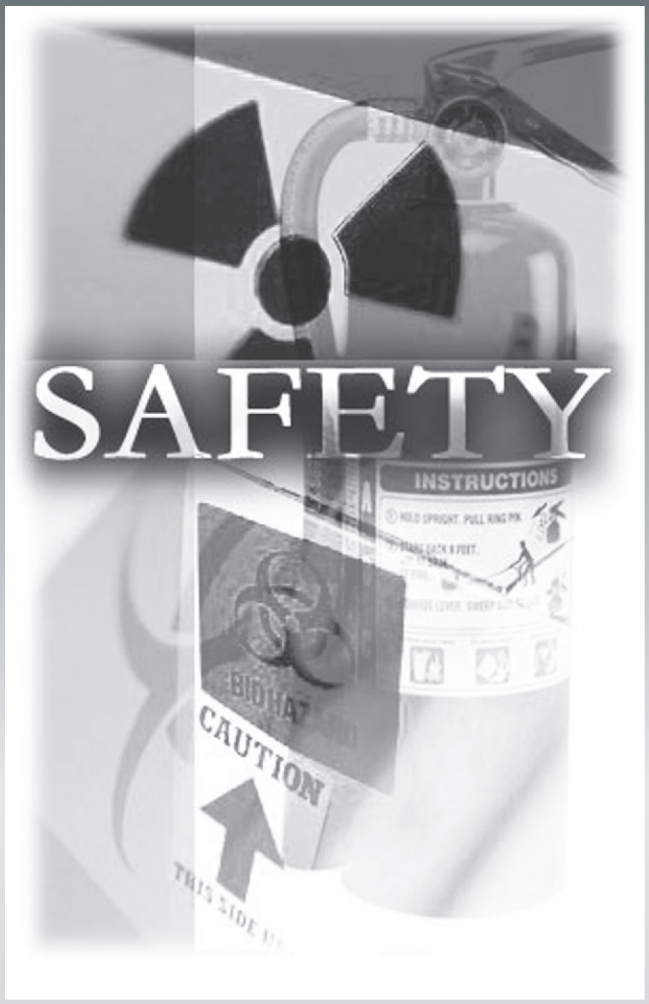
SAFETY GUIDE



INSTITUTE FOR PLASMA RESEARCH

Bhat, Gandhinagar - 382 428

CONTENTS

सुरक्षा, स्वास्थ्य एवं पर्यावरण (सुस्वाप) नीति

आईपीआर, इटर-इण्डिया एवं एफसीआईपीटी अपनी सबसे महत्वपूर्ण सम्पदा अर्थात अपने कर्मचारियों, शोधार्थियों, प्रशिक्षुओं एवं अनुबंधित श्रमिकों के लिए सुरक्षा, स्वास्थ्य एवं पर्यावरण में उत्कृष्टता प्राप्त करने हेतु एक सक्रिय नीति का अनुपालन करने के लिए वचनबद्ध है। संस्थान का यह उद्देश्य है कि सुस्वाप निष्पादन को प्रभावी एवं सफल अनुसंधान प्रबंधन का एक अभिन्न अंग बनाया जाये।

आईपीआर, इटर-इण्डिया एवं एफसीआईपीटी यह सुनिश्चित करने का हरसंभव प्रयास करता है कि सुरक्षा, स्वास्थ्य एवं पर्यावरण संरक्षित रहें, कार्य करने की स्थितियाँ यथासंभव सुरक्षित रहें, प्राकृतिक संसाधन संरक्षित रहें तथा सभी उपयोगी मानकों/वैधानिक विधानों का अनुपालन किया जा रहा है।

आईपीआर, इटर-इण्डिया एवं एफसीआईपीटी अपने कर्मचारियों के सक्रिय भागीदारी के द्वारा व्यक्तिगत क्षति, प्रयोगिक सुविधाओं/व्यवस्थाओं की क्षति को कम करने एवं हानिकारक पर्यावरण प्रभावों को कम करने के लिए निरंतर एवं समर्पित प्रयास करता रहेगा।

प्रो पी के काव

तिथि : ३१ अगस्त, २०१० *निदेशक*

SAFETY, HEALTH AND ENVIRONMENT (SHE) POLICY

IPR, ITER-INDIA and FCIPT are committed to maintain an active policy of excellence in Safety, Health and Environment (SHE) for employees, research students, trainees and contract workers who constitute most important productive asset. It is the institution's intention to make SHE performance an integral part of efficient and successful **Research Management**.

IPR, ITER-INDIA and FCIPT strive to ensure that Safety, Health and Environment is protected, working conditions are as safe as it is practicably possible, conserve natural resources and conform with all relevant standards/statutory legislation.

IPR, ITER-INDIA and FCIPT through active participation of all personnel, will make continuous and dedicated effort to minimise loss in any form including personal injury, damage to experimental facilities and reduce the adverse environmental impact.

Prof. P.K.Kaw
Director

Date: August 31, 2010

SAFETY AND HEALTH PLEDGE

I solemnly affirm that I will dedicate myself to the cause of safety, health and protection of environment and will do my best to observe rules, regulations and procedures and develop attitudes and habits conducive for achieving these objectives.

I fully realize that accidents and diseases are a drain on the national economy and may lead to disablement, deaths, harm to health and damage to property, social suffering and general degradation of environment.

I will do everything possible for the prevention of accidents and occupational diseases and protection of environment in the interest of self, family, community, organization and the nation at large.

- An Employee of IPR


WORK TOGETHER
WIN TOGETHER!

IPR's SAFETY PROTOCOLS

1. Safety Shoes and Safety Helmet shall wear by each employee while working in work area. Other Personal Protective Equipments (PPEs) shall use as appropriate.
2. Visitors are not allowed inside the Labs without escorting by an IPR employee.
3. People with pacemakers or other medical implants must stay out from Radio Frequency / Microwaves and high Magnetic Field areas.
4. Only qualified person or contractor having certificate from competent authority are allowed to carry out electrical related works.
5. While awarding any work contract, safety clauses shall be included in Work Order.
6. While procuring new chemical or any hazardous material, requirement of Material Safety Data Sheet (MSDS) is must and its requirement shall include in the purchase indent.
7. New system shall be designed with safety interlocks and other inbuilt safety measures.
8. All the exits are to be kept free of obstructions to facilitate quick escape in an emergency.
9. Good Housekeeping is considered as the backbone of safety. Returning equipment not in use to their proper storage place, clear labeling of chemicals, keeping plant floor free of obstruction and other good housekeeping practices should be strictly followed.
10. Clearance has to be obtained from Safety Committee before carrying out any new expansion or modification or changes in existing system etc.

11. While working in the liquid Nitrogen or liquid Helium handling Labs, if Oxygen deficiency alarm blows, or in case of leakage of liquid Nitrogen or liquid Helium, leave the area safely and go in open area for fresh air.

12. All substances should be regarded as potential sources of hazards and handled with care.

13. Electrical Isolation Procedure shall be followed while working on Electrical Equipments.

14. Electrical insulated tools and appropriate protective appliances shall be used while doing work having electric shock and other hazards.

15. Welding, Gas Cutting and other spark producing jobs are not allowed on or inside the flammable gas/liquid storage without clearance from Safety Officer/Safety Committee.

16. If any incident occurs in the IPR premise, report it to Chairman - Safety Committee/Safety Officer and Administrative Officer immediately. Also, fill the 'Initial Incident Report (IIR)' form and submit to Safety Committee.

