

School: _____ Room Number: _____ Date: _____

Person Completing Report: _____ Title: _____

PART 1 – GENERAL SCIENCE SAFETY CONSIDERATIONS – LABORATORY

DESCRIPTION

A school science laboratory is defined as a classroom where demonstrations and/or laboratory instructions are provided for individual or group experiments in which hazardous chemicals or gases are used. These areas may include chemistry classrooms, rooms used for student experiments, and prep areas.

<u>Item/Description:</u>	<u>Citation</u>	<u>Meets</u>	<u>Does Not Meet</u>	<u>N/A</u>
<p>1. FIRE EXTINGUISHERS.</p> <p>a. At least one 2A-20BC rated (or larger) portable fire extinguisher must be provided for each 3,000 feet of laboratory. Travel distance must not exceed 50 feet from anywhere in the lab.</p> <p>b. At least one fire extinguisher suitable for class D fires must be provided in laboratories where combustible metals are used and stored.</p>	MSFC (07) 906.1			
<p>2. EGRESS AISLES. Aisles serving work areas on two sides must be at least 36" wide; those serving work areas on one side must be 24".</p>	MSFC (07) 1027.21			
<p>3. NUMBER OF EXITS. Minimum of two means of exit access must be provided when the laboratory exceeds 500 sq. ft. in size for new labs using hazardous materials or 1,000 square feet for existing labs using hazardous materials.</p>	MSFC (07) 1015.1 &1027.23.4			
<p>4. FIRE SEPARATIONS. Labs must be separated from other portions of the building by not less than a 1-hour fire separation.* <u>Note:</u> In labs located in building protected by automatic sprinkler systems – no separation is required. Smoke separation still requires a steel or solid wood door. * Recommend this be determined by a licensed design professional.</p>	MSFC (07) 705.3			
<p>5. FIRE ALARM & DETECTION. Labs must be equipped with automatic detection electrically inter-connected with the building's fire alarm system. Note: labs protected by a complete automatic sprinkler system that is interconnected to the building fire alarm require no additional detection.</p>	MSFC (07) 907.2.3 & 907.3.2			
<p>6. ELECTRICAL SAFETY. All electrical outlets must be properly grounded and all fixed electrical equipment and appliances must be plugged in to grounded outlets as required by the electrical code.</p>	MSFC (07) 605.7			
<p>7. EXTENSION CORDS. Extension cords must not be used as a substitute for permanent wiring.</p>	MSFC (07) 605.5			
<p>8. ELECTRICAL MULTI-PLUG ADAPTERS. The use of multiplug adapters, octopus arrangements, cube adapters, strip plugs or any other device that does not comply with the Fire Code is prohibited.</p>	MSFC (07) 605.4			
<p>9. ELECTRICAL PANEL ACCESS. A working space of not less than 30" in width, 36" in depth and to a height of 72" shall be maintained in front of electrical panels.</p>	MSFC (07) 605.3			
<p>10. INVENTORY. A complete inventory of chemicals on hand must be maintained and must be available to the fire chief. All materials must be</p>	MSFC (07) 2701.4.2			

dated upon receipt.				
11. EMERGENCY PLANNING. Persons responsible for each lab must be familiar with the chemical nature of the materials present in the lab and the appropriate mitigating actions to be taken in case of fire, leak or spill.	MSFC (07) 2703.9.1			
12. SPILL CONTROL. Neutralizing chemicals, spill kits, dry sand, oil dry, 3M Absorbent and other spill control methods must be readily available while the lab is in use.	MSFC (07) 2703.3.1.2			
13. GAS SHUT-OFF VALVE. Provide a properly marked, easily accessible master gas shut off valve in the room.	MSFC (07) 2703.2.2.1 (# 4)			
14. FUME HOODS. Fume/exhaust hoods must be listed or engineered for its intended use and maintained in proper operating condition.	MSFC (07) 2703.2			

