



KUWAIT NATIONAL PETROLEUM COMPANY

SAFETY REGULATIONS

CHAPTER - 20

HANDLING AND STORAGE OF HAZARDOUS MATERIALS

IMPORTANT

Mandatory rules (or "must") are characterized by the word "SHALL" throughout the text. Advisory rules or recommendations are indicated by the word "SHOULD". The words 'shall and should' have been used to remain in line with the terminology used by American National Standard Institute.

REFERENCES

Hazardous Material Reference Hand Book, OSHA, NIOSH Requirements, Encyclopedia of Occupational Health and Safety, IP Code, CONOCO Manual, MSDS (Genium), Accident Prevention Manual (NSC), NFPA-30 Flammable & Combustible Liquids Code, NFPA-471, 472 & 704, Hazardous Materials (Isman & Carlson), KNPC Inspection Procedures IC-37 & IC-38, KNPC Environmental Regulations.


This document can be viewed in KNPC Intranet → Documents → Rules & Regulations → Safety Regulations
(<http://home.knpc.net/departments/ins/s-reg-ch-20.htm>)

CHAPTER – 20			
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KNPC SAFETY REGULATION REVIEW COMMITTEE			

HANDLING AND STORAGE OF HAZARDOUS MATERIALS

TABLE OF CONTENTS

	PAGE
20.1 INTRODUCTION	4
20.2 DEFINITIONS	4
20.2.1 FLAMMABLE (EXPLOSIVE) LIMITS	4
20.2.2 FLASH POINT & AUTOIGNITION TEMPERATURE	4
20.2.3 THRESHOLD LIMIT VALUE (TLV)	5
20.2.4 TOXICITY	5
20.3 CLASSIFICATIONS	5
20.3.1 FLAMMABLE GASES	5
20.3.2 FLAMMABLE AND COMBUSTIBLE LIQUIDS	6
20.3.3 FLAMMABLE SOLIDS	6
20.3.4 EXPLOSIVES	6
20.3.5 COMPRESSED GASES	6
20.3.6 CORROSIVE MATERIAL	6
20.3.7 TOXIC SUBSTANCES	6
20.3.8 OXIDIZERS	7
20.3.9 RADIOACTIVE MATERIALS	7
20.4 HAZMAT INFORMATION & RESPONSIBILITIES	7
20.4.1 LABELING AND MARKING OF HAZARDOUS MATERIALS	7
20.4.2 MATERIAL SAFETY DATA SHEET (MSDS)	7
20.4.3 GENERAL PRECAUTIONS	8
20.4.4 USERS RESPONSIBILITIES	8
20.5 FLAMMABLE & COMBUSTIBLE LIQUIDS	8
20.5.1 GENERAL SAFETY MEASURES	8
20.5.2 LOADING ROAD TANK VEHICLES	11
20.5.3 BITUMEN LOADING AND UNLOADING	12

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 3 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001


20.5.4	Containers and Portable Tanks for Handling Flammable Liquids	13
20.5.5	Storage Inside Buildings	14
20.5.6	Storage Outside Buildings	15
20.6	FLAMMABLE SOLIDS	16
20.6.1	General precautions	16
20.6.2	Special Precautions	16
20.7	POISONS (TOXIC MATERIALS)	16
20.7.1	Storage	16
20.7.2	Handling	17
20.8	CORROSIVE MATERIALS	17
20.9	RADIOACTIVE MATERIALS	17
20.9.1	Storage	17
20.9.2	Personal Safety	17
20.9.3	Working on Site	18

APPENDICES

APPENDIX-A	HAZMAT LABELS	20
APPENDIX-B	SAMPLE MSDS	21
APPENDIX-C	INCOMPATIBLE CHEMICALS	24

TABLES & FIGURES

TABLE 20.1	FLASH POINTS AND CLASSIFICATION OF FLAMMABLE AND COMBUSTIBLE LIQUIDS	6
TABLE 20.2	MAXIMUM ALLOWABLE SIZE OF CONTAINERS SIZE OF CONTAINERS AND PORTABLE TANKS	14
TABLE 20.3	INDOOR CONTAINER STORAGE	15
TABLE 20.4	OUTDOOR CONTAINER STORAGE	15
FIGURE 20.1	RECOMMENDED PRACTICE ON BONDING AND GROUNDING	9
FIGURE 20.2	BONDING AND GROUNDING OF A FLAMMABLE LIQUID TANK TRUCK AND LOADING RACK	10

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 4 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

HANDLING AND STORAGE OF HAZARDOUS MATERIALS

20.1 INTRODUCTION

"Hazardous Material" means a substance or material, which is capable of posing an unreasonable risk to health, environment and property. Explosives, Oxidizers, Corrosives, Compressed gases and Flammable liquids etc. are considered as Hazardous Materials. This Chapter discusses the storage and day to day handling of various types of hazardous materials used in KNPC. This chapter intent does not cover engineering standards.

When properly handled, stored and transported, these materials constitute no hazard. But, experience teaches us that human error; structural failure etc. can create situations harmful to the well being of man and his environment. Because of the dissimilarity of the hazardous materials, prior knowledge and training is required to have an effective control on any hazardous materials emergencies.

20.2 DEFINITIONS

20.2.1 FLAMMABLE (EXPLOSIVE) LIMITS

a) Lower Explosive / Flammable Limit (LEL / LFL)

Minimum concentration of vapor or gas in air which will burn when a source of ignition (spark) is introduced.

Note-1: Flammable Gas Detectors (Meters) measure % LEL, hence actual LEL means 100% or full-scale reading of the meter. Below LEL (100% of meter reading), a mixture is "too lean" to burn.

Note-2: LEL of airborne combustible dust: If the dust obscures vision at a distance of **5 feet** (1.52 m) or less it is considered as at LEL (ex. sulfur or coke).

b) Upper Explosive / Flammable Limit (UEL / UFL)

Maximum vapor/gas to air concentration above which flame propagation will not occur, i.e. the mixture is "too rich" to burn.