17. In case of fire, lift should not be used. Use staircases.

DO RESPECT SAFETY PROTOCOLS


SAFETY FIRST
SCHEDULES
ARE IMPORTANT
But
SAFETY
COMES FIRST !

1. SAFE HANDLING OF CRYOGENS

At IPR, mainly two Cryogens namely liquid Nitrogen and liquid Helium are used for various research activities.

Nitrogen and Helium gas are odourless, colourless and tasteless. One cannot detect presence of Nitrogen or Helium gas by just smelling but it requires detection instrument.

Nitrogen and Helium are not toxic but it reduces availability of Oxygen by displacing air. Continuous monitoring of oxygen level is strongly recommended in Nitrogen and Helium handling area.

As per the Occupational Safety & Health Assessment Series (OSHAS) environment containing 19.5% (V/V) or less Oxygen is considered as 'Oxygen Deficiency Hazard Area'.

Do's

- Ensure proper functioning of Oxygen deficiency warning siren and calibration of Oxygen Monitors periodically.
- Always ensure that all systems provided for ventilation should be inline and functional.
- Collect all vents and drains in a closed system and take the final exhaust outside the hall or lab.
- If you find yourself in the path of gas cloud, try to hold your breath until you reach out of the cloud.
- Splashing of liquid Nitrogen or liquid Helium causes cold burn or frost bite. Use appropriate Personal Protective Appliances like chrome leather hand-gloves, Safety goggles, Face shield, cryogenic suit, etc.

Safety is as simple as ABC –
Always Be Careful.

- Presence of moisture in vessel/pipe causes ice blocking and renders safety devices inoperative, which leads to physical explosion due to over pressurisation. Ensure moisture removal from the pipes/vessels.

Don'ts

- Do not work alone. Always try to work in-group of at least two people in 'Oxygen deficiency hazard area' like Cryogenic hall, Helium Compressor hall, SST Machine Hall, NBI Bay, etc.
- Don't attempt for rescue without wearing airline respirator or Self Contained Breathing Apparatus (SCBA) set.
- Never enter into any confined space or tanks without taking safety clearance from competent person / safety officer.
- Don't bypass any safety valve or overpressure protective devices given on cryogenic system. Ensure functioning by testing periodically.
- Do not temper setting of any over pressure protective devices unless you are authorised to do so.
- In case of splashing of liquid cryogen, do not rub affected part. Flush affected body part with running water for at least 15 minutes under the Emergency Safety Shower.

CAUTION:

If you feel dizzy, have an unexplained loss of coordination, or if your heart rate becomes unusually high, these may be signs of Oxygen deficiency. Tell those around you of the problem and seek fresh air and medical attention immediately.

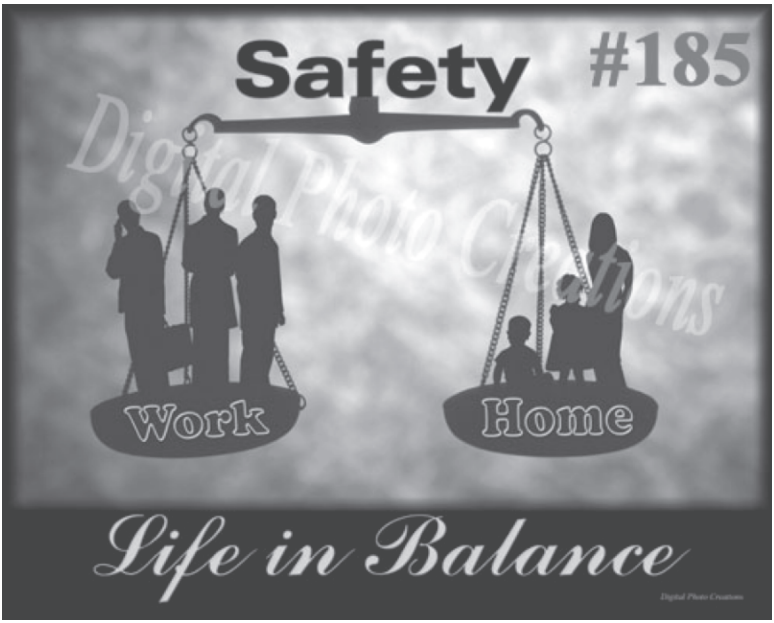
The safe way is the only way.

OR

In case of Oxygen deficiency warning alarm sounds leave the area immediately and go in area of fresh air. Don't walk through Nitrogen or Helium vapour cloud without protective equipment.

%O_2 in Air	**Signs & Symptom of Oxygen-Deficient Exposure**
15.0 – 19.5	Impair co-ordination, decreased ability to work
12.0 – 15.0	Increased pulse rate, impaired perception, poor judgment
10.0 – 12.0	Further increase in rate and depth of respiration
08.0 – 10.0	Mental failure, vomiting, unconsciousness, blue lips
06.0 – 08.0	8 minutes exposure may be fatal, recovery with First Aid
04.0 – 06.0	Coma in 40 seconds, respiration ceases, immediate death

Safety First, Last and Always.


Safety
#185
Digital Photo Creations
Work
Home
Life in Balance
Digital Photo Creations

2. SAFE HANDLING OF DEWAR

At IPR, small quantity of liquid Nitrogen and liquid Helium are handled in double wall vacuum insulated Cryogen Storage Container called DEWAR.

Dewar for smaller quantities (less than 100 ltrs.) of liquid Nitrogen is a simple open top vessel, typically of aluminum construction. Dewars used for liquid Helium have very sophisticated construction & superior insulation properties.

Do's

- Ensure Dewars are properly labeled with the identity of the housed cryogen.
- Always keep the Dewar upright position.
- While Dewar is not in use, liquid access valve (white handle valve) and vent valve (yellow handle valve) should be kept closed, to avoid ice plugging but pressure relief valve (green handle valve) must be kept open to prevent pressurisation (refer figure 1).
- When using a hand truck or trolley for Dewar transport, it must be strapped onto a Dewar transport trolley. (Refer figure 2: for how to handle Dewar).
- Monitor Dewar pressure periodically. If pressure exceeds 15 psi, relieve pressure by opening vent valve.
- While pouring cryogenic liquid, use filling funnel having partly covered top to reduce splashing.
- Use chrome handgloves, face-shield, chemical goggles and cryogenic protection suit while filling, venting or transferring cryogenic fluids from Dewar.
- Shift leaky / damaged Dewar in open ventilated area & cordon the area. Inform Stores In-Charge, Lab In-Charge and Safety Officer about the failure of Dewar.

