SULTANATE OF OMAN DIRECTORATE

GENERAL OF CIVIL DEFENCE FIRE SAFETY REQUIREMENTS

PART FOUR TRANSPORT, STORAGE AND HANDLING OF HAZARDOUS MATERIALS
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Section 1
Safety requirements for the transport of hazardous materials by road.
SECTION 1
SAFETY REQUIREMENTS FOR THE TRANSPORT OF
HAZARDOUS MATERIALS BY ROAD

1. DEFINITIONS

1.1 Hazardous Materials
Any substance included in Appendix 1, or any other substance, which by reason of its properties, poses a risk to the health and safety of lives when transported by road.

1.2 Vehicle
A transport unit used for transporting hazardous materials by road. It can be a motor vehicle or an articulated vehicle which consists of a prime mover and a trailer or a motorless trailer.

1.3 Tank Vehicle (Road Tanker)
A vehicle carrying one or more tanks used for hazardous materials. The tanks may be fixed or demountable.

1.4 Consignor
A person who supplies a hazardous material, whether as a principal or through an agent.

1.5 Competent Authority
The Directorate General of Civil Defence and the Directorate General of Environment at the Ministry of Regional Municipalities and Environment or any other authority involved in hazardous materials.

1.6 Vehicle Operator
An organization or person authorized to use a vehicle for transporting hazardous materials, or a person in charge of a vehicle and controls its operation in the transport of the hazardous material. In this case he may not be the owner of the vehicle.

1.7 Licence
The licence for transporting and possessing hazardous materials.

1.8 Authorised person
A person or organization for whom the licence is issued.

1.9 A Technical Organization
A technical body authorised to carry out the inspections and tests of storage tanks.

1.10 Pressure Vessels
Tanks, mounted or fixed, used to contain a hazardous material more than 500 millibars above or below the atmospheric pressure.

1.11 Flashpoint
The lowest temperature, at which vapour from a hazardous material is adequate to ignite momentarily in the form of flashes when it is in contact with a flame. The rate of emission of vapour is usually inadequate for continuous burning of the material.
1.12 Fire Resistance.
The ability of any structural element to withstand the combustion of fire charge, whilst continuing functioning as a separator and I or load bearing within a specific period of time.

2. LICENSING REQUIREMENTS FOR THE TRANSPORT OF HAZARDOUS MATERIALS BY ROAD

2.1 A hazardous material should only be transported by an authorized vehicle and according to the measurements stated in these Requirements.

2.2 The license shall be issued by the Competent Authority valid for 3-6 months dependent on the hazards of the material. It is renewable for one or more similar periods.

2.3 The license must be returned to the issuing authority when:
   a) The vehicle is put out of service.
   b) The ownership of the vehicle is transferred to another owner.
   c) Substantial change takes place in the contents of the vehicle.
   d) The validity of the license expires.

2.4 Application to obtain a license for a vehicle shall be submitted to the Competent Authority along with the following documents:
   a) Information on the material (its properties and the UN's number).
   b) The nature of danger of the material and how to deal with it in emergencies.
   c) Copy of the importing license of the material.
   d) Copy of the agreement between the licenses and the user of the material.
   e) Copy of the documents which confirm that the appropriate technical tests are carried out to the pressure vessels and that the vehicle is suitable for the purpose.
      Copy of a satisfactory document ensuring that the driver has received adequate instruction and training, that he knows the dangers involved and what emergency action he should take.

3. THE REQUIREMENTS OF VEHICLES AND TANKS

3.1 Any vehicle used for the transport of a hazardous material shall be:
   a) Strong enough and made up of resistant materials.
   b) Suitable for the purpose for which it is being used, with consideration to the following:
      _ the nature and circumstances of the trip and roads on which it operates.
      _ the nature, properties and quantity of the hazardous material transported.

3.2 Hazardous materials tanks and containers shall be as follows:

   a) the tank mounted on the vehicle for transporting hazardous material and its fittings should be made up of strong and durable material, which does not react with the material, leak or form other elements that put the human health at risk.

   b) it should be an inseparable part of the vehicle's chassis, or otherwise securely attached to it. However, in case of a vehicle which consists of more than one part and carries removable containers or tanks, the tank or container must be well fixed to a cradle.
4. **INSPECTION AND TESTING OF HAZARDOUS MATERIALS**

4.1 The transport of a hazardous material in a mounted tank shall be permitted if there is a document approved by the technical organization that regular inspections and testings were carried out and that the tank is usable for the material. The document should contain the following information:

   a) The date and results of the inspection and testing, and the date of the next inspection.
   b) That the tank is suitable for its purposes which are included in the license.
   c) That the pressure tanks are suitable for maximum operation pressure.
   d) That the tank and its fittings are free of any damage, defect, modification or repairs that may affect the safety requirements.

4.2 Where the tank has been damaged, modified or repaired, it shall only be used for the transport of hazardous materials if it has been inspected, tested and certified as mentioned in para (4.1).

4.3 If an inner coating with a specific material is applied to the tank for safety reasons, the properties of the coating shall remain unchanged at all times.

