. Reciprocating blade slicers shall be equipped with limit switches to prevent the machines from operating when knife head covers are open.

(b) Suitable covers shall be provided on each cutter and chopper to prevent operators from touching the blades.

(c) Meat and band saws are difficult to guard, because of the large portion of the blade that must be left open to accommodate varying thicknesses of meat. The wheels and return sides of blades shall be completely enclosed. The cutting portion of the blades shall be fitted with an adjustable sliding guard that will protect the point of cutting as much as possible. Saws shall never be allowed to continue running unattended.

(d) Food or meat grinders shall be guarded so operators' fingers cannot come in contact with the worms. The necks providing access to the worms shall not be more than 2 1/2 inches in diameter at the top. Neck openings shall be at least 4 1/2 inches above the worm. Under no circumstances shall gratings be used with openings wider than 2 1/2 inches. Metal pushers may be used for pressure feeding grinders; wood pushers may splinter and shall not be used. Operators will be able to "inch" grinders by using the control switches. Locate each control switch so that operators can reach them without exposing any part of their bodies to danger. Chutes leading to hoppers are effective means of feeding machines and preventing operators from reaching into rollers. Before cleaning food grinders, operators shall lock control switches in the "off" position.

(e) Mixers fitted with covers shall be equipped with interlocking devices that will prevent the machines from running unless covers are securely in place.

(f) Ice crusher containers or receivers shall always be emptied before "backups" or "chockups" in crushers are created. Ice service personnel will use appropriate protective equipment during the ice handling operations.

e. Refrigeration Equipment and Systems. All dining facility refrigeration systems that use toxic or flammable refrigerants under pressure shall be installed and maintained according to the safety code for mechanical refrigeration. Adequate ventilation shall be provided to prevent dangerous concentrations of toxic or flammable gases around refrigeration equipment.

(1) Operating instructions for emergency shut down of refrigerating equipment shall be posted outside compressor rooms.

(2) Refrigerator doors for walk-in refrigerators and cold storage rooms shall be equipped with at least one door than can be opened from the inside. When doors must be locked from the outside, permanent signs shall be mounted on the doors. These signs shall read: "DETERMINE NO ONE IS INSIDE BEFORE LOCKING DOOR," in at least three inch letters.

(3) When meat hooks are not in use, store them in containers or place them on racks with the points turned away from working areas.

(4) Monorail conveyers shall be installed according to standard engineering practices. Under no circumstances shall loads heavier than design specifications be allowed to be placed on

monorails. Tracks and supports shall be inspected frequently to detect signs of weakness or wear. Rail joints shall be kept tight and level to prevent derailing of trolleys.

f. Food Service Accessory Cleaning. Floors around dishwashing areas shall be sloped toward drains to remove spilled water. Automatic conveyor-type dishwashers shall be equipped with curtains to prevent water from spraying outside the machines. Each open shaft and drive mechanism shall be properly guarded to prevent personnel hazards. Loaded trays shall be pushed, not lifted, into dishwashers. Operators shall be careful not to overload washing trays and baskets. The best results will come when trays are loaded according to operating instructions. When washing kitchen utensils by hand, personnel shall keep the wash water at safe temperatures.

g. Handling of Cutting and Slicing Equipment. Knives, more than any other single source, cause injuries in food service operations. When not in use, knives and other sharp-blade instruments shall be stored in racks or drawers in such a way that the blades will be completely enclosed or protected. Cadmium-plated knives shall never be used in food operations. Knives shall be fitted with guards to keep operators' hands from accidentally slipping down onto the blades. No knives used in kitchens shall be fitted with round handles; slippery handles can be made safe by scoring the surfaces. Metal mesh gloves shall be worn by dining hall personnel during manual cutting operations, particularly those involved in meat processing. These gloves shall be washed immediately after use or as often as necessary, but never less than twice daily. Metal mesh gloves shall never be worn by power saw operators. Specially designed and approved safety aprons shall be worn by personnel engaged in any boning, cutting or meat slicing operations to prevent injuries from slipping knives.

(1) Steels, used for sharpening knives, shall be guarded at the handles by metal, leather, or stiff rubber disks at least two inches in diameter. To sharpen a knife on a grindstone, the butcher shall hold the knife firmly in one hand, with the cutting edge away from the body. The other hand will be used to apply pressure and guide the blade.

(2) Sheaths, scabbards, or pouches shall be used to carry knives on the person. These holders shall be made of sturdy materials that can be easily washed and sterilized.

(3) Knife holders shall be built into work tables and meat blocks to prevent accidental contact with the cutting edges. Food service facility supervisors will enforce safety rules covering the use, care and storage of knives and shall make certain that all safeguards and protective equipment are used.

h. Handling Heavy Food Packages and Containers. Boxes and crates in dining areas shall be handled and stored according to accepted safety standards. Mechanical handling equipment will be used to move heavy or bulky packages. Boxes or crates bound with steel straps shall not be carried by these straps. Use cutters to remove straps; never bars, claw hammers, chisel, or other similar tools. When cutting steel straps, the person doing the cutting shall always wear a face shield and gloves and use his free hand to hold the strap to prevent the cut ends from flying loose.

(1) When wire bound or nailed boxes are opened, the wire ends shall be bent back and nails removed.

(2) Paper cartons that are not to be used a second time, shall be opened with protected blade safety cutters. When paper cartons are to be reused, open them with a flat steel bar.

i. Safe Operation of Steam Equipment and Accessories. Steam equipment must be operated within the safety limits prescribed by the manufacturer. Inspect kitchen steam equipment and all system components, regularly. Safety valve outlets shall be faced away from working areas so steam discharges will not endanger personnel. Pressure reducing valves shall be replaced only with valves of the same type and rating. Hand operated steam bypass valves for emergency are prohibited. If mechanical agitators are not provided on steam cookers, wooden sticks or paddles shall be used for stirring contents. Care shall be taken when stirring to avoid denting the insides of steam jacketed cookers.

(1) Canopy hoods and exhaust systems shall be installed over steam equipment to remove cooking vapors. The exhaust systems shall be designed to provide minimum air velocities of 150 feet per minute over the entire faces of the hoods. Exhaust hoods shall be cleaned frequently to prevent accumulations of flammable greases.

(2) Steam kettles shall be completely drained of water before steam valves are opened. The valves shall be opened slowly to avoid sudden expansion as steam enters the equipment.

(3) Steam kettles shall never be filled to a point where splashing will occur when the contents are stirred. Install splash guards to prevent operators from being scalded.

(4) Electrical fixtures near steam equipment shall be of vapor-proof types to prevent electrical shock or short circuits caused by moisture.

(5) Exposed steam lines shall be covered with a heat resistant material to protect against burns caused by accidental contact.

j. Soaps, Detergents and Other Cleaning Compounds. Soaps and cleaning compounds shall be plainly marked and stored in locations where they cannot be mistaken for food containers. Industrial soaps that are irritating to the skin, shall not be used by kitchen personnel as hand cleaners or toilet soaps. Use mild germicidal or toilet soaps.

k. Cooking Equipment. Each stove and range in food service facilities shall be installed according to manufacturer's instructions. They shall be located away from combustible materials or be protected by fire resistant shields.

(1) Manufacturer's instructions shall be carefully followed when lighting gas-fired ranges. Long tapers shall be used to light burners beneath the top of stoves, and the person doing the lighting must stand to one side to avoid flashbacks. Never use flammable liquids to start fires in wood or coal burning equipment.

(2) Each stove, range and their components, shall be thoroughly cleaned once a week in addition to required daily cleanups.

(3) The cooking chambers of deep frying equipment shall be thoroughly cleaned each day with a non-corrosive fat solvent. Deep fat fryers shall be equipped with two thermostats. The primary thermostat will be variable temperature type to control the temperature in the cooking vessel. The second thermostat will be a nonadjustable, fusible or manual resetting type.

(4) Ovens, drip pans and grease troughs shall be carefully cleaned each day.

(5) Canopy type hoods and vents shall be used over stoves, ranges and griddles to remove smoke and vapors. Forced air exhaust systems of an approved design, providing air velocities of 100 to 150 feet per minute across the faces of hoods, shall be used on all smoke removing installations. Exhaust systems shall be fitted with grease traps or filters. These traps, filters and stove hoods shall be inspected and cleaned frequently to prevent accumulation of flammable greases. Fire extinguishing equipment will be in accordance with NFPA Standard No. 96, "Vapor removal from cooking equipment" and the Rules and Regulations of the State Fire Marshal.

4. Laundry Facilities and Equipment. Most laundry equipment is adequately safeguarded and thorough operator training will ensure safe operation. Good housekeeping and safe working habits will ensure maximum efficiency and accident free operation. Laundry workers shall be completely familiar with the following safety requirements:

a. The safety devices on laundry equipment shall not be tampered with or made inoperative. Regular preventive maintenance shall be performed on all laundry equipment. All equipment, including safety devices, shall be inspected periodically. Replace defective parts immediately. Equipment found to be defective shall be taken out of service until repaired.

b. Smoking shall be allowed only in areas approved by the Fire Marshal. "No Smoking" signs shall be posted where smoking is not permitted.

c. Drying tumblers shall be provided with locking devices to prevent the tumbler from being turned while the access door is open. An effective means shall be provided to hold access doors open while operators are loading or unloading tumblers. Lint shall be removed from tumbler traps at least at the end of each day's work. Place it in approved waste cans, removed from the plant and dispose of it safely. Lint trap covers shall be securely in place before operating drying tumblers. Pipes and valves connected to drying equipment shall be inspected on a regular schedule. Do not leave garments in tumblers overnight.

d. Extractors shall be equipped with liquid-tight covers (preferably of a nonferrous metal) designed to prevent liquid from being thrown out while the extractor is in motion. The cover shall be provided with interlocks to keep it from opening while the basket is in motion. This same locking device also will be designed to prevent the basket from operating while the access door is open. Baskets shall be constructed with a nonferrous metal rim and be well-balanced.

e. Cylinders and shells of all laundry machines shall be permanently and effectively electronically grounded according to the NFPA National Electrical Code.

(1) Effective door checks shall be provided on all washing machines to hold splash-proof doors open on shell and tumbler cover while the equipment is being loaded or unloaded.

(2) Washing machines shall be equipped with locking devices to prevent tumbler operation while outside doors are open and to keep outside doors from being opened while tumblers are turning.

(3) Present equipment lacking interlocking devices, and on which it is impractical to install the required lock, shall be safeguarded by a brake or other mechanical means to prevent the inside tumbler from being turned while the outside door is open. This provision shall not apply to open-end cylinder type machines or those in which the cylinder can be moved by a hand-operated mechanism.

(4) Individual button and lint traps shall be provided on all washing machines. Lint shall be removed at least at the end of the day and disposed of safely.

f. Flatwork irons shall not be used unless the barrier guard is in place and functioning properly.

g. Rafters, beams, overhead pipes, machinery and other surfaces on which lint may collect, shall be cleaned by vacuum at regular intervals. Surfaces that may collect lint shall be covered with fire-resistant paint.

h. Damaged electric cords shall be immediately replaced or repaired by authorized personnel or electricians. Do not place cords where they are exposed to excessive wear or where they may expose personnel to injuries from trips, falls and so forth.

i. All aisles and stairways in laundries and dry cleaning plants shall be kept clean and free of obstructions.

j. Brooms, mops, buckets and other housekeeping equipment shall be properly stored in racks or closets. Adequate ventilation must be provided in these storage areas.

k. Boilers shall preferably be in a building separate from the laundry. If they are in the same building, the boilers shall be separated from the laundry by approved fire-resistant partitions.

l. All persons handling laundry shall wash their hands and faces thoroughly before eating. Suitable locker and washroom facilities shall be made available to laundry workers.

m. Sewing machine needles shall be effectively guarded. The guard shall be designed so the needle can be threaded without removing the guard.

n. Feeder steam pipes, less than seven feet above the floor, shall be covered with heat resistant material or otherwise guarded to protect against accidental contact by personnel. Drying room heat pipes and workroom heating systems need not be guarded in this manner; however, protection shall be provided to guard against contact with hot piping.

o. To prevent injury from sharp or jagged objects left in clothing, workers shall always dump dirty laundry from the bags before sorting. Heavy bundles of laundry shall preferably be handled by mechanical means.