Part 2 – GENERAL SCIENCE SAFETY RECOMMENDATIONS

1. SUPERVISION OF STUDENTS. Students must be under the direct supervision of a faculty member or an assistant at all times. In most cases it is recommended that direct supervision means direct eye contact. It is recommended that no more than two students be assigned to a lab station.	NFPA 45, (2000) 2.2.2.1
2. ELECTRICITY & SPILLS. Electrical receptacles, switches, and controls must be located so as not to be subject to liquid spills.	NFPA 45 (2000)
4. GAS PIPING SYSTEMS. Piping systems must comply with nationally recognized standards.	MSFC (03) 2703.2.2.2
5. EYE PROTECTION. Enough eye protection devices (goggles) must be provided for every student in the room, visitors, and the teacher whenever potentially hazardous activities are taking place.	MN Public Law, section 126.20
6. USE OF REFRIGERATORS. Refrigerators, freezers and other cooling equipment used to store or cool flammable liquids must be of explosion-proof construction.	NFPA 45 (2000) 9.2.2.2
7. USE OF REFRIGERATORS. Each refrigerator, freezer or cooler must be prominently labeled to indicate whether it is or is not suitable for storing flammable liquids.	NFPA 45 (2000) 9.2.2.1
8. EXPLOSIVE MATERIALS NOT ALLOWED. It is recommended that due to the serious explosion hazard present, the following chemicals not be used in an instructional setting: Benzoyl Peroxide Carbon Disulfide Ethyl Ether Perchloric Acid Picric Acid Potassium metal Magnesium powdered metal	Recommendation
9. PERSONAL SAFETY. Loose clothing (e.g. sleeves, full cut blouses, neckties, etc.) and long hair should be properly restrained. Also, some laboratory activities could be dangerous to persons wearing contact lenses.	Recommendation
10. HEAT SOURCES. Heat sources should never be left unattended (e.g. gas burners, hot plates, heating mantles, etc.)	Recommendation

11. DANGEROUS RISK CHEMICALS. See lists of chemical where risk exceeds the educational value or the chemicals should be used in limited quantities. (Tables 2 and 3)	Recommendation
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PART 3 – CHEMICAL STORAGE FACILITIES/ROOMS

DESCRIPTION

Chemical Storage Facilities means any area or room where chemicals are stored. Usually this refers to the chemistry storage area, but these rules apply to all areas where chemicals are stored.

<u>Item/Description:</u>	<u>Citation</u>	<u>Meets</u>	<u>Does Not Meet</u>	<u>N/A</u>
1. FLAMMABLE/COMBUSTIBLE LIQUID QUANTITIES IN USE. Quantities of flammable and combustible liquids shall not exceed the amounts necessary for demonstration, treatment, laboratory work, maintenance purposes or operation of equipment. See limits in "Use" column of Table 1 below (adapted from MSFC Table 2703.1.1)	MSFC (07) 3404.3.4.1			
2. FLAMMABLE LIQUIDS CABINET. Quantities of flammable and combustible liquid in excess of 10 gallons must be stored in a flammable liquids cabinet. Quantities not exceeding ten gallons must be stored in an approved location.	MSFC (07) 2703.8.7			
3. FLAMMABLE/COMBUSTIBLE LIQUID QUANTITIES IN STORAGE. The maximum quantity of flammable and combustible liquids in storage and use in a lab must not exceed 120 gallons. <u>Note:</u> These quantities may be doubled if stored in approved storage cabinets or in sprinklered buildings. (Both increases apply)	MSFC (07) 2703.1.1			
4. HAZARDOUS MATERIALS – QUANTITIES IN STORAGE & USE. Quantities of hazardous materials being stored or used shall not exceed the amounts shown in Table 1 (adapted from MSFC Table 2703.1.1).	MSFC (07) 2703.1.1			
5. FLAMMABLE/COMBUSTIBLE LIQUID CONTAINERS. Class I and II liquids must be stored in approved storage containers.	MSFC (07) 3404.3.6.1			
6. REACTIVE MATERIALS. Materials which will react with water or other liquids to produce a hazard must not be stored in the same room with flammable or combustible liquids.	MSFC (07) 2703.9.8			
7. GAS CYLINDERS. Stored gas cylinders shall have all protective devices on (caps collars and similar devices)	MSFC (07) 3003.4.1			
8. GAS CYLINDERS. All gas cylinders must be secured in a place to prevent falling.	MSFC (07) 3003.5			
9. MSDS AVAILABLE. Material Safety Data Sheets (MSDS) must be readily available on the premises for all hazardous chemicals.	MSFC (07) 2703.4			
10. APPROVED CONTAINERS. All chemicals must be stored in approved containers (if possible, chemicals should be stored in the original shipping package).	MSFC (07) 2703.11.3.5			
11. INCOMPATIBLE MATERIALS. Incompatible materials shall be segregated to prevent accidental contact with one another. (Storage of	MSFC (07) 2703.9.8			