4.4 A vehicle used for transporting hazardous materials shall be subject to regular technical inspections to ensure that it is mechanically and electrically in good condition at all times.

4.5 The authorized person shall be responsible for the implementation of the inspection and testing requirements of both the vehicle and the tank.

5. **IDENTIFICATION AND MARKING**

5.1 A hazardous material should be identified by its proper technical name, the U.N. number given in the internationally approved list and the nature of dangers inherent in the substance (e.g. "Inflammable Liquid", "Corrosive" etc).

5.2 The common name of a material may be its proper name, provided it is sufficient to identify the material and to enable concerned parties to find out its chemical name.

5.3 A material which is a compound of a number of elements should be identified with the name of the most hazardous element.

5.4 The chemical name of an inflammable liquid should be supplemented by its flashpoint.

5.5 Each packet containing a hazardous material should be clearly marked according to the design made and approved by the Directorate General of Civil Defense as in Appendix 4.

5.6 The operator of any vehicle used for the transport of a hazardous material, shall ensure that it is provided with three hazard-warning plates, one at the back and one on each side of the vehicle.

5.7 The hazard-warning plate shall be in the same shapes and colors as shown in the figures in Appendix 3.

5.8 The hazard-warning sign shall be used inside the plate and shall conform to the shapes and colors as in the drawings in Appendix 4.
5.9 The following information shall be shown on each warning plate:
   a) The hazard-warning sign for the classification of the material.
   b) The chemical name of the material.
   c) The United Nations number of the material.
   d) The emergency action code "HAZCHEM".
   e) The name of the manufacturer or local agent.
   f) A telephone number to be dialed, during transportation, for advice and help in emergencies.
5.10 Each warning plate shall be:
   a) Weather resistant and identical to the shapes, specifications, colors and information as in Appendix 3.
   b) Either strong or fixed in a manner that it is maintained strong.
   c) Positioned as much as possible midway between the front and the rear of the tank or container.
5.11 Tanks containing petroleum products should be painted white and surrounded with a red stripe. Tanks containing other materials should be painted white and surrounded with a yellow stripe.

6. **PACKING REQUIREMENTS**

6.1 Hazardous materials should be packed in waterproof wrapping according to the packing standards. The size of packages should conform to the international agreement on the transport of hazardous materials by road.

6.2 The wrapping must be strong enough in all parts so as not to break up during handling.

6.3 The cushioning used in the packing should be suitable to the nature of the contents.

6.4 Each package or container must be distinctly marked with:
   a) The identity and the chemical name of the material.
   b) The nature of the hazard involved in the material and how to deal with it in emergencies, (HAZCHEM).
   c) The U.N. number of each material.

6.5 Markings and labeling should be as prescribed in (Appendix 3 and Appendix 4).
7. REQUIREMENTS. ROAD TANKERS AND TANKS CARRYING FLAMMABLE LIQUIDS

7.1 The body and fittings of both the vehicle and the tank should be made up of strong and fireproof materials.

7.2 The engine fuel feeding pipe should be fitted with a handy and easy to shut off valve. If the engine fuel is fed by a pump operated directly by the engine or electrically by a switch, the switch-on-off button must be in a handy and clearly-marked position.

7.3 The engine and electric batteries shall be well screened from the vehicle's body by a fire-resistant shield carried down to at least the top of the chassis, and upwards to the top of the tank, or to the top of the cabin if the cabin's roof is made up of fire-resistant materials and is without holes.

7.4 If the fuel used to operate the vehicle has a flashpoint of less than 65°C, the fuel tank should only be behind the aforesaid shield if the following requirements are fulfilled:

a) The fuel tank is protected from shocks by strong steel guards or by the chassis. The tank should be up to Oman's standards.

b) The fuel tank filler cap is provided with a lock.

c) The fuel feed device, which carries the contents of the tank, is placed in front of the fire-resistant shield.

7.5 Where windows are provided in the aforesaid fire-resistant shield, they shall be fixed in fire-resistant framing with wired glass or any other heat resistant substance approved by a recognized authority. The frames should be impossible to open.

7.6 The total connections of the vehicle's exhaust system shall be placed in the front of the aforesaid shield.

7.7 The following requirements shall be complied with in the lighting of any vehicle:

a) The voltage shall not exceed twenty four volts.

b) The circuit shall be heavily insulated and be independent of the chassis.

c) The wiring shall be installed and protected as to reduce, as much as possible, any risk of damage.

d) The battery shall be in an accessible position.

e) A handy circuit breaker placed near the battery should be provided in the form of a double-pole switch or any other suitable method.

f) If the vehicle is to be provided with a fire-resistant shield, the dynamo, battery, switches and fuses should be placed in front of that shield.

7.8 A trailer shouldn't have less than two axles. If the trailer is attached to a prime mover, it must well screened from the prime mover by a fire-resistant shield carried down to at least the top of the chassis frame, and upwards to the level of the top mounted tank. If the prime mover is wider than the trailer, the said shield should extend 600 millimeters on both sides.