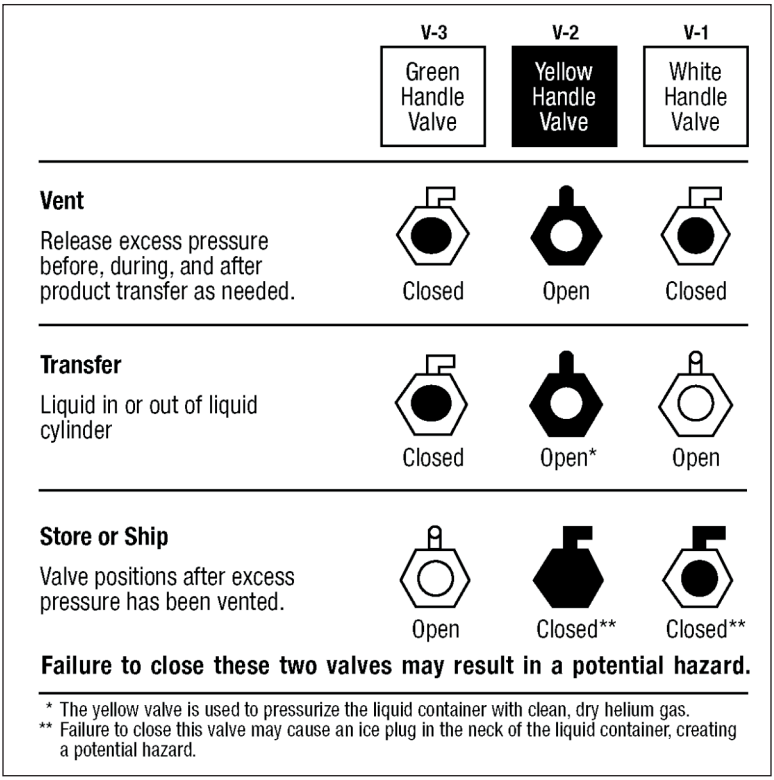
Keep safety at the first step.

Don'ts

- Never cross contaminate in service Dewars with other cryogenic liquids, i.e. do not use liquid Helium Dewar for liquid Nitrogen or vice a versa.
- While shifting Dewar through lift, do not travel along with Dewar in the lift.
- Do not bump or drop the Dewar from an elevation. This could ruin the insulating properties of the Dewar. Dewar that fall onto their side could rupture if the inner vessel cracks and cryogenic material flows into the vacuum space between the inner and outer vessels. The cryogen will contact the warm metal and boil rapidly, greatly increasing the pressure in the Dewar.
- Never bypass the safety valve or pressure relief valve given on Dewar.
- Do not keep Dewar close to heat source. Protect Dewar from direct heat exposure and radio frequency/ micro wave exposure.

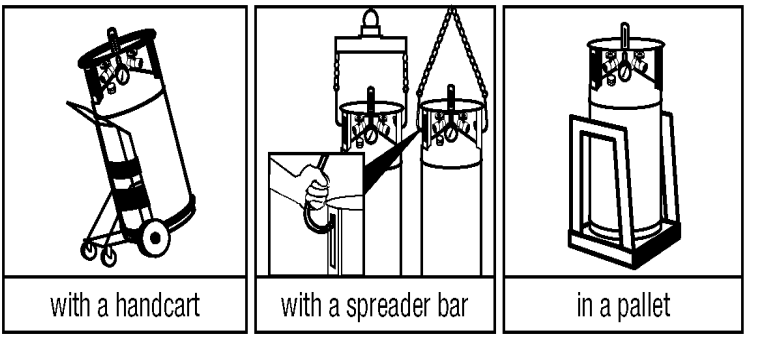
The safe way is the only way.

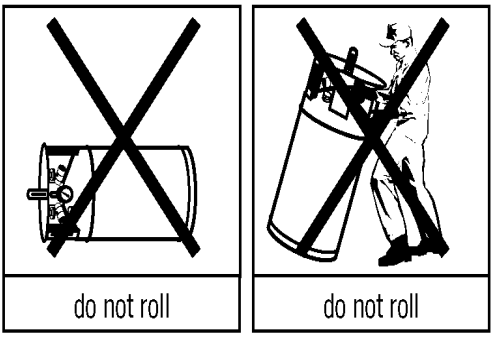
Proper Valve Position on Cryogenic Liquid Container (Figure 1)

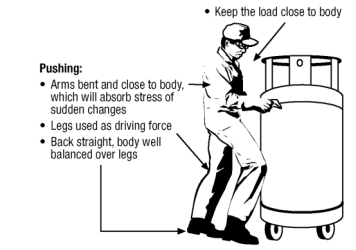


V-1: Liquid Access Valve, V-2: Vent Valve, V-3: Isolation Valve

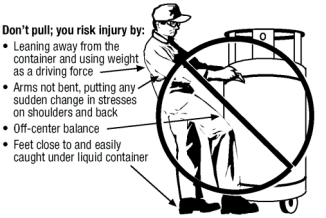
How to handle Liquid Containers (Dewars)?







If the container tips over . . . ***let it go!***



(Figure 2)

Come safely, work safely and arrive home safely.

3. SAFE HANDLING OF COMPRESSED GAS CYLINDERS

Argon, Nitrogen, Hydrogen, Helium, Methane, Oxygen, Acetylene, etc. gases are handled in gas cylinders at moderate to very high pressure.

For a compressed gas cylinder of Argon at 150 Kg/cm^2 pressure and having volume of 6.2 M^3, total stored energy in the cylinder is 1.7 x 10^5 kJ, which is equivalent to 37.2 Kg TNT power. In case of valve damage, the gas cylinder acts as a rocket attaining a speed of over 30 miles per hour in a fraction of a second after venting from the broken cylinder connection. This is a hidden truth for compressed gas cylinders and more tragic is that people do not foresee the severity of an accident.

Do's

- While procuring filled gas cylinder ask supplier to supply cylinder with (i) valve protective cap,(ii) Colour code as per the IS 4379-1967,(iii) Material Safety Data Sheet (MSDS) and (iv) labeling on the cylinder. These conditions shall be mentioned in Purchase Indent and also in Purchase Order.
- Cylinder Safety Tag' shall be tagged on each gas cylinder & fill all the details in the tag.
- For flammable and/or toxic gas cylinder, do leak test to confirm about leakage from valve.
- Filled and empty cylinders shall be clearly marked and stored separately.
- Valve caps shall be kept on at all times except when cylinders are physically connected to regulator.
- Cylinders shall be transported by suitable hand trolley with chain binding.

Tomorrow – your reward for working safely today.

- User shall check the identity of the gas before use.
- Suitable pressure regulating devices (ISI marked) must be used in all cases to regulate gas feed pressure.
- Before a cylinder is removed from service, ensure that valve is closed and pressure is released from the connected system.
- Before returning cylinders to Stores, mention the status of cylinder (Filled / Empty) in 'Cylinder Safety Tag'.
- In case of fire in nearby area, disconnect cylinder and shift the cylinder away from the flame or cool the cylinder by spraying water.
- Incase of leakage shift the cylinder in open area and inform stores.

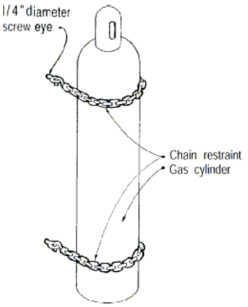
Don'ts

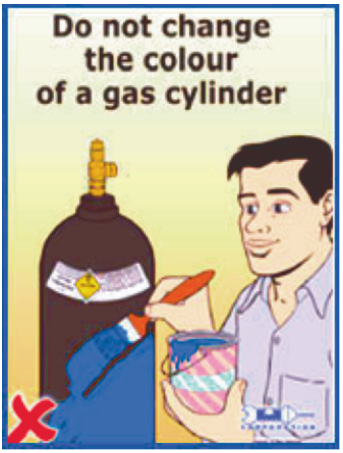
- Do not store Flammable and Oxidizing gas cylinders together but store separately & maintain proper distance of at least one meter.
- Cylinders shall not be dropped or permitted to strike violently.
- Cylinders shall not be allowed free standing but ensure proper chain binding / belt clamping.
- Do not store or transport liquefied gas cylinder (e.g. Acetylene, LPG etc.) horizontally but always handles vertically upward position.
- Cylinder shall not be placed where they might become part of an electric circuit.
- Do not apply oil or grease on valve of a cylinder.
- Do not use wrenches to apply excessive torque to open cylinder valve.
- Never hammer the valve that is hard to open.