materials which are incompatible shall not be allowed in the same cabinet or exhausted enclosure).				
12. SHELVING FOR STORAGE. All shelving must be of substantial construction and properly secured to prevent falling over. (Shelving above work areas should be kept free of chemicals. Storage above eye level should be avoided). Storage of hazardous materials shall be orderly.	MSFC (07) 2703.9.9			
13. DEFECTIVE CONTAINERS. Defective containers must be removed and disposed of in a proper manner	MSFC (07) 2703.2.6.2			
14. CHEMICAL RELEASE. Hazardous Materials shall not be released into a sewer, storm drain, ditch, drainage canal, lake, river or tidal waterway, or upon the ground, street, sidewalk, street or highway or into the atmosphere.	MSFC (07) 2703.3			
15. SECURITY FOR CABINETS & ROOMS. All storage cabinets and storage rooms must be locked or otherwise secured against unauthorized entry.	MSFC (07) 2703.9.2			
16. CONTAINER LABELING. All containers must be properly labeled to identify the contents.	MSFC (07) 3403.5			
17. TRANSFER OF FLAMMABLE LIQUIDS. When transferring flammable liquids between containers, the containers must be properly bonded together. The practice of purchasing large containers and dispensing into smaller ones is discouraged.	MSFC (07) 3405.3.2			

TABLE 1 - Quantities of Materials Allowed in a Single Room or Area

MATERIAL:	CLASS:	MAX. QUANTITY - STORAGE:	MAX. QUANTITY - USE:
Combustible Liquids	II	120 gallons	30 gallons
	III-A	330 gallons	80 gallons
	III-B	13,200 gallons	3,300 gallons
Corrosives & Acids		5,000 lbs.	1,000 lbs.
		500 gallons	100 gallons
		810 cu. ft.	
Cryogenic (flammable)	Flammable	45 gallons	10 gallons
Flammable Gas	Gaseous	1,000 cu. ft.	No specific limits
	Liquefied	30 gallons	
Flammable Liquids	I-A	30 gallons	10 gallons
	I-B	120 gallons	30 gallons
	I-C	120 gallons	30 gallons
Organic Peroxides	I	5 lbs or 5 cu. ft.	1 lb or 1 cu. ft.
	II	50 lbs or 50 cu. ft.	10 lbs or 10 cu. ft.
	III	125 lbs or 125 cu. ft.	25 lbs or 25 cu. ft.
	IV	no limits	no limits
	V	no limits	no limits
Oxidizers	4	1 lb or 1 gallon	1/4 lb. or 1 quart
	3	10 lbs or 10 gallons	2 lbs or 2 gallons
	2	250 lbs or 250 gallons	50 lbs or 50 gallons
	1	4,000 lbs or 4,000 gallons	1,000 lbs or 1,000 gallons
Note: These quantities can be doubled if all materials are stored or kept in storage cabinets.			
Note: These quantities can also be doubled if the building is protected with a fire sprinkler system.			