7.9 The capacity of the tank mounted in a vehicle should not exceed 30 cubic meters. If the capacity is to exceed 6.9 cubic meters, the vehicle should be of the following specifications:
a) An articulated vehicle consisting of a prime mover and a trailer, both made according to a recognized design lord carrying inflammable liquids exceeding 6.9 cubic meters.

b) A vehicle equipped with a tank designed by a recognized designer lord carrying flammable liquids of more than 6.9 cubic meters.

7.10 There should be a gap of not less than 150 millimeters between the mounted tank and the lire resistant shield to be provided as specified in item 7.3 above.

7.11 A tank of more than 5 cubic meters should be divided into compartments, the capacity of each should not be no more than 5 cubic meters.

8. **FIRE-FIGHTING APPLIANCES.**

8.1 Any vehicle used lor transporting hazardous materials should be equipped with the following appliances:
   a) At least one portable lire extinguisher of reasonable capacity and suitable lor lighting a lire in the engine or any other part of the vehicle.
   b) In addition to the equipment in (a) above, at least one portable lire extinguisher of adequate capacity and suitable lor lighting a lire in the materialized should be provided.

8.2 Where a vehicle used lor carrying hazardous materials consists of a prime mover and a separate trailer, the trailer must be equipped with at lease one lire extinguisher conforming to the requirements in 8.1. b above.

9. **INFORMATION TO BE OBTAINED BY THE VEHICLE OPERATOR**

9.1 It is the duty of the consigner of each supply of hazardous material to provide the authorized person with accurate and sufficient information on that material to enable the letter to prepare them sells lor the hazards involved in the transport of materials.

9.2 No hazardous material shall be transported before the information as mentioned in no. 9.1 has been obtained.

10. **WRITTEN INFORMATION FOR THE DRIVER**

10.1 The Authorized Person should ensure that the driver has received information in writing including the following:
   a) Type of the hazardous material.
   b) Description of the dangers involved and the safety measures necessary to avert them.
   c) Actions to be taken by the driver in emergencies.

10.2 Information on a hazardous material should be provided in English and Arabic. The driver should keep information only in relation to the material he is transporting. Information on other materials already transported shouldn't be kept in the vehicle.
11. INSTRUCTION AND TRAINING OF THE DRIVERS

11.1 The Authorized Person should ensure that the driver of that vehicle has received proper instruction and training in order to be able to understand the following:
   a) The nature of the dangers involved in the material carried in the vehicle and the emergency action he should take; and
   b) His duties according to these requirements.

11.2 The Authorized Person shall keep a record of such instruction and training received by a driver as long as the letter is assigned to drive the vehicle. The driver also, must keep a copy of his training documents.

12. GENERAL DUTIES UNDER THE REGULATIONS

12.1 Duties of the Consignor:
   a) Ensure that the containers of the hazardous materials are made and packed according to the requirements of these regulations.
   b) Ensure that sufficient and accurate information on the material and the size of the containers are given to the Authorized person to enable them to take measureless as necessary for the transport of the material.
   c) If the Consignor is involved in transport of the materials, he must ensure that the loading, stowing and unloading of the cargo are carried out safely and that all safety precautions are taken.

12.2 Duties of the Authorized Person
   a) Ensure that the hazardous materials containers and the manner of their transport are as required in these regulations.
   b) Obtain from the Consignor the necessary information about the hazardous material.
   c) Ensure that the vehicle and the container are suitable for the proposed trip and the material to be carried.
   d) Ensure that the driver is provided with enough information in writing about the material, the inherent dangers and the emergency action he should take.
   e) Ensure that the driver has received proper instruction and training and that he keeps necessary records on this.
   f) Ensure that loading, stowage and unloading are carried out safely, and that necessary monitoring is performed for specific materials.
   g) Ensure that hazard warning panels and labels are fixed to the vehicle, kept clean and not obscure.

12.3 Duties of the Driver:
   a) Ensure that information in writing about the substance he is transporting, a portable fire extinguisher and a first aid kit are provided.
   b) Ensure the provision of what is mentioned in 12.2 i & 12.2 g above.
   c) Ensure, before starting the trip, that the vehicle is roadworthy.
   d) Ensure that the special conditions relating to the temperature of the organic peroxides and other self-reactive flammable solids are observed.
   e) Ensure that proper labels are attached to the material containers.
f) Ensure that hazard plates and signs are fixed in the proper places on the vehicle, and that they are always clean and conspicuous.

g) Ensure that the hazard material vehicle, when stopping, is parked in a safe place and supervised by himself or by some other competent person above the age of 18.

h) Provide information as requested by the police about the load and route of the vehicle. In case of fire or leak, he should inform the nearest police or civil defense station and the Consigner.

i) Observe the Directorate General of Traffic's instructions with regard to safety on the road during the transport of hazardous materials.

j) A driver is prohibited to do any of the following acts:
   - Smoking, lighting matches or using naked flames.
   - Fuelling the vehicle while loading or unloading.
   - Operating the engine while loading or unloading.
Section 2
Safety requirements for the storage and handling of hazardous materials
SECTION 2
SAFETY REQUIREMENTS FOR STORAGE AND HANDLING
OF HAZARDOUS MATERIALS

1. GENERAL

1.1 Many potential hazards are associated with the storage and handling of hazardous materials. Avoid them by observing the following:
   a) Acquire thorough knowledge of the properties of the materials to be stored and handled.
   b) Comply with safety procedures as necessary for storage and handling.
   c) Inform all personnel who will come in contact with these materials of the hazards involved and the safety precautions which must be taken.