(1) Laundry room floors shall be kept clean and free of oil, soapy water or other slippery substances. Use abrasive surfacing materials on laundry floors if necessary, to minimize the hazards from slips and falls.

(2) Keep floor drains clean to prevent clogging. Floors shall be properly sloped to drains. Sweep accumulations of water into drains.

(3) Laundry or other workers shall wear suitable protective clothing and equipment when preparing bleaches, solvents, acids and other hazardous compounds for use. Emergency washing, bathing or shower facilities shall be made available for immediate use.

(4) Caustic chemical or bleach containers shall not be stored on overhead shelves or in other locations where they may create a hazard. One or more combinations of cleaning detergents and bleaches can release toxic and dangerous fumes.

5. Safety Practices in Warehouses and Other Storage Areas. Handling supplies and materials need not be hazardous. However, disregard of accepted safe practices can result in serious injury, often causing permanent disability. Hernias, back strains, crushed hands and feet, broken bones and severe lacerations are the more common results of poor handling practices.

a. Manual Handling.

(1) The first factor in safe manual handling of materials is the adequate training of personnel. They shall receive thorough instructions in safe lifting and carrying procedures and in using personal protective equipment. Adequate supervision is necessary to make certain that safe practices are being observed at all times by materials handling personnel.

(2) Another important factor in materials handling safety is good housekeeping. Floors, in particular, shall be kept clean and free of water, grease and other slippery substances which could cause personnel to slip and fall while carrying heavy objects. Keep aisles and stairways free of obstructions which could interfere with handling operations or cause workers to trip or stumble.

(3) Proper planning in materials handling is a third important safety factor. Good planning results in materials being handled in logical sequence without conflict with each other; and avoids unnecessary handling. Responsible supervisors shall plan handling procedures to avoid exposing personnel to undue hazards, and to insure an orderly and smooth functioning operation.

(4) Personnel shall not be assigned excessively heavy lifting duties unless a medical examination reveals that they are physically capable of performing these duties. Physical differences make it impractical to set up lifting limits for a worker. An object shall be inspected before it is lifted, to make certain no grease or other slippery substances will cause the object to slip. When lifting, the worker shall first make certain his/her footing is secure, and then grasp the object in such a manner that it can be held if it becomes unbalanced. The employee shall then lift from a squatting position with the back straight and the legs exerting the primary lifting force.

(5) Gloves shall be worn when lifting objects having sharp or burred edges or splintered surfaces. When any load requires excessive exertion, the employee shall use a suitable mechanical device to do the lifting.

(6) Each load shall be carried as close to the body as possible without shifting the grip after the load has been lifted. The carrier shall make certain that his/her view is unobstructed and that the floor in the direction he/she is moving is clear and free of any slippery materials. The load may be carried by the most safe and convenient method, determined by the size, shape and weight of the object.

(7) Any object too heavy to be carried easily by one person shall be carried by two. If two people cannot safely carry any load, a suitable mechanical device shall be used. When two people are carrying an object, they shall use oral signals to coordinate their movements. Before starting to carry any material together, both carriers shall decide on an appropriate emergency signal to be given if the grasp of either shall slip or if the load must be released suddenly. Walking in step will make it easier for both carriers to coordinate their movements and make the transfer safely and smoothly.

(8) The person carrying a long object shall make certain the way is clear and vision is unobstructed.

(9) The same safe method of lifting, but reversed, shall be used to set an object down. The load shall be lowered by bending the legs and squatting with the back straight. Particular care shall be taken when releasing the load to prevent injury to fingers, hands and feet. Coordinated release of loads is essential.

(10) Mechanical materials handling equipment shall be used when loads are too heavy or bulky to be lifted, carried efficiently, or safely by hand. Fork lifts, conveyors, hand trucks, dolly, chutes, rollers and cranes, when properly used, simplify materials handling and greatly reduce the hazards of handling supplies and equipment manually.

b. Mechanical Handling Equipment.

(1) Mechanical handling of materials involves the use of many types of lifting equipment. Although mechanical handling equipment is intended to reduce the hazards involved in manual handling, the unsafe use of joists and trucks presents an increased danger to personnel.

(2) Only fully trained operators shall use mechanical equipment. Each operator shall be given complete instructions in the proper operation and use of the equipment. These instructions shall include safety standards of operation, inspection, preventive maintenance and material handling practices.

(3) Where mechanical handling equipment is used, sufficient clearances shall be allowed for aisles, at loading docks, through doorways, and wherever turns must be made. Aisles shall

be at least two feet wider than the widest vehicle used on them, and they shall be clearly marked by lines painted on the floor. Obstructions such as columns and posts shall be indicated by lines painted on the floor and shall be marked preferably with diagonal strips of black and yellow. Wooden guards marked with black and yellow strips, shall be used at the corners of stacked material to prevent accidental dislodging and to protect the stacks.

(4) In closed areas, where internal combustion powered handling equipment is used, adequate ventilation shall be provided to prevent accumulation of dangerous carbon monoxide gas. Electrically powered equipment shall be used in areas where adequate ventilation equipment cannot be installed.

(5) Hand trucks shall be pushed rather than pulled when practical. Truck handles that expose worker's hands to possible injury shall be equipped with knuckle guards. When trucks are not actually in use, the handles shall be effectively locked in a vertical position.

c. Forklift Operations.

(1) Operators shall travel with forks approximately 2 to 6 inches above the floor. By traveling with the forks close to the floor, the operator will be less likely to hit and damage material if he/she turns too sharply. Also, when traveling with a load, the driver shall keep the forks close to the floor to prevent the field of view from being obstructed. The forklift operator shall use a spotter in clear view before moving forklift.

(2) Fork trucks shall be parked only in specified areas off the aisles.

(3) Ramp Inclines. Estimated average for gasoline 3000# is about 19 percent and electric sit-down 3000# is 5 percent. 3000# electric stand up lifts are not designed for ramp operation due to the outrigger design and lack of shock absorbers or rigid suspension. Ramp slopes shall never exceed 20 degrees.

(4) When moving a load too high to see over, the operator shall travel in reverse to have a clear field of vision.

(5) A gasoline-powered forklift shall never be left unattended with the motor running. Not only will this cause excessive wear on the engine, but will create excessive carbon monoxide fumes while running in confined areas.

(6) The load center of gravity shall be kept low on all mechanical handling equipment by placing the heavier objects on the bottom and the lighter objects on the top. The load capacity of material handling equipment will not be exceeded. Additionally, in raising material for storage, consideration must be given to the loss of 100# per foot for each foot above 10 feet.

(7) Operators shall never use reverse gears for braking. This practice will cause serious damage to internal combustion powered forklift clutches and transmissions and to the rheostat if electrically powered. If the direction of travel is to be changed, the vehicle shall be braked to a full stop.

(8) Forklift operators shall refuse to move unsafe loads. If an operator believes a load is too heavy or improperly stacked, he/she shall refuse the load and report the situation to the supervisor.

(9) Often the size and shape of a particular load requires the use of special attachments on existing equipment. The development of fork truck attachments to perform special handling functions has increased the versatility of the fork truck. Special attachments such as rams, detachable cranes, fork extensions, etc., are used to handle loads. The use of such accessories, in most cases, modifies the rated capacity and imposes weight limitations that must be considered. All factors must be considered when such attachments are used to handle excessively large or bulky loads. Overhead guards shall be provided on high lift forks and other equipment where operators are in danger from falling objects. Overhead guards shall be maintained free of any material that may obstruct the operator's vision.

(10) Safe operating speeds shall be set for each type of special-purpose handling vehicle. No vehicle shall exceed five miles per hour inside warehouses or other buildings, regardless of its safe operating speed. On long hauls, out of doors, speeds may be increased to the vehicle's safe maximum. Common sense must be exercised by operators to determine how fast they can safely travel with particular loads.

(11) Loaded vehicles shall not be put into motion until the load is properly stacked and secured. When it is necessary to park inside warehouses, the vehicles shall be parked only in an approved area authorized by the Fire Marshal. Drivers shall be particularly careful when approaching

doorways, aisle crossings and other intersections and sound a warning by horn or bell if the machine is not equipped with an automatic signal device. Speed limits will be observed at all times. When the vehicle is parked, the brakes shall be set and the ignition turned off, gear placed in low, or in park with automatic transmissions.

(12) Unless the vehicle is equipped with an adequate passenger seat, and specific authorization is given, no person other than the driver shall be allowed to ride on any material handling vehicles. Forklift operators shall not permit any person to ride on the forks or any other part of the vehicle. Fork trucks are not built to carry passengers, and the practice shall not be permitted.

(13) When permission has been granted to use a fork truck to lift a workman to the top of stacked materials, an approved platform and cage or safety pallet shall first be securely attached to the vehicle. The person being raised shall take a safe position in the cage where he/she is in no danger of falling or catching his/her hands or clothing on any part of the truck as the cage moves upward. Personnel shall not be transported from one place to another in a safety pallet. The driver shall always remain at the vehicle controls while personnel are on the platform.

(14) Stunt driving and horseplay with fork trucks is prohibited. Any operator found driving recklessly must be informed of the violation and warned that any future occurrences will be reason for personnel action.

(15) Fork truck drivers shall not stack empty pallets higher than eye level. This can cause an unsteady load, and become a possible source of injury or property damage. Forklift operators shall have a spotter available.

(16) The forks of lift trucks shall not be used to push another forklift or motor vehicle. Forklifts shall not be used to tow trailers or other equipment.

(17) Internal combustion engine-powered materials handling equipment and vehicles shall be equipped with flame and spark arrestors, on carburetors and exhaust when operated in areas where a fire hazard exists.

d. Proper Storage Procedures.

(1) Dangerous materials, such as flammable liquids shall be stored only according to the Rules and Regulations of the State Fire Marshal. Hazardous substances shall be stored in special containers in well-ventilated, fire-resistant areas. Prohibit all sources of ignition in these storage areas. Certain other commodities, such as vegetable oil and grease, which are subject to spontaneous combustion, shall be stored where they present no hazards to personnel or property.

(2) Materials shall be stacked in neat rows, stabilized by dunnage if necessary. Leaning or unbalanced stacks shall be restacked immediately to prevent them from falling.

(3) Stacked materials shall be kept at least 18 inches away from electric light fixtures. Lights suspended from overhead shall be enclosed in wire guards.

(4) Smoking shall not be permitted in any storage area. Special locations may be designated for smoking areas in storage facilities.

(5) Oily rags and other wastes shall be stored in fire-resistant containers, equipped with self-closing lids. These containers shall be emptied daily.

(6) Stored materials shall be kept at least 18 inches from automatic sprinkler valves, fire hoses, extinguishers, sprinkler heads, exits and fire doors. Stacks shall be arranged to permit immediate access to all storage areas during a fire.

(7) Hand rails and ladders (portable or fixed) shall be provided for safe access to second level storage bins. Since these bins are more hazardous to use, the materials stored there shall not require frequent handling.

(8) Water type fire extinguishers and stand pipes located in unheated warehouses shall be protected against freezing.