Table 2 - Examples of Excessive Risk Chemicals (Risk Probably Exceeds Educational Value)

Acetic Anhydride	Explosive potential, corrosive
Acetyl Chloride	Corrosive, fire risk, reacts violently with water and alcohol
Acrylamide	Toxic by absorption, suspected carcinogen
Acrylonitrile	Flammable, poison
Adipoyl Chloride	Corrosive, absorbs through skin, lachrymator (causes eyes to tear)
Aluminum Chloride, anhydrous	Corrosive, water reactive
Ammonia, gas	Corrosive, lachrymator (causes eyes to tear)
Ammonium Bifluoride	Reacts with water, forms Hydrofluoric Acid
Ammonium Bichromate	May explode upon contact with organics, suspected carcinogen
Ammonium Chromate	Poison, oxidizer, may explode when heated
Ammonium Dichromate	Reactive, may cause fire and explosion
Ammonium Perchlorate	Explosive, highly reactive
Ammonium Sulfide	Corrosive, poison, reacts with water and acids
Aniline	Absorbs through skin, carcinogen, toxic
Aniline Hydrochloride	Poison
Antimony Oxide	Health hazard
Antimony Powder	Flammable solid, health hazard
Antimony Trichloride	Corrosive, emits Hydrogen Chloride gas if moistened
Arsenic compounds	Carcinogen, poison
Asbestos, Friable	Carcinogen, health hazard (inhalation)
Azide compounds	Extremely reactive, explosive in contact with metals, highly toxic
Barium Chromate	Poison
Benzene	Carcinogen, flammable
Benzoyl Peroxide	Flammable, organic peroxide, oxidizer
Beryllium & its compounds	Carcinogen, poison; dust is highly toxic
Bromine	Corrosive, oxidizer, volatile liquid
Cadmium compounds	Carcinogen, toxic, heavy metal
Calcium Fluoride (Fluorspar)	Toxic fumes when heated, damage to fetus or embryo
Carbon Disulfide	Flammable, toxic
Carbon Tetrachloride	Carcinogen, toxic
Chloral Hydrate	Sedative, hypnotic drug, DEA controlled substance
Chlorine – gas	Corrosive, poison
Chlorobenzene	Explosive, toxic by inhalation
Chloroform	Carcinogen, can form phosgene gas (if old)
Chorosulfonic Acid	Toxic (aka Sulfuric Chlorohydrin)
Chromic Acid	Strong oxidizer, poison
Collodion	Flammable, explosive when dry, nitrocellulose compound
Cuprous Cyanide	Toxic
Cyanogen Bromide	Poison, irritant to skin and eyes
Cyclohexene	Flammable, forms peroxides
Dichlorobenzene	Toxic
Dichloroethane	Flammable, toxic
Dinitro Phenol	Explosive, disposal by bomb squad
Dinitrophenyl Hydrazine	Severe explosion and fire risk
Dioxane	Flammable, forms peroxides
Ether, Anhydrous	Flammable, forms peroxides
Ether, Ethyl	Flammable, forms peroxides
Ether, Isopropyl	Flammable, forms peroxides
Ethylene Dichloride	Contact hazard, toxic, fire risk, explosive in air (6-16%)
Ethyl Nitrate	Explosive, disposal by bomb squad
Ethyleneimine	Flammable
Ferrous Sulfide	Spontaneously ignites if wet
Formaldehyde (Formalin)	Carcinogen, sensitizer, toxic
Gunpowder	Explosive
Hydrazine	Carcinogen, corrosive, flammable, absorbs through skin