20.2.2 FLASH POINT & AUTOIGNITION TEMPERATURE

a) Flash Point (FP)

Minimum temperature at which a flammable mixture of gas or vapor in air will momentarily flash when a source of ignition (spark) is introduced

b) Auto Ignition Temperature (AIT or IT)

Minimum temperature required to initiate self-sustained combustion of a solid, liquid or gas in the absence of a source of ignition

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 5 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

20.2.3 THRESHOLD LIMIT VALUE (TLV)

Atmospheric concentration of a contaminant to which, most workers may be exposed.

a) TLV-TWA

Time Weighted Average concentration of the contaminant in air over the normal work shift of 8 hours, to which workers can be exposed without respiratory protection in a 40-hour workweek

b) TLV-STEL

Short Term Exposure Limit when exposed only for a short period of 15 minutes. This maximum concentration can be allowed to breathe 4 times during 8 hours with minimum 1-hour interval between exposures.

c) IDLH

Minimum concentration of contaminant in air which is **Immediately Dangerous to Life and Health**. (Note: Air supplied respirators are required in IDLH atmospheres.)

20.2.4 TOXICITY

Toxicity of a material entering the body by inhalation is measured in Toxic and Lethal Concentrations (i.e. TC & LC for gases, vapor or dust).

a) TC (Toxic Concentration)

Minimum toxic concentration in air which cause toxic effect

b) LC (Lethal Concentration)

Toxic concentration in air which cause death of test animals

Toxicity of a substance entering the body by ingestion or absorption is measured in Toxic and Lethal Doses (i.e. TD & LD for liquids, etc).

c) TD (Toxic Dose)

Minimum dose to cause toxic effects

d) LD (Lethal Dose)


Dose which killed test animals

(ex. LD₅₀ = dose or the amount that killed 50% of test animals)

20.3 CLASSIFICATIONS

20.3.1 FLAMMABLE GASES

The flammable gases have flash point below room temperature and will form explosive mixture with air or oxygen within the lower & upper explosive limits (e.g. hydrogen, light hydrocarbons like propane & acetylene).

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 6 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

20.3.2 FLAMMABLE AND COMBUSTIBLE LIQUIDS

a) Flammable liquid

A liquid having a closed-cup flash point below 100 °F (37.8°C) and having a Reid Vapor Pressure (RVP) not exceeding 40 psia (2068.6 mm Hg) at 100°F (37.8°C). (eg. Naphtha, Gasoline)

Flammable Liquid	Flash Point Below 100°F (37.8°C)	Boiling Point
Class I A	Below 73°F (22.8°C)	below 100 °F
Class I B	Below 73°F (22.8°C)	at or above 100 °F
Class I C	73-100 °F (22.8-37.8°C)	n/a

b) Combustible Liquid

A liquid having a closed-cup flash point at or above 100°F (37.80°C) (eg. Diesel, Fuel oil)

Combustible Liquid	Flash Point 100°F (37.80°C) & above
Class II	100-140 °F (37.8-60°C)
Class III A	140-200 °F (60-93.3°C)
Class III B	200 °F (93.3°C) & above

20.3.3 FLAMMABLE SOLIDS

A Flammable solid is any solid material other than an explosive which is liable to cause fire through friction or retained heat from manufacturing or processing or that can be ignited readily and when ignited, burns so vigorously and persistently as to create a serious hazard. (e.g. Sulfur, Coke, Pyrophoric)

20.3.4 EXPLOSIVES

An explosive is any chemical compound, mixture, or device whose primary purpose is to function by explosion with substantial releases of heat and gas (eg. Dynamite).

20.3.5 COMPRESSED GASES


A compressed gas is any material having an absolute pressure in the container exceeding 40psi(2.72 Kg/cm²) at 70°F(21.1°C), or having an absolute pressure exceeding 104psi(7.07Kg./cm²) at 130°F(54°C). (For more details see Ch.-10)

20.3.6 CORROSIVE MATERIAL

Corrosive materials are liquids, gases or solids that can destroy human skin tissue, severely corrodes steel or other materials. (e.g. HCl, H₂SO₄, Caustic)

20.3.7 TOXIC SUBSTANCES

- Poison - A** is a gas or vapour of a liquid of such a nature that a very small amount mixed in air is dangerous to life. (e.g. hydrogen cyanide, phosgene, nitrogen tetroxide).
- Poison - B** is any substance (liquid, solid, paste or semi solid) known to be so toxic that a severe health hazard exists. (E.g. TEL/TML, parathion. Aniline).

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 7 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

- c) **Irritating Material** is a liquid or solid, which upon contact with fire or exposure to air, gives off dangerous or intensely irritating fumes.

20.3.8 OXIDIZERS

Oxidizers are materials that contain large amounts of chemically bound oxygen that is easily released, especially when heated, and that will stimulate the burning of combustible material (e.g. Nitrate, Chlorate, Permanganate, and Peroxide).

20.3.9 RADIOACTIVE MATERIALS

Any material, or combinations of materials, that spontaneously emit ionizing radiation, and have a specific activity greater than 0.002 microcuries per gram. (e.g. Iridium192, Cobalt60, Radium, Cesium, Uranium)

20.4 HAZMAT INFORMATION & RESPONSIBILITIES

20.4.1 LABELING AND MARKING OF HAZARDOUS MATERIALS

The containers or systems that hold hazardous materials shall display name of the material and the hazards of its contents by labeling and marking. This includes fixed storage, portable tanks, modules, drums, cans and tankers.

Labeling and marking shall be according to international standards such as UN, ISO, OSHA, IATA or DOT (See Appendix-A).

20.4.2 MATERIAL SAFETY DATA SHEET (MSDS)


Material Safety Data Sheets (MSDS) select and interpret information that is useful in determining the hazardous nature and severity of the chemical (See Appendix-B).

The major information categories required in the MSDS are as follows:

- Manufacturer's name, emergency telephone number, and address;
- Chemical name and synonyms; trade name and synonyms; chemical family and formula.
- Hazardous ingredients
- Physical data
- Fire and explosion hazard
- Reactivity data
- Health hazard data
- Spill or leak procedures
- Special protection information
- Special precautions
- Storage & Handling information

Originating and purchasing divisions shall ensure that MSDS is provided along with the supply of material. MSDS shall be readily available at warehouse, user (operator shelter, lab), ECCC and the Safety Division.