(9) Compressed gas cylinders shall be stored in a space where the danger of their being damaged or knocked over has been eliminated by chain or band supports. Flammable substances such as oil and volatile liquids shall not be stored with compressed gases.

(a) Oxygen cylinders shall not be stored in the same location with cylinders of fuel gases (acetylene, propane and butane) unless separated by a fireproof partition.

(b) Cylinders stored in the open shall be protected from the direct rays of the sun. To prevent rusting, cylinders shall be protected against extremes of weather and from contact with the ground. Eighteen inches of air space shall be maintained between cylinders and the covering.

(c) Storage rooms for cylinders shall be well ventilated to prevent accumulation of explosive concentrations of gas. No source of ignition shall be permitted. Smoking shall be prohibited. Wiring shall be in conduit.

(d) Only cylinders approved by the Interstate Commerce Commission shall be accepted. Do not remove or change numbers or marks stamped on cylinders.

(e) Because of their shape, smooth surface and weight, cylinders are difficult to carry by hand. When cylinders are to be moved, a hand truck, or other mechanical handling device shall be used. Cylinders may be rolled for short distances on the bottom edge, but never dragged.

(f) Do not drop cylinders or permit them to strike each other violently. Protect cylinders from surface cuts or abrasions.

(g) Cylinders shall not be used, full or empty, for rollers, supports, or any purpose other than to contain gas.

(h) When empty cylinders are to be returned to the vendor, mark them empty, close valves and replace valve protection caps.

(i) All cylinders having provisions for the use of valve protective caps shall have them securely in place when being transferred and while in storage. Load or stow cylinders to be transported so as to allow as little movement as possible.

(j) Never use oil or grease as a lubricant on valves or attachments of oxygen cylinders. Do not permit handling of such cylinders or apparatus with oily hands, gloves, clothing or equipment.

6. Boiler Operation Safety. Steam boilers are used for generating both heat and power. The most common hazards of boiler operations include fuel explosions, structural failures, excess pressure explosions and boiler damage caused by low water.

a. Two types of boilers in general use are:

(1) Low pressure boilers operating at pressures up to 15 pounds per square inch. Low pressure steam is used for heating buildings and water and usually for cooking.

(2) High pressure boilers operate at pressures above 15 pounds per square inch. High pressure steam, supplied by either fire-tube or water-tube boilers, is used principally for power, sterilization processes, and also cooking.

b. Steam boilers shall be inspected in accordance with federal and state standards.

c. Boiler Safety Accessories. Each boiler shall be equipped with the prescribed safety devices such as steam and water gauges, try cocks, safety and blowoff valves and low water cutoff devices. Safety valves will be set and resealed by inspectors after each equipment check.

(1) Boiler feedlines shall be equipped with check and cutoff valves, placed as close as possible to each boiler.

(2) Except for water-tube types, all steam boilers shall be fitted with fusible plugs. These plugs shall be replaced at least once a year.

(3) Water gauge glasses, less than 15 feet from the floor or water tender's platforms, shall be carefully guarded to prevent accidents resulting from breakage or blowouts. High pressure gauge glasses shall be drawn down on each shift. Low pressure gauge glasses shall be checked at least weekly. Pressure gauges shall be inspected and tested every 12 months.

(4) No boiler shall be operated unless it is equipped with safety valves of the proper capacity. The design and relieving area of safety valves shall conform to manufacturer's specifications. No other valves shall be placed between the safety valve and the boiler or between the safety valve and the end of its discharge pipe. Safety valves shall be manually tested periodically in accordance with prescribed requirements. The discharge pipe shall be the same size as the safety valve and fitted with an open drain. The following paragraphs explain the design and operating requirements of safety valves installed on boiler equipment.

(a) Safety valve capacities shall be sufficient to release all the steam generated by the boiler without allowing a pressure rise of more than six percent above that for which any valve is

set or more than six percent above the maximum operating pressure of the boiler. Maximum steaming capacities of boilers are determined by the manufacturers, based on the consumption of fuel, air supplies and other safety factors. Safety valve capacity shall not be less than the maximum designed steaming capacity.

(b) One or more safety valves shall be set at or below the maximum working pressure of the boiler. When this is done, the highest pressure setting of any additional valves shall not exceed the maximum boiler working pressure by more than three percent. The complete range of pressure settings of saturated-steam safety valves on a boiler shall not exceed 10 percent of the highest pressure to which any valve is set.

(c) The minimum safety valve relieving capacity shall be determined on the basis of the pounds of steam generated per hour per square foot of boiler and water wall heating surfaces.

(d) To permit safety valves to be inspected and to ensure their being free, each valve shall be fitted with a lifting device that will raise the disks from their seats when there is at least 75 percent full pressure on the boilers. The lifting mechanism shall be so designed that it cannot lock or hold the valve disk open when released.

(e) Safety valve springs for up to 250 pounds of pressure shall not be used for any pressure more than five percent above or below designed pressure limits. If revised operating conditions require a new spring for different pressures, the valve shall be adjusted by the manufacturer, its authorized representative, or persons qualified to make such adjustments. A new plate, specifying safe operating limits and instructions shall be placed on the valve by the person making the adjustments.

(5) Boiler rooms shall have valves numbered and a schematic located in the boiler room for emergency use by the fire department.

(6) When applicable, spark arresters shall be installed on each boiler stack to prevent fire from flying sparks.

(7) Boiler room workers shall be provided with fire-resistant gloves while at work. These gloves shall be sufficiently large enough to allow them to be flipped off the hands in an emergency. Goggles, leggings and respirators shall be provided for immediate emergency use.

(8) All safety and blowoff valve discharge pipes shall be located where any discharge will not create a hazard. Discharge lines from water heater relief valves shall be arranged with the outlet within six inches of the floor. Such an outlet shall not be threaded, capped or plugged. It shall be cut off diagonally and not extend outdoors where freezing might occur. Discharge lines and outlets shall be capable of free flow at all times.

d. Proper Boiler Operations. The maintenance superintendent shall ensure that boiler operators are trained and certified as qualified, to operate the types of equipment to which they are assigned. It is desirable that boiler operators possess a valid state or municipal license.

(1) Power boilers with full automatic control, having a rated output of 1000 or more pounds of steam or vapor per hour and all high pressure, high temperature water boilers should not be operated without being periodically checked by an operator at intervals of not less than once every two hours, regardless of whether or not the boiler is equipped with an automatic feedwater regulator, fuel or damper regulator, high and low water alarm or any other form of automatic control while the boiler is in service. All power and high pressure, high temperature water boilers without fully automatic control should be under the supervision of a full-time operator while the boiler is in service. The operator should be a competent attendant who is familiar with the particular boilers to be operated and who has received proper instructions in their safe operation.

(2) Boilers shall not be operated at pressures higher than determined safe by the most recent inspection, unless a special inspection by the insurance carrier inspector has authorized increased pressures. Under no circumstances shall boilers be operated at greater pressures than specified on the manufacturer's stamped instructions. The instructions, stamped by manufacturers on the boiler, will not be covered or obliterated.

(3) Water in boilers shall be checked frequently and kept at proper levels. Water columns shall be blown periodically to make certain connections are clear and water returns to the proper level in the gauge glass when drain valves are closed.

(4) When water is not visible in the gauge glass, all stresses on the boiler shall be gradually reduced in the following manner:

(a) On boilers fired by the fuels burned in suspension (for example, fuel oil, gas or pulverized coal) stop the fire immediately; shut off all air flow; close steam outlet valve; shut off feed water supply. A slight draft of air through the boiler may tend to stabilize temperature throughout the pressure parts. The induced draft fan (or forced draft, if the unit has no induced draft fan) can be started up with the control damper almost closed. Proceed as in a normal shutdown; inspect boiler thoroughly, including a hydrostatic test, where warranted, before returning to service.

(b) In boilers fired by coal, either stoker or hand fired, stop the supply of fuel and air to boiler and smother the fire with noncombustible materials such as ashes while taking care to avoid an explosion. Do not use water. Close steam outlet valve and feed water to the boiler to maintain normal water level. Shut off feed water supply as soon as brick work has cooled sufficiently to prevent damage to the boiler by overheating. A slight draft of air through the boiler may tend to stabilize the temperature throughout the pressure parts. The induced draft fan (or forced draft fan, if the unit has no induced draft fan) can be started up with the control damper almost closed. Proceed from this point as in normal shutdown; inspect boiler thoroughly and ensure that it is hydrostatically tested where warranted before returning it to service.

(5) If safety valves do not pop when pressures rise above valve settings, or the valves cannot be opened by hand when tested, the boiler shall be taken out of service until the valves have been repaired or replaced.

(6) When fires are banked, boiler operators shall make certain that draft is sufficient to prevent accumulations of flammable gases.

(7) When putting a boiler on the line, all external drains between the boiler and main header shall be left open until the boiler is on the line. The stop valve shall be kept closed until boiler pressure is equal to that in the steam main. The stop valve may then be gradually opened. If no vibrations or disturbances occur on the line, the valve may be opened completely. If vibrations or rumbling occurs during the cutting-in, the stop valve shall be closed immediately.

(8) Steam shall be allowed to enter cold pipes very slowly until the pipes have been warmed enough to preclude damage.

(9) Boiler tenders shall stand to one side when opening fire doors to protect themselves against flare-backs.

(10) Because of the danger of flare-backs, boiler operators shall never throw coal dust sweepings on boiler fires.

(11) When not in use, all boiler room tools shall be stored in suitable racks. Tool racks shall be constructed and located so personnel cannot accidentally touch hot surfaces.

(12) Before lighting, gas and oil fired furnaces, boilers and breeching shall be purged to remove explosive vapors. Burners shall not be lighted if there is oil on the floor of the combustion chamber, around the burners, or in front of the boiler. If the flame of a gas or oil fired burner should go out, the fuel shall be immediately cut off and the furnace purged before relighting. Never attempt to relight an atomizer from a red hot brick wall. Use a torch.

(13) Any adjustment or removal of valves to increase discharge pressure is strictly forbidden.

(14) Only fully qualified personnel shall be permitted to make boiler repairs. No maintenance work shall be attempted while boilers are under pressure or on the line. Boilers with defective valves shall be taken out of service until repaired. Before sending workers into a boiler, allow it to air out thoroughly. Use portable blowers to provide fresh air for workers. Station a person outside the boiler to render assistance if necessary.

(15) Boiler rooms shall be off limits to all personnel except boiler operators. Boiler rooms shall not be used as a storage area.

(16) Personal protective equipment shall be worn when handling hazardous chemicals associated with boiler operations.

7. Sewage and Water Treatment Plants.

a. Sewage Plants. Careful control of sewage plants, sewage systems and industrial waste plants is necessary to avoid accidents. Injuries can be received from unguarded plant machinery and infection can result from contact with sewage. Sewage plant personnel shall use the following safety standards as guides for their everyday activities.

(1) Install fences and railings to prevent plant personnel from falling into manholes, scum and sludge chambers and open tanks. Each stairway in sewage plants shall be equipped with safety rails. Toeboards shall be placed on walkways where there is danger of tools or equipment being accidentally kicked into tanks or pits.

(2) When work has been completed in manholes, the covers shall be promptly replaced. Heavy covers shall be handled only with the proper tools. Manhole covers shall be painted or sprayed with a nonskid substance to eliminate a slipping hazard.

(3) Protective guards shall be provided on moving parts of any plant equipment such as clutches, couplings and flywheels.

(4) Unless it is a required procedure, sewage plant machinery shall not be lubricated or adjusted while it is in operation. If an adjustment to moving machinery is a normal procedure, the equipment must be effectively guarded to protect each person making the adjustments.

(5) Electrical power shall be disconnected before repair work is started on automatic or remote control equipment. All machinery shall be equipped with central switches that can be locked closed and tagged to prevent accidental starting while under repair.