2. LICENSING PROCEDURES:

2.1 Hazardous materials shall only be stored in places specially made for this purpose and licensed by the Competent Authority.

2.2 The license shall be issued by the Competent Authority.

2.3 The application for license shall enclose:
   a) A sketch of the site, the proposed buildings, neighboring buildings and access roads. The dimensions and distances must be indicated.
   b) Full information about the types, properties and quantities of the materials to be stored as well as the sizes of containers, the hazards involved and the standards of storage thereof.

2.4 Application for licensing for use of the store shall be finally approved after the completion of standard requirements.

3. GENERAL REQUIREMENTS, HAZARDOUS MATERIAL STORES

3.1 Location:
   A location for storing hazardous materials should:
   a) Pose no danger to neighboring facilities.
   b) Have adequate water supplies for fire fighting.
   c) Be always accessible by fire engines and emergency equipment. The routes should be free of obstructions or water ponds.

3.2 Constructions:
The store should be in a separate facility constructed of non-combustible materials that are suitable for the substances to be stored, and can resist fire for not less than two hours.

3.3 Access:
   a) Routes should be available inside and outside the storage facilities for the maneuvering of fire engines and equipment, and to enable fast and safe removal of the stock in case of emergencies.
   b) Lanes and passageways should not be obstructed. Containers of materials to be transported should not be stacked or piled in a manner that blocks the way to them.
3.4 **Ventilation:**
The inside of a hazardous materials store should be well ventilated. The standard ventilation for any material, according to its properties, should be provided before the approval of its storage.

3.5 **Drainage:**
a) Traps, separators, neutralizing pits, or efficient effluent treatment plants should be provided to prevent the leak of flammable or toxic liquids into the public sewage system, or to neutralize these liquids.
b) Where large quantities of hazardous materials are to be stored, emergency draining system should be set up to drain off leaks and the contaminated waste of fire-fighting water.
c) Each application should be considered individually, and the requirements will be established by the Competent Authority.

3.6 **Lighting:**
Safe and appropriate lighting must be maintained in the store at all times.

3.7 **Control of the ignition sources:**
a) Practical measures should be taken to prevent any possibility of ignition in the storage area. These include the "NO SMOKING" signs, provision of appropriate ventilation, observing safety measures in the storage and handling of materials and carrying out necessary repairs of the store's fittings.

B) Ignition may take place inside the store by exposing the stock to an ignition source including naked flames, smoking, frictional heat, spontaneous ignition, chemical reaction or heat radiation.

3.8 **Safety and fire projection equipment:**
The storage should be provided with safety and fire equipment suitable with the dangers of the hazardous materials and as determined by the Competent Authority.

4. **GENERAL REQUIREMENTS, STORAGE LAYOUT AND STACKING**

4.1 Hazardous material containers should be stored, handled and stacked with due consideration to their hazards.

4.2 Hazardous material containers to be stored should be made up of non-reactive substance. Each container should be labeled with the proper chemical name of the material and with obvious signs identical to the design approved by the Directorate General of Civil Defense (Appendix 4).

4.3 Maintain good access all the time inside the store with the gangways well defined.

4.4 Special consideration should be given to individual cases of storage systems which are provided with the mechanized fire protection.

4.5 Stacking should be made in a manner that limits the spread of fire, if it ever happens, and facilitates the rescuing of containers in emergencies.

4.6 Separate the highly combustible materials from other stocks with a concrete wall and separate also the highly reactive materials (Appendix 2).

4.7 Stack the containers in a manner to remain stable and balanced at all times, especially if fire breaks out.

4.8 To facilitate the fire-fighting operations, reduce as much as possible the volume of stacks and maintain them to the standards.

4.9 Combustible materials shouldn't be stacked near the main columns of the building which are not protected with fire resistant elements.

4.10 Ensure that the stacks do not hamper the operation of the built-in fire-fighting system.
4.11 Materials liable to damage by water should be stacked on stands at least 100 mm above the ground.

4.12 Materials which expand when in contact with water should be stacked at least one meter away from the walls of the store.

4.13 An appropriate clearance should be kept around the fire-resistant doors to ensure that they are used effectively. A clearance of not less than 600 mm should be maintained on both sides of the gangways access to the doors.