Contact number of local agent and Internet reference shall also be available in the MSDS.

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 8 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

20.4.3 GENERAL PRECAUTIONS

- Safety Shower/eyewash shall be available near the chemical handling area. It shall be painted in green & white and provided with green & white identification symbol visible from distance.
- Plant chemical shelters should be away from hazardous area. Overstocking of chemicals shall be avoided in unit chemical shelters.
- Hazardous materials shall be stored only in approved areas, which are equipped with proper fire protection and safety features as per MSDS requirements.
- Separate storage areas shall be provided for **"incompatible chemicals"** as these chemicals may react together and create a hazardous condition because of this reaction (See Appendix-C).
- Expired material shall be disposed in compliance with KNPC and Kuwait Govt. environmental regulations (also see Chapter-19).
- Waste material (including radioactive waste) shall be disposed in accordance with the KNPC Environmental Regulations.

20.4.4 USER'S RESPONSIBILITIES

The word 'user' shall mean the personnel involved in using, handling, storing, transporting and emergency response of hazardous materials.


- Suppliers, Materials Section, transporters and end users shall make sure that all hazardous material containers are properly labeled and identified.
- Users shall be aware of chemical labeling system and shall understand information on MSDS. They shall follow the safety instructions displayed in labels and MSDS.
- User division superintendent shall ensure all users are aware of nature, uses and hazards of the material. Users shall be properly trained on general handling of hazardous material and special training on highly hazardous materials applicable for a particular user.
- Highly hazardous materials should be handled in closed systems wherever possible.
- User division superintendent shall ensure the provision of required PPE and user compliance. PPE signs shall be displayed at locations wherever hazardous materials are handled or stored (e.g. eye goggles, gloves, and respiratory protection signs).
- Users shall check all empty containers, equipment and tools prior to use for the condition, cleanliness, and compatibility with the material.

20.5 FLAMMABLE & COMBUSTIBLE LIQUIDS

20.5.1 GENERAL SAFETY MEASURES

The most common flammable and combustible liquids are crude oil, coal tars, hydrocarbons, alcohol, and their by-products. They are chemical combinations of hydrogen and carbon. The combination may also contain oxygen, nitrogen, sulfur or other elements.

Manufactured liquids and fluid commodities which contain flammable liquids, such as paints, floor polish, cleaning solutions, dryers and varnishes shall be considered as flammable liquids and classified according to the flash point of the mixture.

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 9 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

Precautions pertaining to their handling and use differ according to their flash points, volatility, and the amount of flammable liquid within the mixture. MSDS, operation manual, etc. stipulate these requirements.

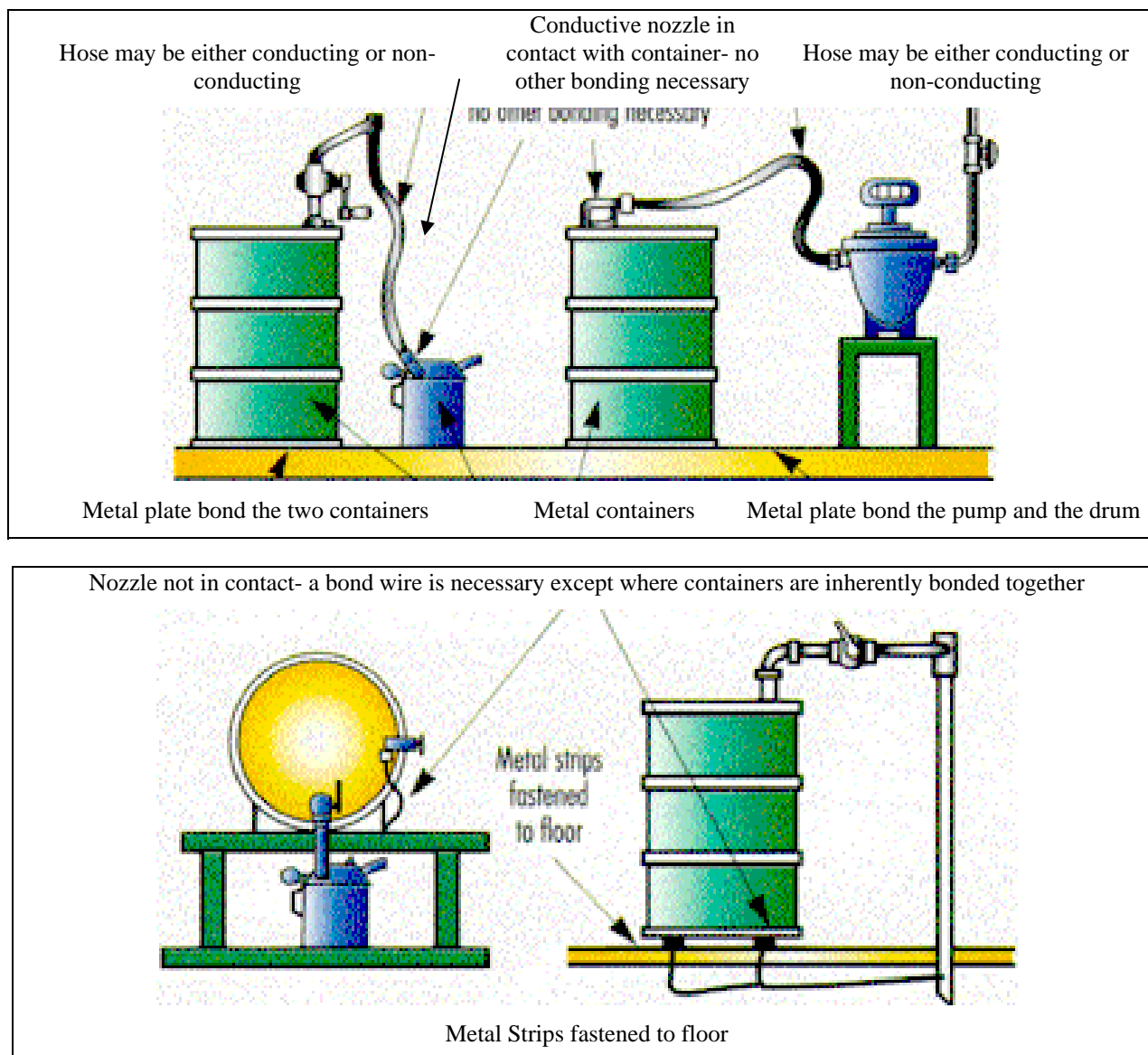
a) **Ignition Sources**


Smoking and carrying of matches, lighters and other spark or flame producing devices shall not be permitted in a building or area where flammable liquids are stored, handled, or used. The extent of the restricted area will depend on the type of products handled, the design of the building, and local conditions. Suitable 'NO SMOKING' and other signs shall be posted in buildings, and areas where smoking is prohibited.

b) **Static Electricity**

Static electricity is generated by the contact and separation of dis-similar materials. For example, static electricity is generated when a fluid flows through a pipe or from an orifice into a tank.