(6) Cleaning solvents with a flash point below 140 degrees Fahrenheit shall be used in sewage plants.

(7) Exhausts on internal combustion engines used for regular or standby power shall be directed to the outside of the building. Fuel tanks also shall be vented to the outside. Crankcase breathers shall be vented either to the outside or to the engine's intake manifold.

(8) Except for major repairs, all sewer maintenance shall be performed through manholes located in streets utilizing a fresh air supply mechanism.

(9) Persons working in sewers shall wear an approved safety belt and lift line. At least two people shall remain outside to handle the line and provide assistance to the person in the sewer in an emergency.

(10) Barriers and warning signs shall be placed far enough from open manholes to give oncoming traffic sufficient warning of the hazard.

(11) Personal cleanliness is important to the continued good health of sewage plant workers. Immediately after work and always before eating, plant personnel shall wash their faces and hands thoroughly with soap and water. Clothing shall be changed before leaving the wash room when dining in a cafeteria, etc. When plant workers come in direct contact with sewage, they shall wash immediately.

(12) Rubber gloves and other protective clothing shall be worn to avoid contact with sewage or sludge.

(13) Most sewage contains large numbers of harmful bacteria that can cause serious disease. Sewage plant workers shall observe the following standards to ensure personal cleanliness and to safeguard their health.

(a) Wash their hands frequently and avoid touching their mouths.

(b) Treat all cuts and scratches immediately.

(c) Do not drink from laboratory glassware.

(d) Provide potable water for washing and drinking. Warm water, wash bowls, soap and paper towels shall be conveniently located throughout the plant. A clean eating area shall be provided for plant personnel.

(14) Canister masks, respirators, safety harnesses and other necessary protective equipment shall be provided for sewage plant workers. At least one ring-type life preserver and rope shall be placed near each tank or pit into which personnel could fall, except at tanks having a span of not over 15 feet, where a life saving hook may be substituted, The hook shall have a handle one foot longer than half the width of the tank and be located near the tank in a conspicuous and permanent place.

(15) All sewers, pits and settling tanks shall be tested for explosive gases and oxygen deficiencies before workers are permitted to enter. When either of these hazards are found, forced ventilation shall be provided and personnel shall wear appropriate breathing apparatus.

(16) Fixed iron steps shall be installed in one vertical wall of manholes providing access to storm sewers more than 12 feet deep. Use portable, lightweight ladders to enter storm sewers, less than 12 feet deep, which are not equipped with permanent steps.

(17) The gases formed in sewage plants create various hazards. When mixed in proper portions with air, they can explode violently, causing serious fires. Sewer gases can also suffocate or poison personnel exposed to them. Gases originating in digester tanks, and the chlorine used for sewage treatment, shall also be carefully controlled. Sewers and pits apparently free of harmful gases may still be dangerous because of the lack of oxygen.

(a) Hydrogen sulfide is usually present in sewer lines and treatment plants. This gas is extremely toxic and explosive and is formed by the decomposition of sulfur-containing proteins and organic compounds in untreated sewage.

(b) Methane gas, formed in digester tanks, is the result of decomposition of organic materials. Not only is it explosive and flammable, but methane gas displaces oxygen in confined or inadequately ventilated areas.

(c) Carbon dioxide, an asphyxiating gas, is generated in large quantities in the sludge digestion process.

(d) The gases generated by digesting sewage sludge may be explosive, toxic or suffocating. Before personnel are permitted to work in or around digester tanks, the air shall be tested and adequate measures put into effect to minimize any hazards found to be present. To prevent the accumulation of dangerous gases, forced ventilation shall be used, if necessary, when filling or emptying digester tanks.

(18) Most sewage system fatalities are caused by chemical asphyxiants. Special emphasis on the dangers of asphyxiants shall be included in training sewage system workers. Simple asphyxiants are gases such as methane, carbon dioxide and hydrogen which displace oxygen in the air. Chemical asphyxiants are substances that combine with the hemoglobin of the blood or parts of tissues and prevent oxygen from reaching body tissues. Carbon monoxide is a typical example of a chemical asphyxiant.

(19) Because of the possible presence of explosive and flammable gases, all electrical equipment and connections located in enclosed sewage treatment areas shall be explosion proof. Adequate control equipment shall be provided throughout the plant.

(20) Chlorine containers shall be stored in a separate room, equipped with a floor level forced air ventilating system that discharges directly to the outside of the building. The ventilation system shall be controlled by a switch located outside the building. Never store other gases in the same room with chlorine containers, even empty ones. Chlorine cylinders shall be protected at all times from direct sunlight and heat. Only trained and authorized personnel shall be permitted to handle chlorine cylinders. Cylinders, valves and fittings shall be regularly checked for leaks, which are to be stopped immediately when detected. A bottle of household ammonia, properly labeled shall be kept available to detect chlorine leaks. Chlorine gas produces a dense white mist in the presence of ammonia. When the bottle is not in use, it shall be stored outside the chlorinator equipment room. When chlorine is used in sewage plants, at least two gas masks shall be provided and stored outside of the chlorine room for emergency use in the event of leaking gas. Extreme care shall be exercised to ensure that carbon monoxide from engine exhausts or other sources is not allowed to mix with chlorine gas; deadly phosgene gas may be formed as a result. Sewage plant workers shall know the limitations and use of canister gas masks, self-contained air breathing equipment and fresh air hose masks.

(21) Pressure and vacuum relief valves on digesters shall be checked at regular intervals to make certain they are working properly. Antifreeze solutions shall be used during cold weather to prevent these valves from freezing.

(22) Flame arresters used on sewage plant facilities shall be thoroughly cleaned according to the manufacturer's instructions. Dirth flame arresters do not give adequate protection against fires.

(23) Waste digester gases shall be burned only in an approved gas burner. A pilot light shall be provided to ensure continuous burning of waste gases.

(24) Good housekeeping is a must if the health of sewage plant workers is to be protected. Floors, sidewalks, catwalks and stairways shall be kept clean and free from obstructions. Spilled materials, debris and standing liquids shall not be allowed to accumulate anywhere in the plant. Keep tools in their proper storage place when not in use.

(25) Smoking shall not be permitted where explosive and flammable gases may be generated. Suitable "No Smoking" signs shall be posted in these areas.

(26) When gasoline, oil or any other hazardous substance is detected in sewer systems, plant personnel shall immediately notify responsible authorities.

(27) Air will not be allowed to enter digester tanks during sludge removal operations. Digester gases and air combine to form a highly explosive mixture.

b. Water Treatment Plants. Water treatment plants shall be operated under the following safety precautions:

(1) Guard rails shall be placed around all pits and tanks into which personnel could accidentally fall. Beams over pits and basins shall not be used for walkways unless they are equipped with handrails.

(2) Low hanging pipes, valves and other obstructions shall be color coded to permit personnel to be aware of the identity of overhead obstacles.

(3) Treatment plant workers handling acids, caustics, chlorine, fluoride and ammonia shall wear suitable and adequate personal protective equipment.

(4) Personnel must practice extreme caution when handling dry activated carbon near chlorine or calcium hypochlorite. When these substances are combined, a violent explosion will occur. Personnel also shall carefully avoid concentrations of carbon dust in treatment plants. Explosion-proof motors and electrical equipment shall be installed in rooms where dry activated carbon is handled.

(5) Smoking shall be permitted only in designated areas.

(6) Fume hoods equipped with adequate exhausts shall be installed in laboratories where poisonous or corrosive chemicals are handled.

(7) Suitable personnel protective equipment shall be worn by laboratory personnel.

(8) When eating, drinking and smoking by employees in laboratories are considered hazardous by local authorities, they will be prohibited.

(9) Each bottle or other container kept in laboratories shall be clearly labeled as to its contents. Protect the legibility of labels with coats of shellac or clear lacquer.

8. Refrigeration and Air Conditioning Equipment. Such equipment can be the cause of serious personnel injuries or substantial equipment damage, if improperly used or maintained.

a. Refrigeration Equipment. The following minimum safety standards apply to all activities where refrigeration systems are installed.

(1) Most mechanical refrigeration involves the evaporation of a liquid (refrigerant) by absorbing heat from the medium being cooled. The refrigerant vapors are condensed and then cooled with atmospheric air or available water.

(2) There are four principal hazards in the operation and maintenance of refrigerating equipment: explosion, fire, toxic effects and personal injury potentials.

(a) Explosions usually result from one or two causes: excess pressure or explosive mixtures of gas and air. To avoid explosions from excess pressures, refrigeration systems shall be designed to accommodate high pressure, and also shall be fitted with approved safety devices. Explosive air mixtures released from cooling systems can be prevented by adequate inspection and proper maintenance.

1. Another explosion source exists when refrigerants are forced into a frozen part of the system. Pressure differential switches across the pump or a water pressure failure switch at the condenser will provide protection against this possibility.

2. Another frequent cause of explosions is the overfilling of refrigerant service cylinders. Cylinders shall be weighed or other suitable procedures used to prevent exceeding the rated capacity of the service cylinders (used by mechanics in recharging refrigerant systems).

(b) By eliminating the sources of explosion, fire hazards are reduced since both are caused by the same situations.

(c) Ammonia and other gases used in refrigerating systems are toxic. To guard against gas leaks, refrigerating systems shall be closed down periodically and completely inspected for defects.

(d) Exposed pulleys, fan belts, open sprockets, exposure to toxic chemicals and gases and electrical shock are typical examples of injury potentials. Mechanical guarding and isolating of hazardous equipment shall effectively reduce accidents caused by these hazards.

(3) The following methods are used to test for refrigerant leaks:

(a) An electronic test involves the use of an instrument that is extremely sensitive to the presence of refrigerant gases.

(b) A soap-water test can be safely conducted on pipes and fittings of any refrigerating system, including those containing carbon dioxide and highly flammable refrigerants.

(c) A halide torch test may be used on systems containing nonflammable gases. Care must be taken to restrict the open flame test to nonflammable refrigerants. If systems containing methyl chloride, ethyl chloride, dichloroethylene or other flammable refrigerants are to be tested, the soap and water test shall be used instead of the halide test. When halogenated refrigerants such as R-11, R-12, R-22 and methylene chloride are detected when using the halide torch test, very small quantities of these agents are decomposed. The decomposition products include halogen acid and, if a source of water or oxygen is present, a smaller amount of phosgene may be formed. These decomposition products are toxic. Due to the minute quantity of refrigerant necessarily burned to discover a leak, the test is not considered hazardous to operating personnel. An additional safety factor is provided by the fact that the halogene acids produced have a sharp stringent odor and are easily detected by the nose at concentrations well below toxic levels. Therefore, even if sufficient quantities of the refrigerant are decomposed to produce a hazardous environment, the danger is detectable by our sense of smell. If such an odor is detected, the area will be evacuated until ventilation has removed these decomposition products.

(d) The ammonia swab test should be used for detecting leaks in systems containing sulfur dioxide.

(e) The sulfur candle test causes a white smoke cloud to be generated when escaping ammonia comes in contact with a burning sulfur candle. This test will be used only on ammonia carrying systems.

(f) The dye and odorant test should be used for detecting leaks in freon systems. A harmless dye or odorant will be introduced into the system; leaks will be detected by escaping dye or odor.

(4) Refrigerating systems should not be installed on stairways, landings or near building entrances where they could create hazards.

(5) Only unit systems or sealed absorption-type refrigerating plants should be installed in hallways or lobbies of buildings used by large numbers of personnel.

(6) Only qualified personnel should service, adjust, repair, or test refrigerating equipment. All equipment should be designed, installed and maintained according to accepted safety codes and municipal and state requirements.