4.14 Store combustible material at least one meter away from any door in the store.

5. **SPECIAL REQUIREMENTS STORAGE OF SOME HAZARDOUS MATERIALS.**

In addition to the general requirements applicable to all cases of storage of hazardous materials, there are special requirements, which must be observed with regard of every category of the following hazardous materials:

5.1 **Storage Requirements, Flammable Liquids**

a. These requirements are applicable to buildings for indoor storage of portable containers of flammable liquids. They are not applicable to open storage areas, filling and service stations or refineries which are subject to special requirements.

b. Containers of the flammable liquids should be unbreakable bearing a label of the chemical or common name of the material, a brief statement of its flammability, toxicity and any special tire fighting measures.

c. Provisions for access i.e. openings or windows or lightweight, removable and fire-resistant panels should be made in the external walls of the store to enable fire-fighting operations.

d. The store's external walls and roof should be provided with explosion venting system, including light fixtures or windows or hatch covers. The explosion venting system must be placed properly in the walls or roof such that the explosion pressure is vented outward, and thereby prevent injuries to personnel or damage to the exposed parts.

e. If the store is located at more than 3 meters and not more than 15 meters from a neighboring building or a plot for future building, the wall facing this property should be fire-resistant for at least two hours, and provided with a door which is fire-resisting for not less than one and a half hour.

f. If the store is located at 3 meters or less from any of the properties as mentioned in (e) above, the wall facing the property should be fire-resisting for 4 hours and doors for 3 hours.

g. Any doorways or openings should be provided with kerfs or ramps not less than 150 mm high from the ground level to contain the spill of any likely leak of the liquid.

h. Electrical fittings and fixtures should conform to the standards of storage of flammable liquids.

i. The store should be properly ventilated by one of the following means:

   - Openings made in one wall at not more than 300 mm from the ground level to let air in the store, and extractor openings in the opposite wall. Both of the air-in and extractor openings should be far apart as possible from each other.

A mechanical ventilating system which freshens air in the store at not less than one cubic meter per minute for every 3 square meters of the ground area and shouldn't be less than 4cu mm.
j. Appropriate arrangements should be taken for temporary storage of empty containers and their prompt removal from the main store.

k. The store should be provided with the prescribed fire and safety equipment.

l. Conspicuous warning signs indicating the existence of flammable liquids (as in Appendix 4) should be posted in the store. Signs which read “Danger, No Smoking” should be provided in Arabic and English.

5.2 Storage Requirements, Flammable Gases:

a. Flammable gas cylinders, other than those permitted, shouldn’t be stored in residential areas.

b. Prescribed safety distances from neighboring constructions or their boundaries should be observed according to the quantity and type of the gas to be stored.

c. Ignition sources are not permitted in the storage area.

d. The store should be located in an accessible place and supplied with arrangements for prompt removal of the cylinders in emergencies.

e. The store should be located and designed in a manner to release the pressure of an explosion, if it ever happens, in a direction where the risk is less.

f. The store should be a single storey with doors and windows, for natural ventilation, spaced uniformly up and down the walls. The total area of the doors and windows, and that of the permanent ventilating openings should respectively be at least 10% and 20% of the total area of the walls and the roof.

g. The height of the upper ventilating windows should be at least 2.5 m. from the ground level and the base of the lower ones should be on the ground level. The distance between one opening and the other should not be less than 2m.

h. At least two emergency exits should be provided in two different sides.

i. The ceiling should be of non-combustible elements to protect the cylinders from rains, sun heat, etc.

j. The floor should be smooth-finished concrete, shock absorbent and free of any grooves or draining holes.

k. Electrical installations and equipment should be explosion-proof and not less than 2 meters above the ground level. Electrical lamps should be of the type which emit minimum heat, with a shoe and fixed to the ceiling or near the upper ends of the walls.

l. All contents of the store should be made up of non-combustible materials.

m. Cylinders should be stacked vertically with their nozzles upward. The rows should be separated by gangways so that each cylinder is accessible.

n. Gas-filled cylinders and empty ones should be kept in separate places. A signboard should indicate this.
To avoid risks in emergencies, oxygen cylinders should be kept away from flammable gas cylinders.

Provide the store with adequate safety and fire prevention equipment.

Warning signs fixed in appropriate places should indicate the details of gases in stocks, their hazards and the initial actions in emergencies. The approved colors of gas cylinders (as in Appendix 5) should be complied with.

5.3 Storage Requirements, Toxic Chemicals:

a. Toxic chemicals may enter the human body by inhalation, swallowing or by soaking through the skin. Information about toxicity and potential risks of a chemical may be obtained from the supplier. These information should include the personal protection equipment and the medical care needed upon exposure to these substances.

b. Some chemicals, although not toxic in their normal form, decompose into other toxic elements when exposed to heat, moisture or acids. These chemicals should be treated as toxic.

c. The quantity of toxic chemicals to be stored should be kept to a minimum.

d. Drums of toxic liquids of high vapor pressure should be protected from direct sun rays.

e. Flammable materials should not be kept in the same store with toxic chemicals. Toxic chemicals should be stored in a cool and well-ventilated store.

g. All People dealing with toxic chemicals should be informed of the potential hazards of these substances and the safety measures.

h. Nobody should eat or drink anything within an area where toxic chemicals are stored or handled.