FIGURE 20.1 RECOMMENDED PRACTICE ON BONDING AND GROUNDING



	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 10 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

A spark between two bodies occurs when there is no electrical conductive path between them. Hence, grounding and bonding of flammable liquid containers shall be provided to prevent static electricity causing a spark as in Figure 20.1.

To avoid a spark from discharge of static electricity during filling operations, a wire bond shall be provided between the storage container and the container being filled, unless a metallic path between the containers is otherwise present.

Above ground tanks used for storage of flammable liquids shall be properly grounded. Ground wire is preferred to be uninsulated, so it may be easily inspected for mechanical damage. Petroleum liquids are capable of building up electrical charges when they flow through piping or agitated in a tank or a container, or subjected to vigorous mechanical movement such as spraying or splashing. The grounding wire shall be provided to drain off this static charge to ground as fast as it is generated.

High static charge shall be controlled by reducing the flow rates, avoiding violent splashing with side-flow fill lines and use of relaxation time. Figure 20.2 shows the bonding and grounding of a flammable liquid tank truck and loading rack.

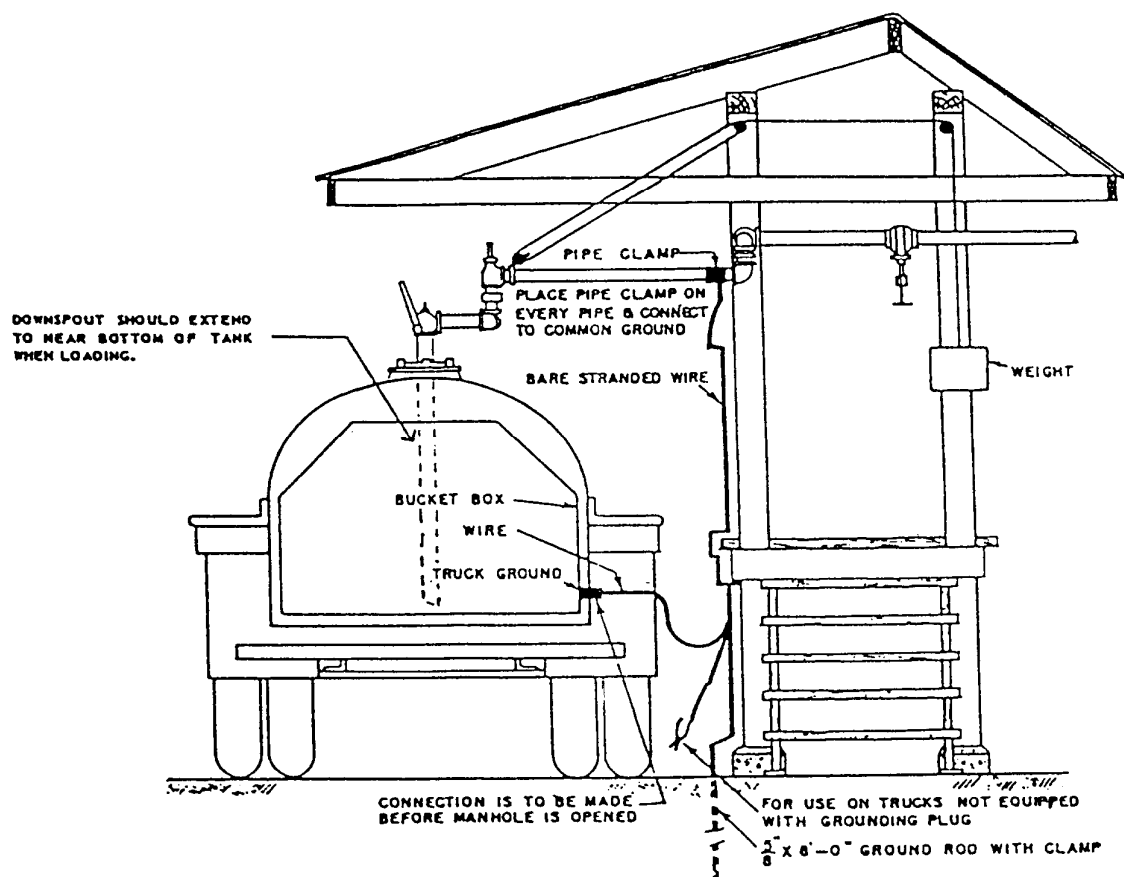



FIGURE 20.2 BONDING AND GROUNDING OF A FLAMMABLE LIQUID TANK TRUCK AND LOADING RACK

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 11 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

c) Electrical Equipment

Electricity is a common source of ignition where flammable vapors exist. Hence, the proper type of electrical equipment for these atmospheres (e.g. Explosion proof, Intrinsically safe) shall be installed and they shall be properly maintained (please also see Chapters 1 & 14).

d) Health And Flammability Hazards

Most of flammable vapors are heavier than air and it can flow into pits, tank openings, confined areas, and low places in which they contaminate the normal air and, thus cause a toxic as well as explosive atmosphere. Oxygen deficiency may occur in closed containers, such as a tank, which has been closed for a long time and in which rusting has consumed the oxygen.

All containers shall be ventilated and tested for flammable, toxic and oxygen deficient atmosphere before man entry or any work (see confined space entry precautions in Chapter-7).