(7) When refrigerants are handled and used, adequate ventilation should be provided. An approved canister gas mask will be provided for personnel working on ammonia or sulfur dioxide refrigeration systems. Gas masks should be worn even when small concentrations of ammonia, sulfur dioxide or methyl chloride are present in the air, an escape of some of the less toxic refrigerant gases seems likely, or the presence of products of decomposition or combustion is suspected. Appropriate eye protection should be worn to avoid injury to eyes from a spray of refrigerants.

b. Air-Conditioning Equipment. The following minimum safety standards apply to all activities where air conditioning systems are installed.

(1) Coils carrying flammable and/or toxic refrigerants shall not be placed in air ducts or other circulating passages. Brine or water cooled by these refrigerants may be sprayed into air passages or circulated through coils located in air passages, but the brine shall not contain any flammable substance.

(a) The following refrigerants have been classified by UL, NFPA, ASHRAE and/or SBCCI as being flammable and/or toxic:

1. Ethyl Bromide
2. Methyl Bromide
3. R-40 (Methyl Chloride)
4. R-123 (Trifluoroethane)
5. R-160 (Ethyl Chloride)
6. R-170 (Ethane)
7. R-290 (Propane)
8. R-600 (Butane)
9. R-611 (Methyl Formate)
10. R-717 (Ammonia)
11. R-764 (Sulfur Dioxide)
12. R-1130 (Dichlorethylene)

(b) The following refrigerants are considered by UL, NFPA, ASHRAE and/or SBCCI to be non-flammable and nontoxic:

1. R-11 (Monofluorotrchloromethane)
2. R-12 (Dichlorodifluoromethane)
3. R-21 (Dichloromonofluoromethane)
4. R-22 (Monochlorodifluoromethane)
5. R-30 (Methylene Chloride) (Dichloromethane)
6. R-113 (Trichlorotrifluoroethane)
7. R-114 (Dichlorotetrafluoroethane)
8. R-134a (Tetrafluoroethane)
9. R-502 (Monochloropentafluoroethane)
10. R-744 (Carbon Dioxide)

(2) When handling refrigerants, it is important to remember that most refrigerants which are classified as nontoxic are nonetheless considered simple asphyxiants. As such, they remain a threat to personnel whenever they are present in quantities sufficient to displace breathing air under conditions of accidental release.

(3) In mechanical rooms containing refrigeration equipment, purge vents and safety relief valve vents should be piped to discharge outside the building.

(4) In mechanical rooms containing a refrigerant detector, periodic tests of the detector and its audible and visual alarms shall be performed in accordance with the manufacturer's recommendations. Mechanical ventilating systems shall also be tested to verify proper operation.

9. Ladders and Scaffolding. When personnel use ladders to gain access to high places where work is to be performed, the most common hazard is falling. Several types of ladders may be used. Each is designed for a particular need. Since the falling hazard is the most prevalent accident resulting from the use of ladders and scaffolding, care shall be taken to repair worn walking surfaces or make them safe by using nonslip materials.

a. Construction. Ladders shall be made of seasoned or laminated wood, substantial metal, or fiberglass and conform to the accepted industry safety code and federal regulations. Rungs will be strong enough to hold a weight of approximately 500 pounds.

b. Single Ladders. Nonadjustable ladders that are not self-supporting shall be equipped with nonskid bases (spikes or safety shoes). Safety hooks shall be placed at the tops of ladders not equipped with nonskid feet. Nonslip bases shall be securely bolted, riveted, or attached by equivalent construction to the side rails. In addition, ladders shall be lashed to nearby supports when necessary to ensure stability. Nonslip tape or adhesive materials shall be affixed to metal ladder steps to ensure sound footage.

c. Extension Ladders. Each adjustable extension ladder shall be equipped with nonslip bases and spring loaded rung locks with metal shackles. Pulleys and ropes shall be provided for adjusting ladder length. No ladder shall be extended beyond 60 feet. The sections shall overlap at least three

feet for a 36-foot extension; four feet for up to a 45-foot extension and five feet for any extension over 45 feet.

d. Step Ladders. All step ladders are self-supporting. These ladders shall be used only on flat surfaces to ensure solid footing. When open, the steps shall be horizontal, and all step ladders shall be equipped with an automatic spreader or locking device to keep them open.

e. Trolley Ladders. Trolley ladders usually operate on a rail. They shall be equipped with safety clamps or locking devices to prevent accidental movement. Wheels shall be designed so they cannot jump the tracks. Safety stops shall be placed at each end of trolley rails.

f. Fixed Ladders. Fixed wood or metal ladders shall be permanently secured at the top, bottom and necessary points in between. All fixed ladders more than 20 feet high shall be equipped with cages or other safety devices to prevent personnel from falling. These cages begin about seven or eight feet above the base of the ladder and extend to at least 42 inches above the top of the ladder or landing. Fixed ladders shall have at least a 30-inch climbing clearance, a seven inch front clearance between the rungs and supporting walls and side clearances of at least 15 inches measured from the center. Side rails shall extend at least 3 1/2 feet above landings. Landings or platforms shall be provided on all high ladders, at no more than 20-foot intervals. Fixed ladders shall be made of top quality materials and painted to protect them against deterioration.

g. Metal Ladders. Metal ladders shall never be used around electrical equipment and facilities.

h. Inspection. Each new ladder shall be carefully inspected to make sure it conforms to safety specifications. Ladders shall not be proof-tested beyond design loads. Before use, check all ladders for:

- (1) Loose or broken steps or rungs.
- (2) Broken, split or cracked rails.
- (3) Loose nails, screws or bolts.
- (4) Missing, broken or damaged safety shoes.
- (5) Condition of hinge and spreaders on step ladders.
- (6) Defective locks on extension ladders.
- (7) Condition of ropes and sheaves of extension ladders.
- (8) General serviceability.

i. Care and Storage. To avoid concealing defects, portable ladders shall not be painted. Instead, clear varnish, lacquer, shellac, or linseed oil shall be used for ladder protection. Store ladders where it is dry, well ventilated, and cool, and in such manner that their weight will not cause them to sag and take a set.

j. Safe Use. In use, portable or extension ladders shall be placed with the foot of the ladder approximately one-quarter of its length away from the building. Follow these procedures:

(1) Place the ladder so each side has secure footing, with solid objects set under the rails in soft ground. Never lean a ladder against loose or unsafe objects and never use a ladder in a horizontal position. When necessary to place a ladder against a window, secure a board - not with nails - across the rails so it will bear on both sides of the frame. Face the ladder and hold on to each side rail when climbing or descending. Work requiring the use of both hands shall be performed only on step or platform ladders.

(2) When the security of the ladder is endangered by activities in the area, fasten it securely. Another employee shall be assigned to steady the bottom. The area around the ladder shall be roped off. When hangers or falls are used, they shall be secured by safety lines of at least 5/8 inch manila rope and a safety line used by each workman. When ladders are placed in front of doors that open toward them, the doors shall be blocked off and personnel routed to another exit. Ladders shall never be left unattended while they are in place.

(3) Do not stand higher than the third rung from the top, and do not attempt to reach beyond a normal arm's length, when working on a ladder. No more than one man shall be on a standard ladder at any time. When carrying ladders, particular care shall be taken going through doorways. The front end shall be carried high enough to avoid striking persons ahead of the carrier.

(4) Portable rung ladders with reinforced rails shall be used only with the metal reinforcement on the underside. Ladders of this type shall be used with great care near electrical conductor, since the reinforcing itself is a good conductor.

(5) No ladder shall be used to gain access to a roof unless the top of the ladder extends at least three feet above the point of support, at eave, gutter or roof line.

(6) Adjustment of extension ladders shall be made only by the user when standing at the base of the ladder, so that he can ensure the locks are properly engaged. Adjustment of extension ladders from the top of the ladder (or any level over the locking device) is a dangerous practice and shall not be attempted. Adjustment shall not be made while the user is standing on the ladder.

(7) Middle and top sections of sectional or window cleaner's ladders shall not be used as a bottom section unless the user equips them with safety shoes.

(8) Extension ladders shall always be erected so that the upper section is connected to the bottom section.

(9) The user shall equip portable rung type ladders with nonslip bases when there is a hazard of slipping. Nonslip bases are not intended as a substitute for care in safely placing, lashing, or holding a ladder that is being used upon oily, metal, concrete, or slippery surfaces.

(10) The bracing on the back legs of step ladders is designed solely for increasing stability and not for climbing.

(11) When service conditions warrant, hooks may be attached at or near the top of portable ladders to give added security.

(12) Ladders made by fastening cleats across a single rail shall not be used.

(13) Ladders shall not be used as guys, braces or skids or for other than their intended purposes.

k. Scaffold Platforms. Portable ladders or other makeshift platforms will not be used on scaffold platforms.

10. Safe Painting Practices. Although painting operations appear to be relatively easy and safe, painters are exposed to many kinds of personal hazards, such as falls from scaffolds and ladders, burns from fires caused by flammable materials and illness from the use of lead compounds and toxic thinners. General safety practices covering the use of ladders and scaffolds were given in the preceding section. The standards given below will help to eliminate accidents and sicknesses resulting from unsafe painting practices.

a. Mixing of Paints Containing Combustibles or Toxic Fumes. Paint mixing shall be done in designated, adequately ventilated, rooms constructed of fire-resistant materials. When possible, paint shall be mixed in covered areas outdoors. All sources of ignition shall be prohibited in mixing areas. All electrical facilities used near paint preparation spaces shall be of the approved explosion-proof type.

b. Paint Storage. No more than a one week's supply of paint and thinner shall be stored in workshops and no more than one day's supply shall be kept on jobs. Where practicable, paints and thinners shall be stored in outdoor shelters. At no time shall flammable painting materials be stored in open containers.

c. Electrical Equipment. Painting around electrical equipment and facilities using flammable paint mixtures shall only be done under surveillance of a qualified electrician. Painters shall not use metal ladders while working near electrical equipment.

d. Indoor Work. Adequate ventilation shall be supplied for indoor painting, or painters shall wear suitable respirators. Spray booths, equipped with exhaust systems, shall be provided in workshops for continuous indoor painting. Operating personnel shall not remain in the area unless adequate ventilation is present.

e. Personal Protective Equipment. Personnel, who are engaged in preparing surfaces for painting, shall wear goggles to protect their eyes from chips and flying particles. Goggles and rubber gloves shall be worn while acids, lye or noxious cleaning materials are being used.

(1) Painters shall wear clothing that completely covers their bodies, taking special care to avoid exposing their arms and ankles. Continuous contact with paint may cause dermatitis. Clothing shall be changed frequently to eliminate body contamination and fire hazard.

(2) Painters shall always wash their face and hands thoroughly before eating.

f. Water Towers and High Tanks. Water towers, tanks and other high objects shall be painted only by experienced steeplejacks employing appropriate painting equipment.

g. Painting Equipment. Painter's ladders, scaffolds, lifelines, and other equipment shall be inspected at least every three months to be certain they are in safe condition.

(1) At least 3/8 inch wire rope shall be used for boatswain's chair slings when workmen will be handling open flames or torches. Safety belts with lifelines attached to chair slings shall be used on all boatswain's chairs.

(2) Lifelines and safety belts shall be used by painters at all times when working on swinging scaffolding.

(3) When electric lines or air and water hoses are used in painting operations, they shall be securely fastened to a stable anchorage (other than the platform) no more than 15 feet from the point of use.

h. Dangers of Compressed Air. Air pressures used in spray painting will not exceed equipment manufacturer's recommendations. Pressure release valves will be installed in paint gun supply lines, set to open when pressures exceed preset safety limits. Air hose lines shall be handled with care and kept away from oil or sharp objects that could cut or weaken the lines. Air compressors shall be used and maintained according to the standards described in CFP 215-2.

i. Housekeeping While Painting with Flammable Mixtures. Painters' work clothing shall be stored in metal lockers vented at the top and bottom. All wiping rags shall be kept in self-closing metal containers. Paint stored in workshops shall be kept in tightly covered containers.