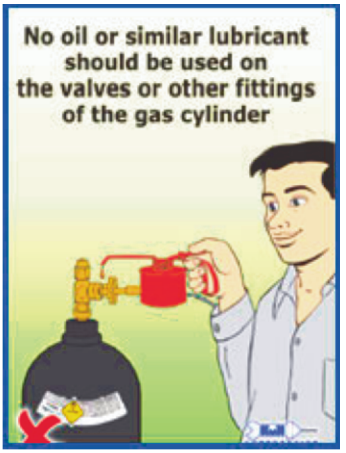
To avoid a scene, keep your workplace clean.

Cylinder Trolley

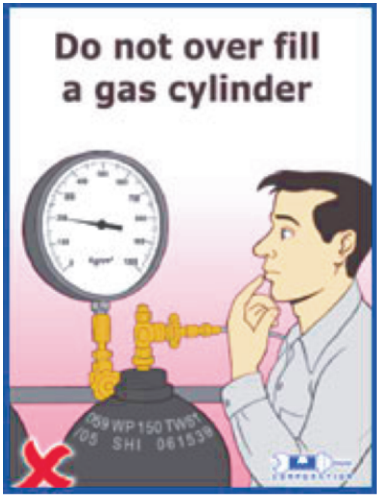
Chain binding

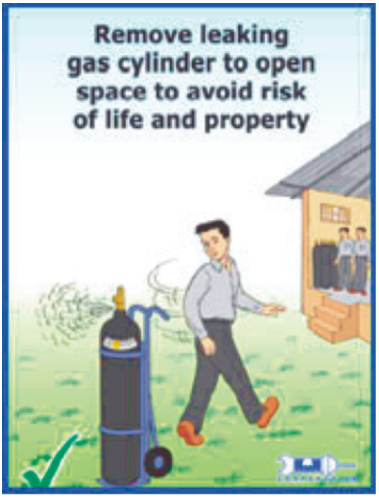


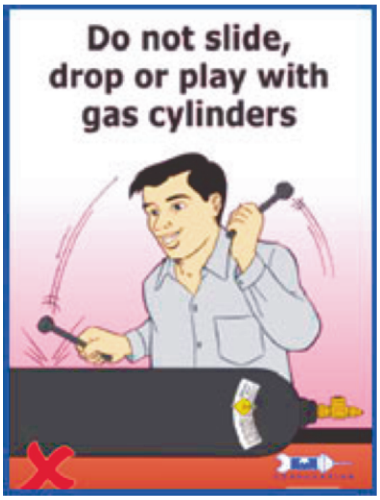




Be pro-active not reactive towards safety.







Broken tools can be replaced. You can't.

4. SAFE USE OF COMPRESSED AIR

Compressed Air is used mainly for instrument actuation, maintaining system pressure e.g. RF transmission system, etc.

In Aditya & SST, Compressed Air distribution system provided to cater requirement of various users. The main header is pressurised up to approximately 16 Kg/Cm^2 and tapings are taken from the header as per requirement.

Due to very high compressibility factor of air, stored energy in compressed air has potential to cause severe accident if not handled properly.

Do's

- Ensure that all pressure system must be protected with Pressure Relief (Safety) Valve. Set pressure of the safety valve shall not be more than the maximum allowable working pressure (MAWP) of the lowest rated component of the system.
- Maximum operating/storage pressure shall be limited to 80-90% of MAWP.
- All protective devices should be inspected/ tested at least once in a year for its functioning.
- For auto-start compressor, display caution board –'Auto start machine, Isolate power before attempting it'.
- Air compressor and storage vessel shall be kept outside the Labs with fencing. Pressure gauge shall be provided to monitor pressure.
- For hose connection, select hose having bursting pressure four times of MAWP. Use Rayon braided hose for high-pressure services.

Chance takers are accident makers.

- Ensure male-female coupling joint for high-pressure hose connection. Do not rely on wire wrapping or ordinary clamping method.
- If users' system design pressure is less than the main header pressure, always install pressure regulator with safety valve to regulate air pressure.
- Always provide end blind flanges on opening in air header, which are not in use.
- Before taking permanent connection from air header, it shall be informed to person who is responsible to maintain the compressed air system. All welding joints should be tested at 1.5 times MAWP.

Don'ts

- Do not rely on temporary hose connection to handle compressed air.
- Do not use compressed air for pressure testing of any component/vessel. It will be very dangerous situation incase of failure of the component/vessel. Do hydrostatic testing instead of pneumatic testing.
- Do not use compressed air for cleaning of cloth or any body part, as jet of pressurised air is sufficient to damage delicate body part.
- Do not keep system pressurised if not to be used for long period. Idle system shall be depressurised.
- Never point the hose at anyone and always see that nearby workers are out of line of high-pressure airflow.

Expect the unexpected. Gear up for safety.

5. SAFE HANDLING OF CHEMICALS

Acetone, Petroleum Ether, Carbon Tetrachloride, Chloroform, Methanol, Ethylene Glycol, Iso-Propyl Alcohol, etc. are flammable chemicals widely used at IPR. Most of the flammable chemicals have flash point lower than the ambient temperature and vapour is heavier than air pausing serious fire hazard.

Nitric Acid, Sulphuric Acid, Hydrochloric Acid, etc. are corrosive chemicals handled at IPR. Corrosive chemicals cause tissue damage (Chemical Burn) in case of physical contact.

Do's

- Always ensure minimum inventory in the labs and at workplaces.
- Ensure proper ventilation in chemical handling area.
- Use appropriate personal protective appliances like fume masks, chemical splash goggles or face shields, hand gloves and apron.
- Ensure proper labeling on chemical containers/bottles. Keep the containers/bottles closed whenever not in use.
- Keep chemical bottles away from heat sources like heater, transformer, Floodlight or lamp, etc.
- Ensure removal of all flammable chemicals from the area before starting open flame operations like welding, gas cutting, etc.
- Incase of chemical spillage; provide proper airflow to dilute the chemical vapour and stop all sparks producing jobs in & around the affected area.
- Protect glass bottles against falling and physical impact to prevent breakage. Keep glass bottles in thermocol bottle holder.
- Material Safety Data Sheet (MSDS) of chemical displays at its storage and usage area.

Good housekeeping prevents accidents.

- While handling Sulphuric Acid in metallic container or piping there is possibility of Hydrogen gas generation, which renders environment explosive.
- In Lead-Acid battery room there is possibility of Hydrogen accumulation in the closed room. So ensure ventilation by exhaust fan and window openings.
- Always handle corrosive chemicals in designated container having resistance against corrosion.
- Acid storage and handling area should be acid proof break lined with proper containment provision.
- Incase of chemical splashing; flush the affected body part with running water till the relief from burn/ pain.
- Always be prepared for any fire eventuality. Keep Fire Extinguishers 'ready to use' status.