i. Unauthorized people are not allowed to enter the storage area of toxic chemicals, and appropriate measures should be taken to ensure this.

j. Provide the toxic chemicals storage or handling area with necessary safety equipment including gloves, rubber safety shoes, breathing masks, first aid facilities, and train personnel how to use them.

k. Warning signs should be posted in appropriate places of the site to caution civil defense personnel to use breathing apparatuses in emergencies.

l. In case of leak of a toxic material, the following measures should be taken:
   - The material shouldn't be in contact with a human body.
   - Vapors shouldn't be inhaled.
   - Liquid toxics shouldn't get into a human mouth.
5.4 Storage Requirements, Oxidizing Agents

a. Oxidizing agents are chemicals which can supply any reaction with oxygen. They include: oxides, peroxides, nitrates, nitrites, bromated, chromates, chlorates, dichromate's, per chlorates, permanganates. Since oxidizing agents intensify the combustion if other materials burn, they pose hazard when stored with combustible materials. Some oxidizable materials react with oxidizing agents at room temperature to make fires or explosions.

b. Oxidizing agents shouldn't be stored in the same area with flammable materials, organic chemicals or reducing agents.

c. The store should be cool, well-ventilated and remote from any other operations. Including the shelves and the oxidizing agents boxes, the store must be made up of fire-resistant and non-combustible materials.

d. The floor of the storage room should be fire-resistant, watertight and free of holes or cracks into which the hazardous material may pass.

e. The storage room should be kept tidy and the containers well-arranged. Any leaks should be cleaned up immediately.

f. The store should be provided with fire protection equipment as determined by the Directorate General of Civil Defense. Automatic water sprinklers may be necessary for the store.

5.5 Storage Requirements, Corrosive Chemicals

a. Many acids and alkalis are corrosive to their containers, other materials in the storage area and to the body tissues. Acids react with many metals to form hydrogen gas, and alkalis may also form hydrogen gas on contact with aluminiums. Since hydrogen forms an explosive mixture with air, accumulation of hydrogen in the storage room of these materials must be prevented.

b. Corrosive liquids should be stored in a fireproof store which is well ventilated, cool, dry and free of moisture.

c. The storage area should be provided with good corrosion-resistant drainage system and with water hoses for cleaning up any leaks.

d. With some corrosive liquids, such as sulphuric acid, periodic venting of drums may be necessary to relieve the accumulated internal pressure of hydrogen formed by the reaction of the corrosive material with the metal of the drum.

e. Safety showers, eye wash fountains and other protective equipment should always be available while the personnel are handling corrosive chemicals or working in the store.
5.6 Storage Requirements, Water and Air-reactive Chemicals

a. Some chemicals like alkalis, anhydrides, carbides, hydrides and oxides, etc. react with water to evolve heat and flammable or explosive gases. Among these gases is hydrogen, which at sufficient temperature for its ignition, is produced with explosive violence.

b. These chemicals, which are sensitive to water, should be stored in watertight and airtight containers kept on stands above the ground.

c. Water sensitive chemicals should be kept in containers in a separate store designed to prevent any accidental contact with water, whatsoever.

d. The store should be constructed of a fire-proof material and should be cool, well-lighted, well-ventilated and free of any combustible substance.

e. Air-reactive chemicals are usually stored under water, other liquids or inert gases, according to the nature of each substance, (for example white and yellow phosphorus are kept under water, metallic sodium is kept under oil).

5.7 Storage Requirements, Incompatible Chemicals:

Separate storage areas should be provided for "Incompatible chemicals", chemicals which may react with other substances and create a hazardous condition as a result of this reaction. Some examples of the common incompatible chemicals are listed in Appendix 2. as a guide.

5.8 Storage Requirements, Radioactive Materials:

All radioactive substance used in the Sultanate of Oman must comply with the Ministry of Regional Municipalities & Environment regulations. However, in the case of highly radioactive sources these regulations should be applied according to the following details:

5.8.1 Storage

a. Features to be considered when selecting a storage site for radioactive substances:
   Neither the surroundings are exposed to pollution by radiation, nor the store is under the risk of fire or explosion from the surroundings.
   The possibility of floods, lightning and quakes.
   Direction of wind and related risks.
   Approval of the Ministry of the Regional Municipalities & Environment.

b. In case of a permanent store for radioactive material is to be constructed on the ground level, it should be a single storey constructed from fire proof and non-combustible elements. The store should comply with the requirements of the Ministry of Regional Municipalities & Environment including the design of the fences and safety devices, and subject to the following specifications:
   The floor of the store should be designed to drain off any spillage to an outside underground tank constructed of concrete with thickness of not less than (30cm). The tank should have a steel cover with thickness of not less than (2cm).
   Walls, ceilings and doors should be painted internally with a non-porous washable paint.
c. Provide the storage area with adequate light. All electrical installations must comply with the approved standards. Lamps should be provided with shades.

d. Keep radioactive substances in the proper containers as specified by the manufacturer according to the international standards. Breakable containers should be kept in shock absorbent covers, except in the cases which require that a radioactive substance be taken from its transport container to a specified storage container.