11. Electrical Safety. Short circuits, overloading, improper grounding, lack of equipment grounds, poor electrical contact and misuses of equipment are all responsible for major accidents involving electricity.

a. Personnel shall treat low voltage systems with the same respect as high voltage circuits.

Severe shocks resulting in death can be received by contact with electrical lines carrying low voltages when working on poles, ladders, or other high places; the shock may be sufficient to cause the worker to lose his footing and fall.

b. The term "high voltage" applies to any circuit, combination of conductors or an exposed point of contact in which the potential to ground or between conductors is 600 volts or greater. The term "hazardous contact" is any potential situation in which the potential current passing through the body, if contact occurred, would be 50 milliamperes or more. It must be recognized that lower voltages or currents can be dangerous and even lethal if unusual conditions exist. Some of these conditions are excessive humidity, wet areas, lack of protective clothing or other equipment, and exposed contacts to an electrical ground other than the equipment itself. When such conditions exist, the power shall be cut off unless it is absolutely necessary to work the equipment or supply lines "hot." It also shall be emphasized that regardless of the voltages involved, if manpower is available, a safety observer shall be employed when work is being done on communications equipment.

c. Electrical control boards, switches, transformers and other hazardous electrical devices shall be located where there is a minimum possibility of accidental contact with energized components. Access routes to electrical controls or panels shall be kept free of obstacles. Locked enclosures or barriers shall be used to protect passing personnel from accidental contact with exposed energized components of electrical control panels.

d. Control switches shall be suitably enclosed. When circuits are being installed or repaired, the line switch shall be locked open and tagged to prevent the circuit from being accidentally energized. Only the person tagging the switch shall be permitted to remove the tag and lock.

e. Grounded railings, barriers, or enclosures shall be used to protect personnel and equipment from accidental contact with conductors, bus bars, switches, control panels and other hazardous facilities. When a high voltage energized circuit is to be repaired, at least two qualified electricians shall work together. They shall be outfitted with the necessary personal protective equipment to complete the job safely. The type of components being repaired and other conditions under which the work will be done, will determine the type of safety equipment needed, i.e., rubber gloves, sleeves, blankets or mats, insulated platforms, safety belts and other. This equipment shall be checked frequently to make certain the insulating qualities are adequate for complete protection.

f. Adequate warning signs shall be placed in plain sight in all areas where hazardous electrical facilities exist, particularly around high voltage fixtures and transmission lines.

g. Metal frames on electrically-powered equipment carrying high voltages shall be connected to effective low resistance grounds. The size and material for grounding conductors shall be selected according to the provisions of the National Electrical Code.

h. In locations where ground wires are exposed to possible mechanical damage, they shall be protected by suitable protective conduits or devices.

i. Outdoor transformers shall be completely enclosed by grounded chain link fences or by grounded translosures. Only authorized personnel shall be permitted to enter transformer installations. Provisions shall be made in all outdoor transformer areas for the safe removal of oil that may be spilled during routine maintenance work. This can be accomplished by drainage ditches or by covering the area around the transformer bank with several inches of cinders, gravel or other absorbent materials. Appropriate voltage warning signs shall be posted.

j. Indoor transformers immersed in a flammable liquid shall be equipped with protective sills to prevent the liquid from overflowing. Adequate drainage facilities also shall be provided at transformer banks. Transformers and flammable liquid tanks, located inside buildings, shall be placed in ventilated, fire-proof vaults. These vaults shall be entered only by trained, authorized personnel. Transformers rated in excess of 25 KVA and immersed in a nonflammable liquid shall be equipped with pressure-relief vents. If installed inside a building used for other than transformer station purposes, and not well ventilated, the transformer shall be equipped with a means for absorbing any gases generated by arcing inside the case; otherwise, the pressure-relief vent shall be connected to a chimney or flue that will carry such gases outside the building. Additional information is in the National Electrical Code.

k. To ensure maximum safety and efficiency, each electric motor shall be of the proper type and size needed to accomplish a particular job. When used in areas where flammable or explosive atmospheres are present, all electric motors shall be of the explosion-proof type. Overloading electric motors shall not be permitted and any existing unsafe wiring found shall be corrected. Proper maintenance is necessary for the prevention of motor damage and, since excessive dust and oil are particularly damaging, they shall be removed from motors by vacuum cleaning or wiping. In unusual circumstances when compressed air is authorized to be used in cleaning electric motors, a pressure not exceeding 15 pounds per square inch may be permitted. The best method for ensuring proper motor maintenance is to prepare a simple card file showing the location of each electric motor, its type, rating class, and past maintenance schedule. Installed electric motor frames shall be effectively grounded to a low resistance ground.

l. Overloading electric circuits is extremely dangerous and shall not be permitted at any time. All systems installed shall be equipped with fuses, circuit breakers, or other accepted means, based on the current carrying capacity of the conductors, to prevent accidental or intentional overloading. Protective devices of the proper rating shall always be used in circuits. Wire, tin foil or other materials shall never be used in place of fuses.

m. Specific types of electrical cords or cable, as specified in the National Electrical Code shall be used to ensure that they are proper for their intended use. Personnel shall avoid excessive bending, stretching and kinking of electrical supply cords. Each cord shall be inspected regularly for defects. Damaged or frayed electric insulation, cords and plugs shall be replaced immediately or repaired by qualified electricians. Receptacles which will permit the plugging in of a standard 220/230 volt plug shall be marked with the proper voltage output designation. Electric equipment shall be disconnected from the power source when not used for long periods.

n. Flexible cords used with portable equipment shall be secured to the machine by an underwriter's knot or by a special approved device to prevent putting strain on conductors and connections.

o. Cords used with heating appliances, such as smoothing irons, shall be covered with a flame-proof insulating material. Extension cords used with portable tools shall be of the three wire type with three prong plugs except when using double insulated tools. Plugs shall be non-conducting. Personnel shall ensure that the wire size of extension cords are capable of handling the required load without heating.

p. Only qualified and authorized electricians shall install and maintain electrical generation and distribution facilities. Two qualified employees shall work together when high voltage circuits or energized circuits of any voltage are involved.

q. Personnel working with electrical components, regardless of location, shall not wear rings, watches, metal rimmed glasses or other metallic objects that could act as conductors of electricity and cause shock or electrocution.

r. For maximum protection against shock, when working with high voltages, repairmen shall use electrical safety gloves. When it is necessary to wear gloves, only those designed for electrical work shall be used. Before beginning work, safety gloves shall be inspected for cuts, punctures, or signs of wear. Never use safety gloves with voltages higher than the glove insulation rating. Only gloves specified for electrical work shall be permitted in rooms holding high voltage equipment, except chemical-resistant gloves which shall be stored near battery installations. To avoid cutting or tearing rubber electrical gloves, personnel shall wear leather gloves over their safety gloves when actually working on high voltage equipment. Rubber goods shall be subjected to voltage tests annually except that rubber gloves in active use shall be tested every three months. Testing shall be in accordance with applicable specifications of the American Society for Testing and Materials (ASTM).

s. Repair personnel shall not use metal rules or uninsulated tools near energized circuits. Tools shall not be taped nor otherwise self-modified to provide insulation.

t. Work benches shall be kept clean at all times. When a voltage is applied to equipment being repaired and/or tested, other equipment and tools not essential shall be removed from the bench. Metal or metal framed/legged work benches used for repairing and testing electrical equipment shall be grounded to a low resistance ground. Wooden, fiberglass or other non-conducting polymer plastic stools shall be used when working on electrical equipment.

u. At least one grounding stick (shorting stick) shall be provided at every high voltage installation, and in all rooms and buildings housing high potential electrical equipment.

v. To provide immediate help to persons who have touched live circuits, it is essential that all electrical workers be trained in the approved method of mouth-to-mouth resuscitation. When a person has been severely shocked and is unconscious, mouth-to-mouth resuscitation is to be started at once and continued until the victim has begun breathing again and medical aid has arrived on the scene. If the heart stops, closed heart massage must be started immediately. The supervisor, local medical authority and staff training personnel shall coordinate to ensure such training is provided.

w. Vapor-proof equipment shall be installed as required by the National Electrical Code in areas with moist atmospheres, such as shower rooms, vehicle wash rooms, kitchen range hoods and others, to prevent short circuits. Explosion-proof equipment shall be provided where required, such as in areas where flammable mixtures are present in the air.

x. Microwave ovens, in some cases, have revealed leaks of dangerously high intensity rays. Ovens found to be leaking more than the excepted maximum exposure limit shall be removed from service. Doors shall have an interlock which disconnects the microwave circuit before the door opens to the point where leakage or sparking can begin to occur. Food deposits, particularly fats and oils, shall be cleaned frequently from ovens.

12. Color Coding and Signs.

a. Color is used extensively for safety purposes. While never intended as a substitute for good safety measures and use of mechanical safeguards, standard colors are used to identify specific hazards. In general, they are as follows:

(1) Red identifies fire protection equipment, danger and emergency stops or machines.
 (2) Yellow is the standard color for marking hazards that may result in accidents from slipping, falling, striking against, etc. - flammable liquid storage cabinets - a band on red safety cans - materials handling equipment - warnings against starting or moving equipment. Black stripes or "checker board" patterns can be used.

(3) Green designates the location of first aid and safety equipment (other than fire fighting equipment).

(4) Black and white, and combinations of them in stripes or checks, are used for housekeeping and traffic markings. They are also permitted as contrast colors.

(5) Orange is the standard color to highlight dangerous parts of machines or energized equipment, such as exposed edges of cutting devices, and the inside of movable guards and enclosure doors and transmission guards.

(6) Blue is used on informational signs and bulletin boards not of safety nature. Has railroad uses.

b. Piping systems may carry harmless, valuable, or dangerous contents and therefore it is desirable to identify pipelines. The contents of pipelines and methods of applying the colors are as follows:

- (1) Red - Fire Protection
- (2) Yellow - Dangerous
- (3) Green - Safe
- (4) Bright Blue - Protective materials (e.g., potable water, inert gases)
- (5) The proper color may be applied to the pipe in bands 8 to 10 inches wide near

valves, pumps and at intervals along the line. The name of the material is stenciled in black.

c. Accident prevention signs are among the most widely used safety measures, so the uniformity in the color and design of signs is essential. The following is a digest of requirements.

- (1) Danger - immediate and grave danger or peril. Red oval on top panel: black or red lettering in lower panel.
- (2) Caution - against lesser hazards. Yellow background color; black lettering.
- (3) General safety - green background on upper panel; black or green lettering on white background on lower panel.
- (4) Fire and emergency - white letters on red background. Optional for lower panel; red on white background.
- (5) Exit markings - in accordance with the NFPA Life Safety Code.

13. Office Safety. The attitude that office accidents are insignificant is one of the prime causes of office accidents. Office work is generally considered to be about the safest occupation and little thought is given to the hazards that are present in most offices. Slips and falls on waxed floors, collisions with desks and chairs, strains from unauthorized furniture moving and other similar accidents are common to offices. Special machines and equipment also add to the accident potential. All personnel who work in these areas shall be familiar with the hazards and comply with the appropriate rules of office safety.

a. Personnel shall not run on stairs, walkways, in corridors, or when entering or leaving buildings.

b. Floors. Rough, splintered, uneven or other floor defects shall be repaired or the hazards suitably marked. Floors shall be kept free of liquid spills, dirt and debris.

(1) Where floor wax is necessary, only slip-resistant floor wax shall be used.