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Hydriodic Acid	Corrosive, toxic
Hydrobromic Acid	Corrosive, poison
Hydrofluoric Acid	Corrosive, poison
Hydrogen	Flammable
Hydrogen Sulfide, gas	Poison, forms Sulfuric Acid with water
Lithium Aluminum Hydride	Flammable, reacts with air, water, and organics
Lithium Metal	Water reactive
Mercaptoethanol	Corrosive, flammable
Mercury compounds	Poison, heavy metal
Mercury, liquid	Carcinogen, toxic, heavy metal
Methylene Chloride	Carcinogen, narcotic, toxic
Methyl Ethyl Ketone (MEK)	Flammable, toxic
Methyl Isocyanate	Flammable, toxic
Methyl Isopropyl Ketone	Toxic
Methyl Methacrylate	Flammable, vapors cause explosive mixture in air
Naphthylamine, a-	Carcinogen, combustible, toxic
Nickel Oxide	Carcinogen, toxic, flammable as a dust
Nitriiotriacetic Acid	Corrosive
Nitrobenzene	Highly toxic
Nitrocellulose	Explosive, flammable
Nitrogen Triiodide	Explosive, disposal by bomb squad
Nitroglycerine	Explosive, disposal by bomb squad
Osmium Tetraoxide (Osmic Acid)	Highly toxic
Pentachlorophenol	Extremely toxic
Perchloric Acid	Strong oxidizer, reactive
Phosphorus Pentasulfide	Water reactive, toxic, incompatible with air & moisture
Phosphorus Pentoxide	Oxidizer, toxic
Phosphorus, Red	Flammable solid
Phosphorus, Yellow or White	Reactive with air, poison
Picric Acid (Trinitrophenol)	Explosive when dry
Potassium Cyanide	Poison, extremely hazardous
Potassium Perchlorate	Powerful oxidizer, reactive
Potassium Sulfide	Flammable, spontaneously ignites
Potassium, metal	Reactive with water, forms peroxides
Pyridine	Flammable, toxic, vapors cause explosive mixture in air
Selenium	Toxic
Silver Oxide	Poison
Silver Cyanide	Extremely toxic
Sodium metal	Corrosive, water reactive, spontaneously ignites
Sodium Arsenate	Carcinogen, toxic
Sodium Arsenite	Carcinogen, toxic
Sodium Azide	Reacts explosively with metal, poison
Sodium Borohydride	Flammable solid, water reactive
Sodium Cyanide	Poison
Sodium Fluoride (Bifluoride)	Toxic by ingestion & inhalation, skin irritant
Sodium Fluoroacetate	Poison
Sodium Peroxide	Water reactive, fire and explosion risk
Sodium Sulfide	Fire and explosion risk
Strontium	Flammable, water reactive (store under naphtha)
Tetrahydrofuran	Flammable forms peroxides
Thioacetamide	Carcinogen, combustible, toxic
Thionyl Chloride	Corrosive
Thiourea	Carcinogen
Titanium Trichloride	Flammable
Triethylamine	Flammable, irritant, toxic
Trinitrobenzene	Explosive, disposal by bomb squad
Trinitrophenol	Explosive, disposal by bomb squad
Trinitrotoluene	Explosive, disposal by bomb squad

Uranium / Uranyl Compounds Radioactive

Table 3 – High Risk Chemicals – Use Very Limited Amounts

Acetamide	Carcinogen
Ammonium Nitrate	Powerful oxidizer, reactive
Barium Peroxide	Fire & explosion risk with organics; oxidizer, toxic
Butyric Acid	Corrosive
Cadmium Sulfide	Carcinogen, highly toxic
Calcium Carbide	Flammable, water reactive
Chromium Trioxide	Oxidizer, poison
Ethidium Bromide	Mutagen
Hexamethylenediamine	Corrosive, absorbs through skin, lachrymator (causes eyes to tear)
Hexanediamine, 1-6	Corrosive, absorbs through skin, lachrymator (causes eyes to tear)
Hydrogen Peroxide, >29%	Corrosive to tissue, powerful oxidizer
Lead compounds	Highly toxic
Lead Nitrate	Oxidizer, toxic, heavy metal
Magnesium, powder	Flammable
Mercury Thermometers	Corrosive, toxic, heavy metal
Phenol	Poison
Potassium Chlorate	Reactive, powerful oxidizer
Potassium Chromate	Oxidizer, toxic
Potassium Dichromate	Carcinogen, powerful oxidizer
Radioactive Materials	Radioactive
Sebacoyl Chloride	Corrosive, irritant, lachrymator (causes eyes to tear)
Silver compounds	Toxic
Sodium Chlorate	Powerful Oxidizer
Sodium Chromate	Oxidizer
Sodium Dichromate	Reactive, fire & explosion risk
Sodium, metal (small chips)	Corrosive, water reactive
Strontium Nitrate	Oxidizer, may explode when heated
Thermite	Flammable solid
Toluene	Flammable, toxic
Wood's Metal	Poison
Xylene	Flammable, toxic