Don'ts

- Do not store organic chemicals very near to oxidizers and corrosive chemicals. Always maintain proper separation distance.
- Do not store chemicals on or near the electrical equipment, junction boxes, electrical panels, etc. Minor electric spark is sufficient to cause fire.
- Do not dispose chemicals in the washbasin, drains, gutters or locations those are not specified for chemicals disposal. Always dilute or neutralize corrosive chemicals before disposing.
- Do not left spillage unattended but clean it immediately.
- Do not use empty container of flammable chemicals for filling of acids or other fluids but dispose it.
- Do not add water to Acid as it causes spattering/splashing of acids. Add Acid slowly to water and keep stirring the solution to dissipate heat and to prevent spattering while diluting acid.
- Do not wear contact lenses while working with chemicals. Always wear face shield or chemical goggles.

No safety know pain, know safety no pain.

ESAO
The EDUCATION SAFETY ASSOCIATION of ONTARIO

WHMIS SYMBOLS

		Risks	Precautions
Compressed Gas		MATERIALS WHICH ARE NORMALLY GASEOUS KEPT IN A PRESSURIZED CONTAINER • Could explode due to pressure • Could explode if heated or dropped • Possible hazard from both the force of explosion and the release of contents	ENSURE CONTAINER IS ALWAYS SECURED • Store in appropriate designated areas • Do not drop or allow to fall
Flammable and Combustible		MATERIALS WHICH WILL CONTINUE TO BURN AFTER BEING EXPOSED TO A FLAME OR OTHER IGNITION SOURCE • May ignite spontaneously • May be a material which will release flammable products if allowed to degrade or when exposed to water	STORE IN PROPERLY DESIGNATED AREAS WORK IN WELL VENTILATED AREAS • Avoid heating • Avoid sources of sparks / flames • Ensure electrical sources are safe
Oxidizing Material		MATERIALS WHICH CAN CAUSE OTHER MATERIALS TO BURN OR SUPPORT COMBUSTION • Can cause skin or eye burns • Increase fire and explosion hazard • May cause combustibles to explode or react violently	STORE IN AREAS AWAY FROM COMBUSTIBLES WEAR BODY, HAND, FACE AND EYE PROTECTION • Store in proper containers which will not rust or oxidize
Toxic Immediate and Severe		POISONS / POTENTIALLY FATAL MATERIALS WHICH CAUSE IMMEDIATE AND SEVERE HARM • May be fatal if ingested or inhaled • May be absorbed through the skin • Small volumes have a toxic effect	AVOID BREATHING DUST OR VAPOURS AND AVOID CONTACT WITH SKIN OR EYES • Wear protective clothing which is effective against fumes and vapours • Wear face and eye protection • Work in well ventilated areas and wear breathing protection
Toxic Long Term Concealed		MATERIALS WHICH HAVE HARMFUL EFFECTS AFTER REPEATED EXPOSURES OR OVER LONG PERIODS OF TIME • May cause death or permanent injury • May cause birth defects or sterility • May cause cancer • May be sensitizer causing allergies	WEAR APPROPRIATE PERSONAL PROTECTION WORK IN A WELL VENTILATED AREA • Store in appropriate designated areas • Avoid direct contact • Use hand, body, face and eye protection • Ensure respiratory and body protection is appropriate for the specific hazard
Biohazardous Infectious		INFECTIOUS AGENTS OR A BIOLOGICAL TOXIN CAUSING A SERIOUS DISEASE OR DEATH • May cause anaphylectic shock • Includes Viruses, Yeasts, Moulds, Bacteria and Parasites which affect humans • Includes fluids containing toxic products • Includes cellular components	SPECIAL TRAINING REQUIRED WORK IN DESIGNATED BIOLOGICAL AREAS WITH APPROPRIATE ENGINEERING CONTROLS • Avoid forming aerosols • Avoid breathing vapours • Avoid contamination of people / area • Store only in special designated areas
Corrosive Materials		MATERIALS WHICH REACT WITH METALS AND LIVING TISSUE • Eye and skin irritation on exposure • Severe burns/tissue damage on longer exposure • Lung damage if inhaled • May cause blindness if eyes contacted • Environmental damage from fumes	WEAR BODY, FACE AND EYE PROTECTION USE BREATHING APPARATUS • Ensure protective equipment is appropriate • Work in well ventilated area • Avoid all direct body contact • Use appropriate storage containers with proper non-venting closures
Dangerously Reactive		MATERIALS WHICH MAY HAVE UNEXPECTED REACTIONS • May react with water • May be chemically unstable • May explode if exposed to shock or heat • May release toxic or flammable vapours • May vigorously polymerize • May burn unexpectedly	HANDLE WITH CARE AVOIDING VIBRATION, SHOCKS AND SUDDEN TEMPERATURE CHANGES • Store in appropriate containers • Ensure storage containers are sealed • Store and work in designated areas

People working safely in the safest and healthiest workplaces in the world.

For More Information:

The EDUCATION SAFETY ASSOCIATION of ONTARIO 4950 Yonge Street, Suite 1505, Toronto, ON M2N 6K1 (416) 250-8005 or 1-877-732-ESAO (3726) http://www.esao.on.ca

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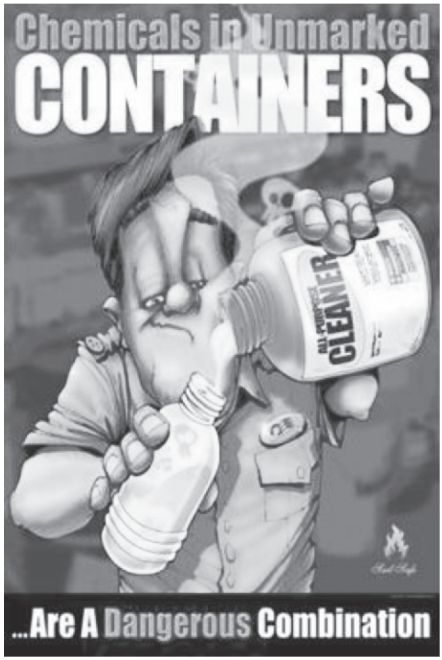
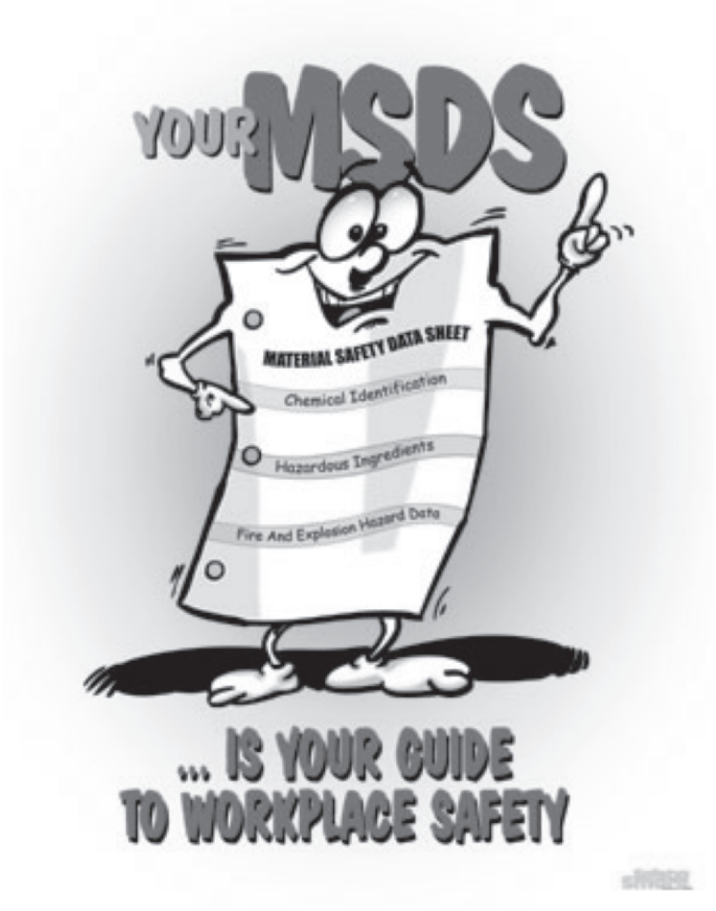
Safety – A small investment for a rich future.