(2) Worn or warped mats under office chairs and rubber or plastic floor mats with curled edges or tears shall be replaced or repaired.

(3) During inclement weather, mud or water may be tracked onto floors near building entrances. To preclude slippery floors, storm mats shall be placed near entrances and the floors mopped periodically.

c. Splintered or jagged edges or other defects found on office furniture shall be immediately repaired or the furniture replaced.

(1) Where projections on book cases, filing cabinets and desks, create an accident source, they shall be immediately removed or guarded.

(2) The casters on swivel chairs shall be on at least a 20-inch diameter base. The casters shall be securely fixed on the base of the chair. Replace broken casters immediately.

(3) Furniture shall never be moved by office personnel; it shall be moved by maintenance personnel, preferably using special dollies and trucks made for such moving.

d. Only one drawer at a time shall be opened to prevent the cabinet from toppling over. Where possible, file cabinets shall be bolted together or otherwise secured.

(1) All file drawers shall be closed immediately after use.

(2) Climbing on file drawers is prohibited.

(3) File drawers shall not open into aisles unless space is provided for this.

(4) Office machines shall not be placed near the edges of tables or desks on which they are used. Machines that creep during operation shall be secured.

(5) Typewriters on folding pedestals shall be fastened to the pedestal.

(6) Electrical fans, both pedestal and oscillating desk or wall type, located less than seven feet above the floor shall be adequately guarded with 1/2 inch or less mesh covering over the front and back of the blade.

f. Doors. Dual doors shall be marked "Entrance" and "Exit" or "In" and "Out."

(1) Glass doors shall contain some conspicuous design, either painted or decal, about four and a half feet above the floor and centered on the top so that people will not walk into it.

(2) Solid core doors, such as rated fire doors, that open directly into a passageway shall be signed "Open Door Slowly" so that a person entering the passageway will be aware of the hazard. As an added protection, it is good practice to have the door hinges on the upstream side of the traffic.

g. Ladders. Chairs, boxes and other objects shall not be used as substitutes for ladders.

(1) Rolling ladders and stands used for reaching high storage shall have brakes that operate automatically when weight is applied to them.

(2) Small stools used in filing areas are tripping hazards and shall not be left in aisle ways when not in use.

h. Chemical Products. Adequate ventilation shall be supplied for duplicating machines, particularly spirit duplicating machines, and others that use ammonia, methanol or other toxic liquids. Duplicating processes shall not be confined to a separate small room, unless it is vented to the outside.

(1) Chlorinated bleaches used for cleaning purposes shall not be mixed with strongly acidic or easily oxidized materials.

(2) Flammable fluids and similar materials shall be stored in safety cans in lockable metal cabinets. Only minor quantities shall be left in offices.

i. Other Hazards.

(1) Spindle spike files shall not be used.

(2) Trim boards (paper cutters) shall be equipped with a guard that affords maximum protection.

(3) Razor blades, thumbtacks and other sharp objects shall not be thrown loosely into drawers.

(4) Materials shall not be stored in areas where they present a tripping hazard.

(5) Movable objects such as flower pots, vases and bottles, shall not be allowed on window sills or ledges.

(6) The use of poorly maintained or unsafe low quality non-UL-listed coffee makers, radios, lamps, etc., provided by or used by employees shall be discouraged.

14. Health Hazards and Protection. Health hazards and protection information is provided to aid supervisors in recognizing conditions requiring further evaluation and action by the environmental health services agency. When personnel detect an environmental condition or occupational situation which is suspected of producing an adverse effect on health, the matter will be promptly referred to the safety officer for appropriate action.

a. Control Methods. Several general control measures may be used to lessen health hazards. These measures will be used by the responsible authority where health hazards exist.

(1) Education. Proper indoctrination of all personnel exposed to health hazards is absolutely necessary. Supervisors will make certain that all health and safety standards are strictly observed.

(a) Personal Hygiene. Personal cleanliness is most essential where health hazards exist, particularly in operations involving possible skin contaminants. To encourage and facilitate personal cleanliness, suitable washrooms, showers and locker rooms shall be made available to personnel involved in operations that produce health hazards.

(b) Good housekeeping. Housekeeping must be kept at the highest possible level in areas where health hazards are present. Particular caution shall be taken to prevent unnecessary accumulation, spillage, dispersion, evaporation, or generation of hazardous materials. Spills and other uncontrolled contamination will be cleaned up immediately and suitable receptacles shall be provided for the disposal of waste products.

(2) Substitution. The most effective means of controlling many health hazards is to substitute a non-hazardous material for a harmful one. Complete substitution may be impractical, but even partial substitution will reduce the hazard. When a substitution can be made, it will be necessary to make certain that another more serious hazard is not created by the new material.

(3) Isolation. When practical, processes creating health hazards shall be isolated. Isolation can be accomplished by physically locating the process away from occupied areas or by the use of barriers or enclosures.

(4) Process Modifications. Partial or complete hazard elimination may be accomplished by changing or revising a particular process to remove unnecessary handling operations, improve control of dangerous materials and establish safety working procedures.

(5) Limiting Exposure. When control methods do not prove totally effective, the length of time a person will be exposed to the hazard will be limited considering appropriate threshold limit values (TLV).

b. Ventilation. Ventilation is the process of passing clean air through any space or area to dilute or remove undesirable air and its contaminants. The health, efficiency, motivation and comfort of personnel will be greatly influenced by the quality and quantity of ventilation in work areas. Poor ventilation may permit the accumulation of air contaminants that can cause personnel injuries, industrial disease, explosion or fire. Ventilation is classified as either "general" or "local."

(1) General Ventilation. General ventilation includes natural and mechanical ventilation.

(a) Natural ventilation is simply that caused by normal air currents or drafts passing through open doors, windows and vents.

(b) Mechanical ventilation is created mechanically by such devices as power driven fans.

(2) Local Exhaust Ventilation. Local exhaust ventilation removes hazardous substances from the atmosphere at the point of generation; intake hoods and ducts are usually provided through which the air impurities are taken in and passed through the ducts to outside air by fans.

c. Cooling and Heating. A primary purpose of heating and cooling air is for personal comfort. Work efficiency can be effected by high temperatures and humidities - workers lose interest rapidly in this environment. In addition to discomfort, unusually high or low temperatures will cause increased accidents because of their adverse effects on peoples' attitudes and manual dexterity.

d. Illumination and Vision. When a worker's vision is subject to extremes of illumination - too much or too little - they are subject to eye fatigue. When eye fatigue occurs, the worker can be affected in various ways; headache, eye strain, impairment of vision; thus, increasing their accident potential.

e. Quantity of Light. The amount of light provided at any location shall be based on the purpose for which the location is being used or the kind of work being performed. Light quantity is measured in foot-candles. Quantities normally needed range from about 5-foot candles for inactive storage rooms to 200-foot candles for extremely fine or detailed work.

f. Noise. Noise is commonly called "unwanted sound." Also, it is referred to as "sound that forces unwilling attention or causes an unpleasant and emotional reaction, or gives a person a distinct feeling of relief upon cessation." Thus, time, place and psychological reactions and physical characteristics of sound are contributing factors in noise. Some noises are merely annoying; others have an influence on psychomotor behavior. Some reduce production and efficiency in activities where speech communication is important, while more intense noises cause physical damage to the human ear - injuries that can result in permanent deafness. Specialized equipment and training personnel are needed to analyze a noise exposure problem. Basically, noise is measured in decibels. Generally, the maximum intensity of sound to which the human ear can be subjected without damage is considered to be in the range of 90 to 100 decibels. If people must work for long periods exposed to sound (pressure) levels higher than approximately 85 decibels, they must wear some form of ear protection.

g. Atmospheric Contaminants. These contaminants may be in the form of dust, gases, vapor, fumes and mists.

(1) Dusts. Dusts are tiny solid particles that are usually generated by grinding, drilling, crushing, sawing, or handling of solid materials. Dusts are generally classified as three types, depending upon the physiological effects.

(a) Fibrosis-producing Dust. This type of dust physically injures a person's lungs. Normal lung tissue is gradually replaced with fibrosis or scar tissue. The most common example of such dust is free or uncombined silica, which causes silicosis.

(b) Toxic Dusts. These dusts may be created from lead, manganese, antimony, arsenic and their compounds. Toxic dusts are dissolved in a person's lungs and are absorbed into the organs and tissues. Certain toxic dusts may irritate a person's skin as well as being harmful when breathed.

(c) Nuisance Dusts. Nuisance dusts are not directly injurious to a person's health. Certain nuisance dusts, particularly those of organic origin, will often aggravate personal allergies and hypersensitivity.

(2) Gases and Vapors. A gas is a substance that exists as a gas in its normal state at ordinary temperature and pressure. A vapor is the gaseous form of a substance that normally exists as a liquid or in some cases, as a solid. Gases and vapors can be divided into four main groups, based on their physiological effects.

(a) Asphyxiants. A number of gases and vapors which are relatively non-toxic or inert become dangerous when present in concentrations high enough to significantly replace the oxygen in the air we breath. These are known as simple asphyxiants; for example, hydrogen, nitrogen and methane can act as simple asphyxiants.

(b) Irritants. Irritant gases and vapors cause inflammation of the respiratory system. Complications such as pneumonia or other pulmonary diseases may result from injuries caused by exposure to irritating gases and vapors, such as ammonia, chlorine and nitrogen oxides.

(c) Anesthetics. Anesthetic gases and vapors have a sleep-producing and depressant effect on persons. The central nervous system may be dangerously depressed and respiratory failure may result in death. Practically all anesthetic gases and vapors belong to the hydrocarbon series: Methyl ether, ethyl, ether, gasoline, naphtha and benzene, are some examples.

(d) Poisons. Poisonous gases and vapors act directly on the body's blood-forming system, tissues, or bones, depending on the type of gas or vapor involved. Methyl chloride, methyl bromide, certain alcohol compounds and tetraethyl lead are some of the sources of poisonous gases or vapors.

h. Skin Contaminants. Many substances and materials used in department operations may cause skin irritations or inflammation, in working personnel. Many occupational skin afflictions are allergic inflammation or dermatitis. Substances, such as strong acids, act immediately on the skin to produce an acute destruction. Other, more dilute substances, such as petroleum fuels, may cause dermatitis only after repeated or prolonged exposure and contact. Certain agents produce characteristic sores that make the cause of the dermatitis easy to determine. Many other substances, however, have similar skin effects that make the cause of skin irritations difficult to isolate when several of the substances are used in the same operation. Also, it frequently happens that what appears to be a simple case of occupational dermatitis may have been caused by some external or off-duty source of irritation, completely unrelated to occupational exposure. These factors shall be carefully considered when making a health analysis of suspected dermatitis-causing industrial operations.

(1) Chemical Agents. The most common dermatitis-producing substance used in the department are solvents and caustic compounds. Through direct action on the skin, these substances and compounds may cause acute or chronic skin injury, depending on the characteristics of the agents.

(2) Pesticides and Herbicides. Not only are most of the pesticides and herbicides used in the department's operations irritating to the skin, but they are toxic when inhaled, absorbed, or swallowed. Therefore, administrators/superintendents must effectively control the use of pesticides and herbicides. In order that insect/rodent and weed control will be safely and effectively carried out, personnel engaged in this work must be competent and thoroughly trained.

(3) Mechanical Agents. The presence of minute cuts and scratches will allow tiny particles of wood, metal, steel wool and other extraneous material to enter the skin. They may cause irritation or inflammation. Other mechanically caused dermatitis may result from constant friction or pressure on a particular area of the skin.