e. Provide the store with a separate ventilating system that does not permit radiation leaks to the outside surroundings, whether in normal conditions or in case of a fire. The ventilation system usually contains air filters to purify the outgoing air. The filters must be changed periodically.

f. The following information should be indicated outside the store in Arabic and English:

   Name of the radioactive substance, type of rays (Alpha, Beta, Gama) and nature of the substance (solid, liquid, gas).
   Permissible level of radiation at the surface of the container and one meter away from the surface.
   Combustibility of the substance and its solubility in water.
   Vapor density and its vapourizability.
   Type of the appropriate container of the material during transport and storage.
   Name of the manufacturer and local agent of the material.
   Measures to be taken in case of emergencies (breakage of the containers, leak of the contents, or their exposure to fire)

g. Provide the material's storage and work areas with radiometers to measure the level of radiation. It is preferable to install an automatic radiation alarm.

h. Provide protective clothing, including breathing masks, plastic boots, gloves and other safety equipment. The clothing should protect the body from radiation.

i. Provide the store and the working Ares with fire alarms, fire detectors and fire-fighting equipment as recommended by the Directorate General of Civil Defense.

j. Inspections and maintenance of safety equipment, fire alarms, detectors and fire-fighting equipment should be carried out on time and according to fixed the instructions.

k. Signs warning of the occurrence of radioactive materials should be displayed in the area of the store, the working areas and fixed to each container.

l. No other materials should be stored in the same place with radioactive material containers

m. Persons involved in the storage of radioactive materials must be experienced in this field, well-trained in the transportation, storage and handling of these materials and fully conversant with the measures to be taken in emergencies.

5.8.2. Measures Necessary for Handling Radioactive Materials

a. Containers of radioactive substances must be identified with the international warning signs and colors.
b. Before the containers are transported from the seaport or airport they must be inspected externally. If they are found intact and safe to transport, the following measures must be taken:

Transportation should be carried under the supervision of specialists.
Bodily contact with the material should be minimal.
Appropriate measures should be taken to keep the packing of the parcels protected from humidity and other conditions likely to cause damage.
Until transported, the containers should be placed away from the places of presence of people or vehicles.
Customer clearance should be completed as soon as possible without opening the parcels.
If it is inevitable to open a parcel, this must be done in the presence of an authorized radiation monitor using proper equipment for gauging the level of radiation dosage. All precautions possible should be taken to prevent harmful contamination in the surroundings.

5.8.3. Measures for Transport of Radioactive Materials:

a) The authorized person should take the appropriate measures for transporting radioactive material containers.

b) Carry the radioactive material containers at the rear compartment of a closed transport vehicle. The compartment must be fitted with a barrier to keep the containers in place and prevent them from falling near the driver.

c) Carry no other goods with the radioactive material containers.

d) Provide the driver with information in writing about the transported radioactive material as listed in item 5.8.1.f above.

e) Put in the driver's cabin a fireproof metal plate engraved in Arabic and English with a warning that the vehicle is carrying radioactive material, and showing the telephone number of the official who is to be contacted in the event of an accident.

f) Provide the vehicle with appropriate fire extinguishers and a radiometer.

g) Fix standard radioactive material warning signs in Arabic and English to both sides and the rear of the vehicle.

h) Train the driver on the necessary procedures to be taken in case of an accident and explain to him how the radiometer gauge is used.

i) The driver should carry a personal dosimeter that should be changed monthly by the vehicle operator.

j) The driver shouldn't leave the vehicle at all without having another responsible person to keep watching.

k) Once the vehicle reaches the assigned place unload the containers using a trolley to carry them by the shortest way to the store. The work must be carried out under supervision.

5.8.4 Requirements for Dealing with Radioactive Materials

a. Places for handling radioactive materials should be constructed of fireproof and non-combustible elements, and shall meet the following specifications.
Ceilings and walls are coated with a lining or paint that is non-porous and washable by water.

The store's floor is sloping enough to drain water and spillage through a draining hole to an outside underground concrete tank covered with a steel lid.

When handling highly radioactive substances, these substances should be well packed and stored.

The place is provided with a separate ventilating system as mentioned in item 5.8.1. above.

b. Use radioactive materials by qualified and well-trained personnel and under the supervision of an authorized radiation monitor.

c. Rooms where radioactive materials are used are restricted places. Signs to this effect should be fixed to the doors in Arabic and English.

d. Access to restricted places is only permitted to authorized persons. Notices written in Arabic and English should be posted to the room's wall indicating the way of work, the protective clothing to be worn and other necessary precautions.

e. All personnel within the restricted areas are required to wear personal dosimeters which should be replaced monthly. Their individual radiation dosages should be entered in a special record for each one for medical examination purposes.

f. Keep radioactive material containers in a specially designed section in the work room.

g. Note the following information in special records:

Quantities received of the radioactive materials.

Quantities used of the radioactive material.