20.5.2 LOADING ROAD TANK VEHICLES

Vehicles are to be loaded only with the class of products for which they are designed and authorized to carry.

The driver shall be aware of the hazards and trained for emergency actions. MSDS and minimum required emergency equipment shall be available in the cabin.

a) Bulk Loading of Road Tank Vehicles

If a loading bay is occupied, an approaching vehicle shall not come closer than 6 meters from the loading position and the engine shall be stopped. Loaded vehicles are to be parked well clear of the loading gantry.

While loading or unloading product, the engine of the vehicle shall be switched off and not started until completion of the loading operation and all discharge valves are closed, hoses disconnected and dome covers securely closed.

Ignition key shall be in the possession of the loader until he is satisfied that the tanker may be moved. Loading attendant shall be in attendance at all times when loading is in progress.


While loading or unloading is in progress, driver and his attendant/s shall stay outside the vehicle all the time. However, during the operation, vehicles shall not be left unattended and parking brakes shall be firmly applied.

A bond to the earth shall effectively connect vehicles before loading or unloading operation is commenced. The earth-bond is not to be removed nor the high level cut-off plug removed, until the operations are completed, all product lines disconnected and dome covers closed.

Faulty earth bond wires, clips etc. shall be reported at once to the appropriate Supervisor and steps taken to correct the fault.

In order to prevent leakage by distortion of the tank by expansion of its contents due to a rise in temperature during transit, no cargo tank or compartment shall be made liquid full. Tanks and compartments shall be filled only to the levels authorized by their capacity rating.

Where night loading or unloading is carried out, all portable electrical equipment such as lighting torches, etc. shall meet area classification and shall be in safe working condition.

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 12 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

b) Loading of Class I and II Petroleum

When vehicles are top loaded with Class I or II petroleum products, the drop of the loading arm shall be lowered to the bottom of the tank compartment before loading commences in order to avoid splash loading.

c) Change of Product and Switch Loading

When tank vehicles are required to be loaded with a change of grade from that previously carried, the tank or compartment shall be completely drained off the entire previous product.

Switch Loading: Where it is unavoidable and become necessary to load an intermediate flash stock such as kerosene, gas oil or fuel oil, into a tank or compartment which has previously contained a low flash stock such as gasoline, the operation shall be carried out with the same safety precautions as for gasoline.

Should a tank or compartment be accidentally over-filled, the excess product shall be drawn off into a suitable container and transferred immediately to a dump tank or closed container.

d) Spillage

Every care shall be taken to avoid spillage. If a spillage of Class I or II petroleum product occur, all operations at the point of spillage and adjoining positions shall cease immediately and foot valves on vehicles be closed. The engines of vehicles shall not be started. The spillage shall be cleaned up, as quickly as possible and loading operations not be recommenced until the area has been pronounced safe by the incident controller.

In the case of spillage of class III petroleum, the spillage shall be cleaned up immediately and the source of spillage shall be controlled. ECCC should be informed immediately and incident report submitted (see Chapter-4).

20.5.3 BITUMEN LOADING AND UNLOADING

a) Handling Temperatures

Although some bitumen is supplied in drums, blocks or sacks, it is mostly handled in liquid form. Bitumen has to be kept hot to be in this state. Harder grades of bitumen require higher temperatures to keep it in liquid form.

Maximum bitumen handling temperatures shall not exceed 160°C.


b) Pipe Work

Piping shall be designed for self-draining and to prevent solidification of the bitumen. It should be insulated and equipped with safe heating system, which incorporates a temperature control.

Insulation shall be provided to protect personnel from accidental burns.

Open Flame Heating or any uncontrolled heating source shall not be used to free blockage in pipe work, (e.g. direct flame heating). If dechoking is required, heating shall only be carried out with temperature controlled heating method. It shall be heated starting from the nearest release point. The temperature shall be maintained at the melting point.

c) Elimination of Moisture

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 13 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

Before loading or unloading operations are commenced, all traces of moisture shall be eliminated by draining or by blowing with air or inert gas.

d) Loading Bulk Bitumen

A check shall be made to ensure that all discharge valves are closed on the receiving tank.

Where a tank or receiver has been used to carry bitumen emulsion or has been injected with steam, it shall be thoroughly drained before being loaded.

Before loading is commenced, the tank or receiver shall be examined for the presence of water or volatile liquid and any trace of these shall be eliminated before filling.

During loading, no source of ignition may be permitted in the vicinity of the tank or receiver.

The field operator responsible for loading shall maintain a constant watch at the loading platform during the filling operation. He shall not leave the platform, until all loading ceases and all valves are closed.

e) Tankers Fitted with Heating Aids

Drivers shall be warned that parking of vehicles on sloping ground may cause heating tubes to become uncovered and can cause dangerous over heating.

When discharging a tanker, burners shall be turned off and tubes allowed to cool for at least 20 minutes before discharging.

The heating system shall not be used whilst traveling and tanks shall not be unloaded if the heating system is working.

Heating equipment shall not be lit if there is less than 150 mm (6 inches) of product above the top surface of burner tubes. The contents of the tanker shall be visually inspected or a dipstick used to make a check. It shall be insured that the tank is set up level or in the correct altitude for operation.

The heating operation may only be carried out in a safe area away from buildings.

When LPG heating systems are used, all gas pipe joints shall be tight. The cylinder stop valve shall be closed at all times except when heating or testing the gas lines.

When LPG cylinders are changed, all lines and connections from the cylinder to the burners shall be tested using soap water before attempting to light the burners. This test shall be completed in all cases. If a leak is detected, the cylinder stop valve shall be closed immediately, the leak shall be rectified and a further test made.

20.5.4 Containers and Portable Tanks for Handling Flammable Liquids

a) General

This Section shall apply only to the storage of flammable or combustible liquids in drums or other containers not exceeding 60 US gallons (227 lt.) individual capacity and those portable tanks not exceeding 660 US gallons (2500 lt.) individual capacity. Flammable and combustible liquid containers shall be in accordance with Table 20.2.

Each portable tank shall be provided with one or more approved devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions.