(4) Physical Agents. Exposure of the skin to extreme heat will naturally cause burns; continued heat exposure will result in drying and cracking of the skin. Extreme cold will freeze the skin;

thus, causing frostbite. Skin chafing is the result of continued exposure to even moderately cold temperatures. X-ray, ultraviolet and other sources of radiant energy will cause serious burns to the skin if exposed for long periods.

(5) Biotic Agents. Various bacteria, fungi, ringworm and other biological organisms may infect the skin. Infection is enhanced when these organisms enter the skin through openings resulting from cuts, burns and other injuries.

i. Personal Protective Equipment. Certain activities, particularly those involving specialized operations, may present hazards that are difficult to completely eliminate or adequately safeguard. Therefore, workers must be given further protection through personal protective equipment or clothing. The importance of protective clothing and equipment to safeguard the health of personnel engaged in hazardous activities cannot be overemphasized.

(1) Use of Personal Protective Equipment. This equipment must not be used as a substitute for the elimination of unsafe acts and conditions, but rather as a supplemental safety measure.

(a) When a hazard exists or is likely to exist in spite of the use of normal corrective or control measures, administrators/superintendents will direct exposed personnel to wear protective equipment and clothing.

(b) When job requirements specify the wearing of protective apparel and devices, this requirement then becomes a part of safety regulations and a condition of employment. In addition, every effort shall be made to impress on workers the value of personal protective clothing and equipment, so they will want to wear it for their own protection and welfare.

(c) Inspection. Personal protective clothing and equipment shall be inspected periodically by the supervisor. Items found to be in need of repair or replacement shall be taken out of service immediately.

(d) The below listed equipment and clothing is only a small portion of equipment available on the commercial market. The equipment discussed herein is directed to department needs. Information on additional equipment can be obtained from the safety officer.

(2) Eye and Face Protection. Protective eye and face equipment is required where there is a reasonable probability of injury that can be prevented by such equipment. Suitable eye protection shall be provided and worn where machines or operations present the hazard of flying objects, glare, liquids or a combination of these hazards.

(a) Goggles. Persons whose vision requires the use of corrective lenses shall wear goggles that fit over spectacles without disturbing the adjustment of the spectacle.

(b) Spectacle Glasses. These glasses are similar in construction to regular eye glasses and are normally used as general occupational glasses. Spectacle glasses are made with impact-resistant lenses designed to give protection against flying objects and they may be fitted with side shields.

(c) Chemical Goggles. These goggles are used to protect the eye against hazards involved in chemical handling operations. The eyecups are ventilated and baffle plates are fitted within the eyecup to protect eyes from splashed chemicals penetrating the ventilation perforations.

(d) Welding Goggles. These goggles are made to give protection from flying sparks, scale, metal splashes and harmful light rays. The lenses are impact-resistant, chemically treated, and filtered in different shades to reduce the effects of infrared and ultraviolet rays.

(e) Face Shields. Face shields give protection to the eyes and face from small flying particles, and are usually used in place of goggles where increased vision is necessary or where goggles are subject to excessive fogging. Face shields are available in various sizes, strengths and light filtering capacities.

(f) Welders' Helmets. These helmets, shields or masks will protect welders from excessive heat, injurious radiation, metallic splashes, flying particles and other welding hazards.

(3) Head Protection. Hard hats or skull guards are designed to protect the wearer's head from injury from falling or flying objects. These hats usually consist of hard, fracture-resistant, composition shells supported on adjustable cradles or hammocks, that act as shock absorbers. Most hats are water resistant, nonconductors of electricity and fire-resistant.

(a) Metal hats are available, but shall not be used in areas where electrical hazards exist. Holes shall not be made in hats because they may split or crack, thus weakening the entire hat.

(b) Bump caps shall be worn by personnel for protection against striking sharp objects, or while working in close quarters. Bump caps shall not be used as substitutes for hard hats.

(4) Arm and Hand Protection. Numerous jobs require that adequate protective devices be worn by personnel to guard their arms and hands. Various types of gloves and arm protectors are described in the following paragraphs.

(a) Welders' Gloves. Special gloves shall be worn to protect welders' hands from heat, burns, abrasions, metal splashes and hot sparks. These gloves are made of chrome-tanned split cowhide and are lined with knitted fabric and cotton duct.

(b) Rubber and Plastic Gloves. Rubber protective gloves shall be worn by personnel working with batteries or where acids, alkalis, organic solvents and other harmful chemicals are used. Plastic or synthetic rubber gloves shall be used for protection against the harmful effects of petroleum products and chlorinated solvents, since the solvents attack and damage natural rubber.

(c) Cotton fabric gloves, covered with synthetic rubber or plastic, shall provide protection against ordinary concentrations of acids, alkalis and salt solutions and may be used for handling wet materials. Because they absorb perspiration, these gloves are much more comfortable to work with than natural rubber gloves.

(d) Electrical Workers' Gloves. This type is designed to protect electrical workers from shock, burns and other electrical hazards. These gloves shall not be used for primary protection and shall never be used with voltages higher than the glove insulation rating.

1. All electrical workers' gloves shall be carefully examined before each use and shall not be worn unless they are in perfect condition.

2. Electrical workers' gloves are available with an external protective glove of leather to guard the rubber from puncture and excessive wear. If a rubber electrical glove shows a leakage of more than 10 milliamperes at an AC potential of 10,000 volts, it will be taken from service.

(e) Workers' Gloves. These gloves, or all-purpose gloves as they may be called, shall be worn to protect the hands from injuries caused by handling sharp or jagged objects, wood, or similar hazard-producing materials. These gloves are usually made of some cloth with chrome leather palms and fingers.

(f) Miscellaneous Hand and Arm Protectors. Suitable mittens, acid sleeves, padded arm protectors, hand pads and other items are available for protection of the hands and arms when handling acids, hot or sharp materials.

(5) Body Protection. The following paragraphs describe briefly some of the various items of clothing designed to protect the body from hazards normally associated with industrial activities.

(a) Aprons - Natural or synthetic rubber or acid-resisting rubberized cloth aprons shall be worn by personnel handling irritating or corrosive substances.

(b) Welders' Clothing, including aprons, sleeves, bibs, capes and jackets shall be worn by welders to guard against hot metal splashes, sparks and heat.

(6) Foot Protection. Safety shoes shall be worn by personnel working in areas where heavy materials are handled, or while performing operations that are considered hazardous to the feet or toes. Various types of safety shoes include: conductive, non-sparking, electrical hazard, foundry, toe guards and wooden. Spats and leggings made of leather, flameproof duck or rubber are designed to protect the feet and ankles from heat, hot metals, acid or similar hazards.

(7) Ear Protection. Ear protectors, in general, usually fall into two (2) main groups - the plug or insert type, and the cup or muff type. The plug or insert type can be classified into aural, which can be inserted in the ear canal, and supraaural, which seals the external edges of the ear canal. Cup or muff devices cover the external ear to provide an acoustic barrier.

(8) Respiratory Protection. Personnel exposed to hazardous atmospheres that cannot be eliminated by engineering control methods will be provided with adequate respiratory protective equipment. The type of respiratory protection shall be based on an assessment of the inhalation

hazard. For example, the composition and expected concentration of the airborne contaminate will be considered with other factors, such as oxygen deficiency. Respiratory protective equipment must be maintained in excellent condition. Users shall inspect the equipment before use and clean the equipment after use. Basic types of respiratory protective equipment are as follows:

(a) Mechanical Filter Respirators. These devices are for protection against airborne particulate matters such as nonvolatile dusts, mist or fumes. It is equipped with one of several types of mechanical filters. Selection of the proper mechanical filter must be based on the particle size of the particulate matter as well as the factors previously discussed. Mechanical filter respirators will not be used in oxygen deficient atmospheres.

(b) Chemical Cartridge Respirators. These respirators provide protection against low concentrations (less than 0.2% by volume) of certain acid gases and organic vapors. These devices utilize small cartridges of certain chemical agents which remove the contaminate. The cartridges will specify the type and maximum concentration for which it was designed. Chemical cartridge respirators will not be used in oxygen deficient atmospheres.

(c) Gas Masks. General purpose gas masks are used for respiratory protection in low and moderately high concentrations of most toxic gases and vapors where there is sufficient oxygen to support life. The general purpose mask will give protection against organic vapors, acid gases, carbon monoxide and other gases in concentrations up to 2 percent by volume of air.

(d) Air Line Respirator. This device consists of a facepiece connected to a hose which supplies breathing air from an external source such as an air compressor or compressed gas cylinders. If the air supply fails, the wearer is without respiratory protection and may not escape from an atmosphere immediately harmful to life; therefore, these respirators are not recommended for such inhalation hazards.

(e) Self-contained Breathing Apparatus. These respiratory protective devices are complete units, in that the wearers carry an oxygen supply along with them. This equipment falls into two (2) general categories -- those providing oxygen/air from a compressed gas cylinder and those which generate oxygen through a chemical process. A self-contained breathing apparatus provides respiratory protection in atmospheres immediately dangerous to health.

(9) Safety Equipment. All accessory apparatus for the protection of workers shall be periodically checked and serviced. Safety equipment of this category include the types of harnesses, shop, laboratory and bench tools, materials and facilities indicated below.

(a) Safety Belts, Lifelines and Lanyards. This equipment shall be worn by all personnel working in high places, or on ladders, scaffolds, roofs and utility poles. This equipment shall be used only for employee safeguarding. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as distinguished from static load testing, must be immediately removed from service and will not be used again for employee safeguarding.

1. Lifelines will be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.

2. Lifelines used in areas where the lifeline may be subjected to cutting or abrasion will be a minimum of 7/8" wire-core manila rope. All others will be a minimum of 3/4" manila or equivalent with a minimum breaking strength of 5,400 pounds.

3. Safety belt lanyards will be a minimum of 1/2" nylon, or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope will have a nominal breaking strength of 5,400 pounds.

(b) Lineman's Insulation Protective Equipment. Lineman or electricians who work on energized high voltage circuits or power lines will wear effective electrical workers' gloves and will use other necessary hot line rubber equipment to guard against electrical shocks. Each shop and crew working with energized high voltage lines and using rubber protective equipment will be furnished with proper storage space, in both the shop and the vehicle. This also applies to fiberglass, epoxiglass and plastic insulator hoods, sleeves or other protective equipment.

(c) Safety Cans. These cans shall be used for carrying and handling small quantities of flammable liquids. The can will be fitted with a self-closing valve or cap and will be vented, either through a pressure relief valve or through the pouring or filling opening. Each filling and pouring

opening will be equipped with a double screen that serves as a flash arrester. The contents of each can will be plainly lettered on the outside for immediate recognition.

(d) Bench Cans. Bench-cleaning cans shall be used where small parts are customarily cleaned with flammable liquids. The parts to be cleaned will be placed on a perforated metal screen or dasher which will then be depressed, allowing the cleaning fluid to filter over the objects. When the pressure is released, a spring forces the screen up and out of the liquid and the screen serves as a flame baffle. The bench can be provided with a vapor-tight hinged lid and may be used in sizes up to 3 gallons.

(e) Oily Waste Cans. This type of container shall be used for disposing of oily waste and rags that may create fire hazards. The can shall be fitted with a self-closing, air-tight cover. It will be supported on legs or a base so the bottom will be above the floor and will also be equipped with a carrying handle. Oily waste cans are available in capacities up to 30 gallons.

(f) Carboy Tilters. This piece of safety equipment shall be used when pouring dangerous liquids from carboys into other containers. Carboy tilters are usually made of steel angle bars mounted on casters for easy movement.

(g) Cleaning and Degreasing Tanks. Cleaning and degreasing operations shall be accomplished in tanks designed to guard against fires, explosions, spillage and personnel exposure to toxic chemicals. Large dip tanks will be equipped with covers and held open by a fusible link or other heat activated device to permit automatic closure if fire occurs.