The safe way is the right way.



Think safety – it couldn't hurt.

6. SAFETY IN OPEN FLAME OPERATIONS

Open flame operations like welding and gas cutting are responsible for major fires and injury if not handled properly.

The main hazards associated with Welding Operation are fire, electric shock, burn injury and eye illness due to UV rays.

Do's

- Ensure necessary fire precaution and availability of fire extinguishers near the job place.
- Wear appropriate safety appliances like welding helmet, chrome leather hand gloves, shoes, etc.
- Ensure the area beneath the work is covered with fireproof cloth and cordon the area if the work is at height.
- Ensure fire watch (supervision) while carrying out the cutting and welding work near flammable gas / liquid storage area.
- Install flashback arrester in oxygen and acetylene/LPG gas hose near torch or regulator.
- Keep welding machine earthed and protect it from water/rain.
- Ensure sufficient purging before starting hot work on flammable material handling system. Take clearance in form of a 'safety work permit' from the Safety Officer & Lab In-Charge before starting open flame operation very near to flammable gas/liquid storage.

Good habits will normally keep you out of bad trouble.

Don'ts

- Do not attempt to repair gas hose with tape wrapping.
- Never try to stop gas supply by folding or crimping hose but close the valve.
- Never put off torch until gas has been completely shut off.
- Do not stand on wet surface while carrying out the electrical welding.
- Do not cool electrode holders by dipping them in water.
- Do not gas cut or weld on empty drums used for storing flammable material.
- Do not carry out sparks test by electrode on the associated pipe/work piece.
- Do not keep acetylene gas cylinder exposed to heat or strong sunlight. Keep the cylinder vertical upright.
- Do not shift welding machine keeping electrical supply 'ON'.
- Don't breathe the fumes. Keep your head out of fumes.
- Provide local exhaust or ventilation to take fumes away from breathing zone.

Safety – A small investment for a rich future.

Wear right protective equipment for the job.

7. SAFETY IN CRANE OPERATIONS

Electric Operated Overhead Travelling (EOT) Crane is used for shifting & lifting the material in Aditya, SST, Workshop, Cryogenic Hall, etc. Failure of any part/ control of crane or operation error by un-trained operator results serious accidents.

Do's

- Crain shall be operated by authorized person who are well Trained and experienced.
- Ensure periodic inspection and testing of all safety devices for its healthiness & proper functioning and slings for its condition.
- Safe Working Load (SWL) shall be displayed on all the cranes.
- Examine all slings before use; reject any that are found defective.
- While lifting and shifting the load, sufficient clearance shall be maintained on either side of the load.
- Slings should be protected from sharp edges or corners of the load by suitable packing.
- To avoid swinging, lift the load only when the hook is directly above the load centre.
- Comply safety requirement mentioned under Rule-35 of Atomic Energy Factories Rules, 1996.

Don'ts

- Operator should not leave crane control, keeping the load in suspended position.
- Do not stand or move under the suspended load.
- Avoid jerks, which may cause swinging of the load.

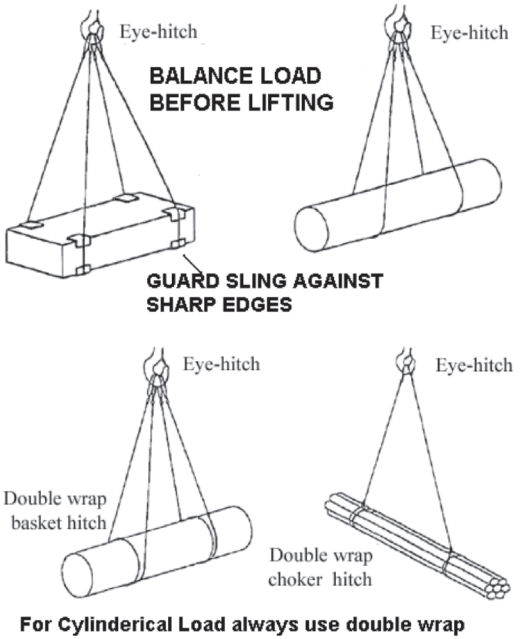
Safety doesn't slow the job down but mishaps do.

- To avoid swinging, lift the load only when the hook is directly above the load centre.
- The load should not be dragged or pulled as it damages cable drum grooves.
- Do not try to lift load, which is under the grip of other material.
- Do not lift load more than the SWL.

DANGER

- No person shall be permitted to work or walk under a suspended load.
- Wear safety helmet for head protection while doing crane operation.
- Operate crane keeping yourself away from the load.

How to lift pipes and sharp edges objects



For Cylinderical Load always use double wrap

Safety is a Mission not an Intermission.

8. SAFE WORKING AT HEIGHT

While working at height there is possibility accidents due to falling from height.

Do's

- When any person has to work at height from where he is likely to fall, provision shall be made, by fencing, railing.
- Safe means of access and platform should be ensured for working at height.
- Barrels, boxes or other unstable object should not be used to support planks as working platform. Avoid makeshift arrangement.
- Scaffolds and ladders shall confirm to IS specification IS 3696 – 1966.
- The planks used for working platform shall be rigidly tied at both ends to prevent sliding and slippage.
- Use safety belt and safety helmet while working in unguarded areas at height.
- When persons are working at height, warn people below through display of caution board and cordon off the area if necessary.
- Obtain safety work permit for working on unguarded height.

Don'ts

- Do not allow two jobs, one above the other simultaneously without extra safety precautions.
- Do not keep tools freely on platform. Keep in a bag or toolkit to avoid falling.
- Do not tie safety belt at lower elevation than the working level of person.
- Do not work without protection near overhead line or un-insulated bus bars.
- Do not take cable trays and pipelines as working platform. Do not walk or stand on cable trays and pipelines these are not designed to take such loads.

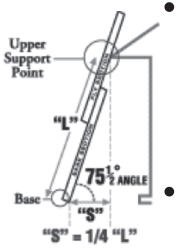
Safety is success by purpose – not Accident.

9. SAFE USE OF PORTABLE LADDER

Portable ladder is a temporary arrangement generally used to approach workplace at height. Main hazard associated with the use of portable ladder is falling from height.

Do's

- Every ladder shall be of good construction, sound material and of adequate strength for the purpose for which it is used. The rungs shall be parallel, level and uniformly spaced at 30 cm.
- No potable ladder shall be over 9 m in length while the width between side rails in rung ladder shall in no case be less than 28 cm for ladder up to and including 3 m in length. For longer ladders this width shall be increased at least 20 mm for each additional metre of length. Uniform step spacing shall not exceed 30 cm.