Table 20.2 MAXIMUM ALLOWABLE SIZE OF CONTAINERS AND PORTABLE TANKS

Container Type	Flammable Liquids			Combustible Liquids	
	Class I A	Class I B	Class I C	Class II	Class III
Glass or approved plastic	1 pt	1 qt	1 gal	1 gal	1gal
Metal (other than DOT Specifications)	1 gal	5 gal	5 gal	5 gal	5 gal
Safety cans	2 gal	5 gal	5 gal	5 gal	5 gal
Metal drums (DOT specifications)	60 gal	60 gal	60 gal	60 gal	60 gal
Approved portable tanks	600 gal	600 gal	600 gal	600 gal	600 gal

b) Storage Cabinet

Not more than 60 US gallons of Class I or II liquids nor more than 120 US gallons (454 lt.) of Class III Liquids may be stored in the storage cabinet. The cabinet shall be of approved type.

c) Storage Room

Storage rooms shall comply with the following specifications:

Inside every storage room there shall be one clear aisle at least 3 feet (1 meter) wide. Containers over 30 US gallons (113.5 lt) capacity shall not be stacked one upon the other. Storage room shall be provided with approved type of natural or mechanical exhaust ventilation system.

Storage room shall not have a door that opens into that portion of the building used by the public.

Dispensing of flammable liquid shall be by approved pump on self-closing faucet only. Construction, electrical wiring and ventilation of the room shall be suitable for area classification.

20.5.5 Storage Inside Buildings

a) Egress

Flammable or combustible liquids, shall not be stored so as to limit use of exits, stairways or areas normally used for the safe egress of people.


b) Office Occupancies

Storage shall be prohibited except for quantities required to operate office equipment. Such storage shall be in closed metal containers and stored in a storage cabinet or in safety cans.

c) Flammable and Combustible Liquid Warehouses or Storage Buildings

The total quantity of liquids within a building shall not be restricted but the arrangement of storage shall comply with Table 20.3.

Containers in piles shall be separated by pallets or dunnage(mats) where necessary to provide stability and to prevent excessive stress on container wall.

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 15 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

No pile shall be closer than 3 feet (1m) to the nearest structural beam or other obstruction and shall be 3 feet (1m) below sprinklers or other overhead fire protection systems.

Aisles of at least 3 feet wide shall be provided where necessary for reasons of access to doors, windows or emergency equipment.

Table 20.3 INDOOR CONTAINER STORAGE

Class of Liquid	Storage Level	Maximum per pile			
		Protected Storage		Unprotected Storage	
		Gallons	55 Gal Drums	Gallons	55 Gal Drums
I A	Ground & Upper Floors	2,750	50	660	12
I B	Ground & Upper Floors	5,500	100	1,375	25
I C	Ground & Upper Floors	16,500	300	4,125	75
II	Ground & Upper Floors	16,500	300	4,175	75
	Basement	5,500	100	Not Permitted	
III	Ground & Upper Floors	55,000	1000	13,750	250
	Basement	8,250	450	Not Permitted	

Note:

1. Class 1 liquid shall not be stored in basements.
2. When 2 or more classes of materials are stored in a single pile, the maximum gallonages permitted in that pile shall be the smallest of the 2 or more separate maximum gallonages.
3. Aisles shall be provided so that no container is more than 12ft. from an aisle. Main aisles shall be at least 8ft. wide and side aisles at least 4 ft. wide.
4. Each pile shall be separated from each other by at least 4 ft.


20.5.6 Storage Outside Buildings

Storage outside building shall confirm to the table 20.4.

Table 20.4 OUTDOOR CONTAINER STORAGE

Class	Maximum per pile (See note 1)	Distance between piles (See note 2)	Distance to property line that can be built upon (See notes 3 & 4)	Distance to street, alley or public way (See note 4)
	US GAL	FT.	FT.	FT.
I A	1,100	5	20	10
I B	2,200	5	20	10
I C	4,400	5	20	10
II	8,800	5	10	5
III	22,00	5	10	5

Notes:

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 16 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

1. When 2 or more classes of materials are stored in a single pile, the maximum gallonage in that pile shall be smallest of the 2 or more separate gallonages.
2. Within 200 ft. of each container, there shall be a 12ft. wide access way to permit approach of fire control apparatus.
3. The distances listed apply to properties that have protection for exposures as defined. If there are exposures and such protection for exposures does not exist, the distance in column 4 shall be doubled.
4. When total quantity stored does not exceed 150 percent of maximum per pile, the distances in columns 4 and 5 may be reduced 50 percent, but not less than 3 ft.

20.6 FLAMMABLE SOLIDS

Flammable solids such as sulfur and coke are handled in KNPC. While some safety features are built-in, it requires maintaining these in proper condition and good safety practices of employees to avoid fire or explosion.

20.6.1 General precautions

- a) The dust content of the flammable solid in air must be kept below the lower explosive limit (i.e. it should not obscure vision at 5ft distance or less). Water spray system shall be readily available.
- b) In addition to right enclosures and dust collection systems, good plant housekeeping shall be maintained.
- c) All sources of ignition shall be excluded from the area of a potentially explosive dust. The no smoking rule shall be rigidly enforced.
- d) Wiring, lights and switches shall be in compliance with area classification (See Ch-1).


20.6.2 Special Precautions

- a) Spills in conveyor systems shall be cleaned as and when it occurs. Dust should not be allowed to rub against the moving parts.
- b) Crew for cleaning shall be continuously in attendance during loading. After completion of loading, entire system shall be thoroughly cleaned.
- c) Static electricity shall be prevented from accumulating by using antistatic material or any suitable method.
- d) Substances, which give off flammable gases on contact with water, shall be stored in dry storage facilities.
- e) Substances which are liable to spontaneous ignition shall be stored in sealed closed and leak proof containers and underwater or in an inert atmosphere.

20.7 POISONS (TOXIC MATERIALS)

20.7.1 Storage

If any container is found to be leaking it has to be disposed by an approved disposal method only (Refer MSDS). Lids of the containers shall be properly closed.

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 17 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

Toxic materials shall not be stored near the sources of food or water etc. Food items, drinks, cigarettes etc. shall not be brought into storage rooms of toxic materials. Eating, drinking and smoking inside the storage rooms shall be strictly prohibited.