Waste radioactive materials disposed of.

h. Breathing masks and a decontamination trolley should be provided and kept in a specific place at both of the storage and working areas.

i. The above decontamination trolley should contain: a contamination monitor, decontamination tools including four personal dosimeters (replicable monthly), gloves, overshoes, protective clothing, face masks, forceps, cleaning mops, sponges, decontaminating chemicals, plastic bags, buckets, absorbent tissues, labels, and other cleaning articles.

Radioactive waste, should be disposed of according to the rules and instructions of the Ministry of Regional Municipalities and Environment.

6. GENERAL MEASURES STORAGE AND HANDLING OF HAZARDOUS MATERIALS:

6.1 The following actions are strictly prohibited during storage or handling of hazardous materials.

6.2 Avoid contamination of the workplace by keeping the storage sections tidy and clean. This reduces the emission of poisonous gases and dust, whether flammable or diffusible in the atmosphere, and therefore reduces the possibility of fire. Provide detection devices to detect the concentration level of poisonous, flammable and radioactive materials at the storage or handling areas.
6.3 Personnel are required to wear protective clothing as appropriate to the potential hazards when they enter or approach the areas of storage or handling of chemicals. Appropriate breathing apparatuses should also be worn for use when necessary.

6.4 Provide artificial ventilation in addition to the natural ventilation to ensure non-concentration of hazardous dust, gases or vapors within the surroundings of the place.

6.5 Provide reasonable quantities of detergents and decontaminants.

6.6 Provide emergency clean water sources within the storage area of poisonous or corrosive materials.

6.7 Organizations involved in the storage or handling of hazardous materials must keep records including the following information:
   a) Type and quantity of the stored materials.
   b) Date of supplying.
   c) Quantity out.
   d) Purpose the quantity is used for.
   e) Method of disposal of the waste material.
CLASSIFICATION OF HAZARDOUS MATERIALS

Hazardous materials are classified, according to the international recommendation, into the following groups:

Class 1  Explosives:
They are not included in these requirements as they are subject to Oman's measures for the transport, storage and handling of materials in this group.

Class 2  Gases: compressed; liquefied or dissolved under pressure:
This Category comprises three groups as follows:
   a) permanent gases: Gases which cannot be liquefied at ambient temperatures or stored under pressure.
   b) Liquefied gases: Gases which can be liquefied under pressure at ambient temperatures.
   c) Dissolved gases: Gases dissolved under pressure in a solvent, and which may be absorbed in a porous material.

Class 3  Flammable liquids:
These are liquids or mixtures of liquids containing solids in solution or suspended mixture (e.g. paints, varnishes, lacquers etc., but not including other substances which on account of their hazardous properties have been included in other categories). They emit flammable vapor at or below 61°C (141°F) in a closed test vessel, corresponding to 65.5°C (150°F) in an open test vessel.

This category is subdivided into three groups:

   3.1 Group of liquids with a flashpoint below 18°C (64°F), in a closed test vessel, or which may have a low flashpoint when in contact with some other hazardous materials.

   3.2 Group of liquids with a medium flashpoint between 18°C (64°F) and 23°C (73°F), in a closed test vessel.

   3.3 Group of liquids with a high flashpoint between 23°C (73°F) and 61°C (141°F) in a closed test vessel. Substances which have a flashpoint above 61°C (141°F) in a closed test vessel, are not deemed dangerous by the assumed fire hazards.

Class 4  Flammable solid substances:
This category is subdivided into three groups:

   4.1 Group of solids substances with the common property of being easily ignited by an external heat source, such as sparks or flames, and of being readily combustible.

   4.2 Group of solid or liquid substances with the common property of being liable to spontaneous heating and ignition.

   4.3 Group of substances which are either solids or liquids, and are with the common property of evolving inflammable gases when in contact with water. In some cases these gases are liable to spontaneous ignition.
Class 5  Oxidizing substances:
The substances which may evolve oxygen, that in turn stimulates combustion and intensifies fire in other materials.

This Category is subdivided further into two groups:

5.1 Oxidizing substances. These are substances which are not necessarily combustible, but may produce oxygen, which causes, or contributes to, the combustion of other materials.

5.2 Organic peroxides. Most substances in this group are combustible, may have the same effect of oxidizing substances, and are liable to explosive decomposition. They are either in liquid or solid form, and they may react vigorously with other substances. Most of them burn rapidly and are sensitive to impact or friction.

Class 6  Poisonous and contagious substances:
This Class is subdivided into two groups:

6.1 Group of poisonous (toxic) substances which cause death or serious injury to human health if swallowed, inhaled, or they are in contact with skin.

6.2 Contagious substances. These substances carry diseases caused by micro-organisms.

Class 7  Radioactive substances:
The substances which spontaneously emit radiation with a specific activity of more than 0.002 micro curie per grime.

Class 8  Corrosive substances:
The substances, which are solids or liquids in their original state and with the common property of being highly or slightly destructive to the living tissues.
The escape or leak of such substances from their packing may also cause damage to other adjacent materials or to the components of the vehicle.

Class 9  Miscellaneous hazardous materials:
Any other substances not included in the above categories, and which experiences have shown