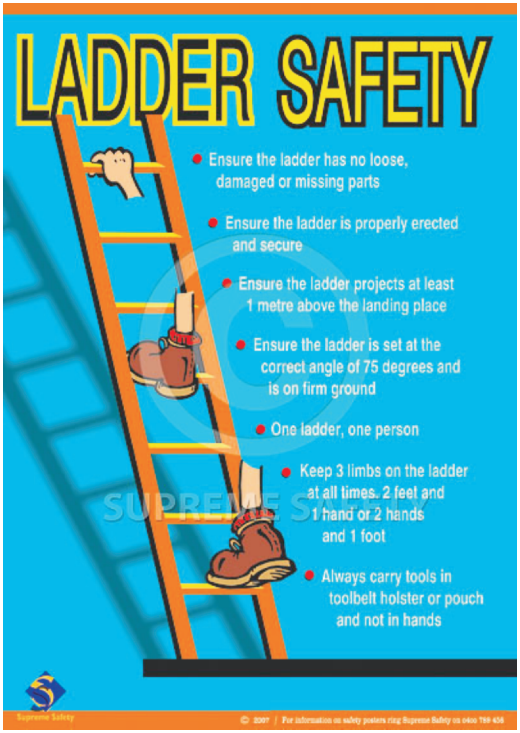
- The ladder shall be placed at angle of 75^0 to the floor. The base of the ladder shall be kept away from the wall at a distance equal to one fourth of the vertical height of the ladder.
- Rubber pads shall be an essential part of a ladder as the pads prevent slipping of the ladder and protect from electric shock also.
- The ladder shall be fixed securely at the top to avoid slip of the ladder otherwise one person shall hold the ladder firmly at bottom end.
- The rungs of the ladder should be free from oil, grease or any other slippery material.

While on ladder, never step back to admire your work.

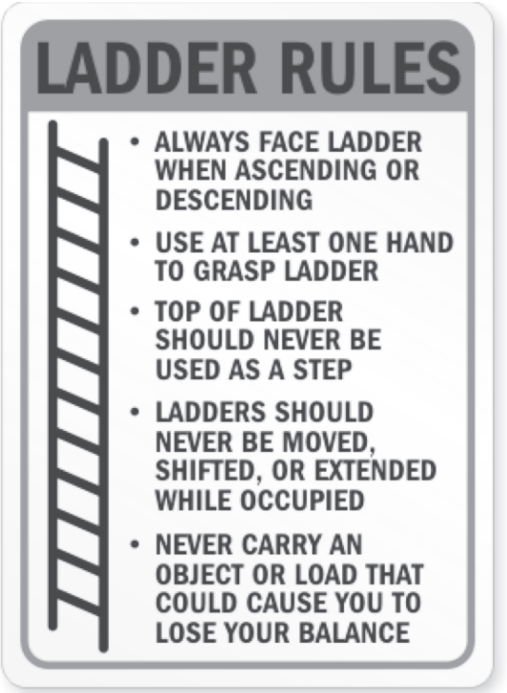
- Keep the ladder nearer to work place to avoid unnecessary stretching of the body.
- Keep the face towards ladder while ascending / descending.
- Always use non conductive (FRP/Wooden) ladder near to the electrical system or in electrical substation.

Don'ts

- Do not place a ladder in front of door, which might open.
- Do not take support of electrical panel or any energised equipment for metal ladder.
- A ladder shall be placed upon a box, barrel, or other movable insecure object and against a round or angular pillar such as pipe or narrow steel section etc.



Never forget about safety.



Always think safety no matter what the task.

10. SAFETY IN USE OF PORTABLE POWER TOOLS

Most of portable power tools are electrical driven. Sometimes, high-speed grinding/buffing is done with compressed air driven grinding machine for surface finishing operations.

Portable Grinding/Buffing machine and Drill machine are the most widely used **Electric Hand Tools.**

Do's

- As practicable as possible use double insulated electric tools and having insulated grip/handle.
- Periodical inspection of the tools shall be done by a competent person/ an electrician.
- Power supply for the electrical hand tools shall be provided through Earth Leakage Circuit Breaker (ELCB) with three conductors' cable and proper earthing.
- Always fit or disconnect accessories after switching off the power and do not forget to put the guards of the equipment in position before using it.
- Wear safety goggles for eyes protection and Crome leather hand gloves for hand protection.
- All tools should be protected from dropping or dragging electrical cord or mishandling.
- Comply safety requirement mentioned under Rule 50 of Atomic Energy Factories Rules, 1996.
- Always ensure rated RPM of grinding wheel should not be less than the rated RPM of grinding machine to prevent wheel disintegration/failure.

Don't be fool! Inspect your power tools.

Use of Grinding Machine / Abrasive Wheel

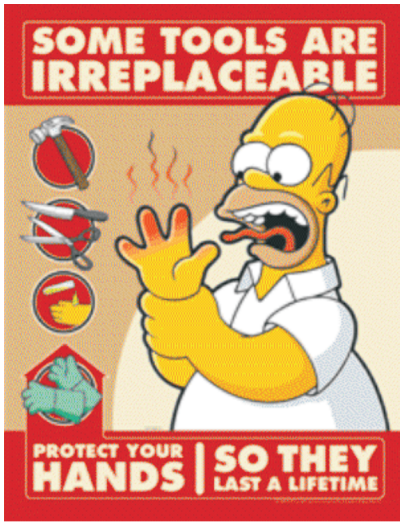
- For grinding on small job, hold it with workbench. Don't do grinding, keeping job or grinder free on ground.
- Use the correct grade of wheel for the work in hand.
- Perform ring test for grinding wheel to ensure its integrity/soundness.
- Before starting grinding, ensure wheel balancing and proper fitting.
- Run a replaced wheel for a full minute before using. Make sure everyone is standing clear during the test.
- Keep the face of the wheel evenly dressed. Never use the side of the wheel unless it is designed for it.
- For the pedestal grinder, the distance between the wheel and the tools-rest does not exceed 3 mm.
- Ensure rotation of the grinding wheel is downwards against the work rest.
- Do not exert excess pressure on the wheel.
- Don't use abrasive wheel after its expiry date.
- Do not grind material for which the wheel is not designed.
- Do not adjust the work-rest while the wheel is in motion.
- Do not grind using the side of the wheel unless wheel is specifically designed for that purpose.

Don'ts

- Do not use electric tools without proper earthing connection.
- Do not handle electric tools with wet hands. Do not stand on wet surface when using a power tool
- Do not wear loose clothing that can be wrapped over the rotating parts.

Working without safety is a dead end job.

- Do not leave tools unsecured at elevated place.
- Do not insert bare wires to draw power but use standard three pin-socket.
- Do not use damaged plug top and line terminal exposed. Replace or repair immediately.



Work safe today – heaven can wait.

11. SAFETY IN TEMPORARY ELECTRICAL WIRING / CABLING

The use of extension cords is restricted to portable equipment intended to be moved from place to place. Items, which are capable of being moved, for example a desktop computer, but are part of a fixed workstation is not considered portable.

Extension cords may not be used as an alternative to fixed-wiring or to extend the existing electrical supply capacity of a work area. Instead, a request should be made, in well advance, to the Electric Maintenance Committee to install additional outlets.