20.7.2 Handling

Handling of all toxic materials shall be done using appropriate protective equipment (Refer MSDS). In addition, tools used for handling the toxic materials or containers of toxic materials shall not be used for any other purpose before cleaning properly.

All contaminated clothes and tools to be cleaned at a separate cleaning room. Clothes worn during the working time shall not be worn afterwards.

20.8 CORROSIVE MATERIALS

Storage shall be under cover in dry well ventilated area, away from all Foodstuffs, segregated as required from other goods and from each Other, on pallets or dunnage and not directly on the floor, under a System of first in first out (FIFO) and allowing access for regular examination for leaking packages.

Corrosive materials shall be handled only with using the appropriate Protective equipment as per MSDS (also see Chapter-5).

20.9 RADIOACTIVE MATERIALS

The section shall be read in conjunction with the KNPC Inspection Procedure IC-37: safe Practices for Industrial Radiography and IC-38: Procedure for Safe Transportation of Radioisotopes. KNPC Inspection shall ensure the following;

20.9.1 Storage

When not in use or transit, the containers shall be kept in the locked storage pit so as to minimize the risk of their coming into the possession of unauthorized and untrained persons.

The storage pit shall be surrounded by a fence on which warning notices are posted. The store shall be under the supervision of the authorized person who is responsible for keeping the source records.


20.9.2 Personal Safety

Radiographers and assistants shall be medically certified and ministry approved for their task They shall be re-certified every six months.

The following safety equipment shall be used when radiation work is to be executed.

- i) Film badges
- ii) Radiation Dose rate meters (Survey meters)
- iii) Pocket Dose meters (Optional)
- iv) Radiation warning signs and signals

Survey meters shall be calibrated every six months. Operator safety is of prime importance and at least two persons shall be employed on every job. This is important in event of an accident of exposure where a single operator could likely get injury in a high radiation area and would be in considerable danger should he have no assistance.

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 18 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

20.9.3 Working on Site

a) Enclosure

Where reasonably practicable, the radiography shall be carried out in a suitable enclosure, having a fence incorporating a lockable gate which must be kept locked whilst radiography is in progress. All except authorized persons will be excluded from the enclosure.

When using Gamma-Ray sources, the dimensions of the enclosure shall depend– on the type of equipment used and the nature or activity of the beam in relation to the article radiographed.

Where X-rays are used these dimensions shall be governed by the operating conditions of voltage & current; other factors include beam filtration, the effectiveness of any collimator used to limit the size and direction of the useful beam.

In both processes, there will be some attenuation of the radiation by the material of the work-place itself and local shielding such as concrete blocks or lead screens.

The enclosure shall be adequately marked with suitable radiation warning signs when ionizing radiation are about to be used.

b) Suitably Marked Area

Where it is not reasonably practicable to use a radiation enclosure, and the work has to be carried out on site, steps shall be taken to provide a suitably marked area encircled by a rope barrier.

The barrier shall be set up at 0.25 millirems per hour distance from the source and shall exclude all except authorized persons.

c) Warning Signals

In all cases adequate warning to all persons in the vicinity shall be given by lamps or audible signals or both when a sealed source is about to be exposed or when an X-ray machine is about to be energized. In the case of X-ray machine it is mandatory that the means for giving warning shall be integrated with control circuitry, so that they operate automatically, and the equipment shall be unable to function unless they are so connected.

d) Dose Rate Measurement

Measurement shall be made with an appropriate Dose Rate meter during radiography to ensure that dose rate at the barrier does not exceed 0.25 millirems per hour.


e) General Precautions

The average person's knowledge of radiation and its hazards is very limited. Therefore it is not enough to erect barriers and provide warning signals just to comply with the regulation. The radiographer or an assistant shall maintain a strict vigil to prevent unauthorized persons entering the area. If this cannot be done, work involving ionizing radiation shall cease until these persons can be persuaded to keep out.

f) Monitoring Dose Rate Meters


The meter shall be used to achieve the following objectives:-

- 1) To check initially that the safety barriers are positioned where the Dose rate is not greater than 0.25 millirems per hour.
















	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 19 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

- 2) To monitor the Dose Rate at safety barriers, particularly when the radiographic technique varies,
- 3) To check that a source exposure container is fully closed after use or that source is fully retracted as appropriate.
- 4) To help locate a lost source, and
- 5) To monitor working conditions.


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	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 20 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

APPENDIX-A HAZMAT LABELS

		
Flammable Gas	Flammable Liquid	Flammable Solid
		
Explosive	Combustible	Dangerous
		
Corrosive	Toxic	Infectious
		
Oxidizer	Radioactive	Non-Flammable Gas
		
Marine Pollutant	Environment Hazard	Dangerous when Wet

Comply with 49 CFR, D.O.T., United Nations, IATA, ICAO, and IMDG regulations. If above images are B&W in your document please refer to an original or KNPC Intranet for correct colours of labels.


	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 21 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

APPENDIX-B SAMPLE MSDS


MATERIAL SAFETY DATA SHEET

SULFURIC ACID, FUMING

SECTION I - Product Identification		
PRODUCT NAME: SULFURIC ACID, FUMING	CAS NO.: 07664-93-9	
FORMULA: H ₂ SO ₄ + SO ₃	NIOSH/RTECS NO.: WS5605000	
FORMULA WT: 178.14	PRODUCT CODES: 9705,9699,9703	
COMMON SYNONYMS: OLEUM; DISULFURIC ACID		
Precautionary Labeling		
BAKER SAF-T-DATA(TM) SYSTEM		
HEALTH - 4 (POISON)	REACTIVITY - 3 (WATER REACTIVE)	
FLAMMABILITY - 0	CONTACT - 4 (CORROSIVE)	
LABORATORY PROTECTIVE EQUIPMENT		
GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES		
PRECAUTIONARY LABEL STATEMENTS		
Poison danger Causes severe burns May be fatal if swallowed	Harmful if inhaled Reacts violently with water Do not get in eyes, on skin, on clothing	
Avoid breathing vapor. Keep in tightly closed container. Loosen closure cautiously. Use with adequate ventilation. Wash thoroughly after Handling. In case of spill, flush spill area with water.		
SECTION II - Hazardous Components		
COMPONENT	%	CAS NO.
SULFURIC ACID (AS SULFUR TRIOXIDE)	12-35	7664-93-9
SULFURIC ACID (AS H ₂ SO ₄ , BY ACID TITRATION)	95-100	
SECTION III - Physical Data		
BOILING POINT: N/A MELTING POINT: N/A SPECIFIC GRAVITY: 1.90 (H ₂ O=1)	VAPOR PRESSURE (MM HG): N/A VAPOR DENSITY (AIR=1): 2.8 EVAPORATION RATE: N/A (BUTYL ACETATE=1)	
SOLUBILITY(H ₂ O): COMPLETE (IN ALL PROPORTIONS)	% VOLATILES BY VOLUME: N/A	
APPEARANCE & ODOR: COLORLESS VISCOUS LIQUID; CHOKING FUMES OF SULFUR TRIOXIDE.		

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 22 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

SECTION IV - Fire and Explosion Hazard Data	
FLASH POINT: N/A	NFPA 704M RATING: 3-0-2
Fire extinguishing media Use dry chemical or carbon dioxide. Do not use water.	
Special fire-fighting procedures Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive Pressure mode Do not get water inside containers.	
Unusual fire & explosion hazards A violent exothermic reaction occurs with water. Sufficient heat May be produced to ignite combustible materials.	
Toxic gases produced: sulfur dioxide	
SECTION V - Health Hazard Data	
THRESHOLD LIMIT VALUE (TLV/TWA): 1 MG/M3 (PPM) TOXICITY: LC50 (INHL-RAT-1H) (PPM) - 347	
Effects of overexposure Contact with skin or eyes may cause severe irritation or burns. Inhalation of vapors may cause coughing, chest pains, difficulty breathing or unconsciousness. Ingestion may be fatal.	
Emergency and first aid procedures Call a physician. If swallowed, do not induce vomiting; if conscious, give water, milk, or milk of magnesia. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.	
SECTION VI - Reactivity Data	
Stability: Stable Hazardous Polymerization: Will Not Occur Conditions To Avoid: Heat, Moisture	
Incompatibles: Strong Reducing Agents, Organic Materials Combustible Materials, Most Common Metals, Water, Strong Bases	
Decomposition Products: Oxides Of Sulfur	

	KNPC SAFETY REGULATIONS	CHAPTER - 20	PAGE 23 of 25
	HAZARDOUS MATERIALS	REVISION 1	SEPTEMBER 2001

SECTION VII - Spill and Disposal Procedures

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.

Stop leak if you can do so without risk. Do not use water.

Neutralize spill and/or washings with soda ash or lime.

With clean shovel, place material into clean, dry container and cover.

Move container(s) from spill area.

Disposal procedure

Dispose in Accordance with all applicable federal, state, and local environmental regulations

EPA HAZARDOUS WASTE NUMBER: D002, D003 (CORROSIVE, REACTIVE WASTE)

SECTION VIII - Protective Equipment

Ventilation:

Use general or local exhaust Ventilation to meet TLV requirements

Respiratory protection

None required where appropriate ventilation conditions exist. If the tlv is exceeded, a self-contained breathing apparatus is advised.

Eye/skin protection:

Safety goggles and face shield, uniform,

Protective suit, rubber gloves are recommended.

SECTION IX - Storage and Handling Precautions

SAF-T-DATA(TM) STORAGE COLOR CODE: WHITE

Special precautions

Keep container tightly closed. Store in corrosion-proof area.

Keep containers out Of sun and away from heat.

SECTION X - Transportation Data and Additional Information

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME

OLEUM (FUMING SULFURIC ACID)

HAZARD CLASS

CORROSIVE MATERIAL (LIQUID)

UN/NA

NA1831

LABELS

CORROSIVE

REPORTABLE QUANTITY

1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME

SULPHURIC ACID, FUMING

HAZARD CLASS

8

UN/NA

UN1831

LABELS

CORROSIVE, POISON

APPENDIX-C INCOMPATIBLE CHEMICALS

<i>Chemicals</i>	<i>Keep out of contact with</i>
Alkaline metals such as powdered aluminum or magnesium, sodium, potassium, etc.	Carbon tetrachloride or other chlorinated hydrocarbon, carbon dioxide and the halogens.
Acetic Acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates.
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury.
Ammonia, anhydrous	Mercury (In manometers for instance) chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid anhydrous.
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials.
Aniline	Nitric acid, hydrogen peroxide.
Bromine	Same as for chlorine.
Carbon activated	Calcium hypochlorite and all oxidizing agents.
Copper	Acetylene hydrogen peroxide.
Chlorates	Ammonium salts, acids, metal powders, sulfur finely divided organic or combustible materials.
Chromic acid	Acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol and flammable liquids in general.
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals.
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide.
Cumene hydroperoxide	Acids – Organic or inorganic.
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, and the halogens.
Fluorine	Isolate from everything.
Hydrocyanic acid	Nitric acid, alkalis.

<u><i>Chemical</i></u>	<u><i>Keep out of contact with</i></u>
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohol, acetone, organic materials, aniline, nitro-methane, any flammable liquid, combustible materials.
Hydrofluoric acid, anhydrous	Ammonia, aqueous or anhydrous.
Hydrogen sulfide	Fuming nitric acid, oxidizing gases.
Hydrocarbons (Butane, propane, benzene, gasoline, turpentine, etc.)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide.
Iodine	Acetylene, ammonia (aqueous or anhydrous) hydrogen.
Mercury	Acetylene, luminic acid, ammonia.
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases.
Oxalic acid	Silver, mercury.
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood.
Potassium	Carbon tetrachloride, carbon dioxide, water.
Potassium chlorate	Sulfuric and other acids.
Potassium perchlorate (see also Chlorates)	Sulfuric and other acids.
Potassium permanganate	Glycerin, ethylene, glycol, benzaidehyde, sulfuric acid.
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid, ammonium compounds.
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium Peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, bensaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural.
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or such compounds with similar light metals, as sodium, lithium, etc.)