Do's

- Use only approved and properly maintained extension cords that have no exposed live parts, exposed ungrounded metal parts, damage, or splices.
- Use cable confirming IS 694 of 1.1 kV grade only.
- Use extension cords that are protected by Earth Leakage Circuit Breakers (ELCB) around construction sites, temporary jobsites etc.
- For single phase, always use three-conductor (Phase, Neutral & Ground) cable.
- Only qualified personnel should do repairs of extension cords.

Don'ts

- Do not insert loose conductor in socket but use three pin & socket.
- Do not use extension cords for the permanent system.

Safety awareness saves lives.

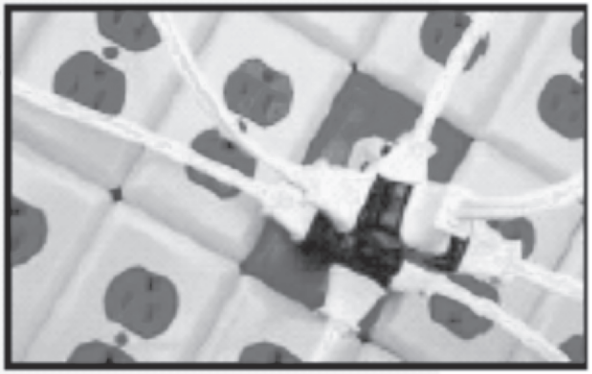
- Avoid running extension cords through doors, ceilings, windows, or holes in the walls. If it is necessary to run a cord through a doorway for short-term use, ensure that the cord is: Protected from damage, Removed immediately when no longer in use.
- Do not plug one extension cord into another extension cord to avoid overloading of fixed supply point.
- Do not overload extension cords. Make sure that the wire size is sufficient for the current required.
- Do not replace blown fuse or reset MCB or ELCB until the fault has been rectified and set right.
- Do not cut off the ground pin of an extension cord or compromise the ground protection in any way.
- Do not use extension cords with a ground conductor that has less current-carrying capacity than the other conductors.
- Do not use frayed or damaged extension cords.

SELECTION OF CABLE

Conductor Size in American Wire Gauge (AWG)	**Current handles up to**
# 10 AWG	30 Amps.
# 12 AWG	25 Amps.
# 14 AWG	18 Amps.
# 16 AWG	13 Amps.

Work safely or Hurt greatly.

Do not overload circuit



When disconnecting cords, pull the plug rather than the cord.

12. SAFE WORKING WITH THE ELECTRICAL EQUIPMENT

The electrical equipments like transformers, motors, breakers, panels, etc. are very dangerous if not handled properly and not followed safety procedures. The main hazards associated with the electrical equipment are electrocution, flashover burn and fire.

Do's

- Consider all the equipment as live before touching until they are tested to be dead.
- Follow SIDE rule before starting maintenance work on electrical equipment especially on Capacitor banks (S : Switch off, I : Isolate, D : Discharge, E : Earthing)
- Before starting maintenance of the electrical equipment, take 'Electrical Isolation Permit' from authorised person. Do not depend on verbal communication for isolation.
- Be sure about isolation by physical verification also. Put electrical isolation tags on feeders/breakers.
- Ensure that only trained/authorised personnel work on the electrical equipment with proper and insulated tool.
- Use rubber mats for high voltage gear operation.

Don'ts

- Do not wear metallic ornament while working on electrical equipment.
- Do not operate a switch without familiarity.

Don't be fool! Inspect your electrical tools.

- Do not overload the power cable beyond its current carrying capacity.
- Do not approach any part of Capacitor Bank unless it is disconnected and effectively discharged and earthed.

- For capacitor bank, do not rely exclusively on automatic discharge and grounding devices for personnel safety. Grounding sticks shall be used.

CAUTION

When Capacitor is not in use or idle, ensure terminals are short / earthed. Open terminals can cause electrical shock due to charge accumulation.

Make safety a reality and don't be a fatality.

13. SAFE WORKING IN CONFINED SPACE

Helium storage tank, Nitrogen storage tank, other Nitrogen / Helium handling tanks / vessels, underground diesel tank and other confined spaces where there is possibility of Oxygen deficiency or presence of toxic gases are to be considered under the controlled entry.

Before entering into such confined spaces clearance is to be asked from Safety Officer in-form of 'Confined Space Entry Safety Permit'.

Do's

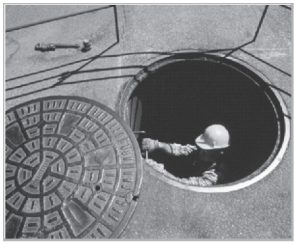
- Purge the confined space and ensure continuous ventilation in the area.
- Ensure continuous communication with the person standing out side.
- Keep all manholes open and the lowest drain point open.
- The man entering into the tank should wear a safety belt and lifeline, the end of which is held by a person standing out side.
- Put up a caution board as “Men working in the tank”.
- Use self contained breathing apparatus or air line respirator if the oxygen concentration is less than 19%

Don'ts

- Do not work without supervision in a confined space.

- Do not rely on closed valves for isolation. The isolation should be supplemented by suitable blanking.
- Do not use electrical equipment without ELCB inside the confined space.
- Do not take large quantity of cleaning chemicals in to a confined space.
- Do not take gas cylinder and welding machine inside a confined space.
- Follow safety requirement mentioned under Rule 88 (Schedule II) of Atomic Energy Rules, 1996.

Confined space can be death traps
Be careful while entering into it!!



Check yourself before you wreck yourself.

14. SAFETY IN LASER OPERATIONS

Laser is an acronym for Light Amplification by Stimulated Emission Radiation. Laser is used in diagnostics systems for Fusion research at IPR.

Laser emits intense, coherent electromagnetic radiation that is potentially dangerous to the eye and skin. Direct exposure to 1 mW power Laser is sufficient to cause eye injury. As per the Safety Standard ANSI Z136.1, 10^{-7} J/cm^2 for q switched laser and 10^{-6} J/cm^2 for non-q switched laser is the maximum permissible limit for Laser exposure.

Do's

- A laser should be isolated from areas where un-informed and curious would be attracted by its operation.
- While LASER is ON, doors should be closed or locked to keep out unwanted onlookers. Display Laser warning signs at the entrance.
- The illumination in the area should be as bright as practicable in order to constrict the eye pupils of users.
- The laser should be set up so that the beam path is not at normal eye level, i.e., it should be below 4.5 feet or above 6.5 feet.
- Clear all personnel and combustible material from the anticipated path of the beam.
- The potential for specular reflections should be minimised by shields and by removal of all unnecessary shiny surfaces.
- For any accessible laser for which the Maximum Permissible Exposure (MPE) could be exceeded, the main beams and reflected beams should be terminated or dumped.

Job of any kind, Plan with Safety in Mind.

- Warning devices & interlock system should be installed for lasers with invisible beams.
- Incorporate safety requirement under ANSI Z 136.1 while designing laser diagnostics system.
- Follow safety guidelines mentioned under Chemical safety and High Voltage Electrical safety.

Don'ts

- Do not look into the primary laser beam.
- Do not aim the laser to the eye; direct reflection could cause retinal damage.
- Do not target laser beam to chemical or combustible material it may initiates fire.
- Do not wear bright, reflective jewelry, wristwatches or other objects.
- Do not adjust or align high power laser beam without wearing eyes protective laser safety goggles.

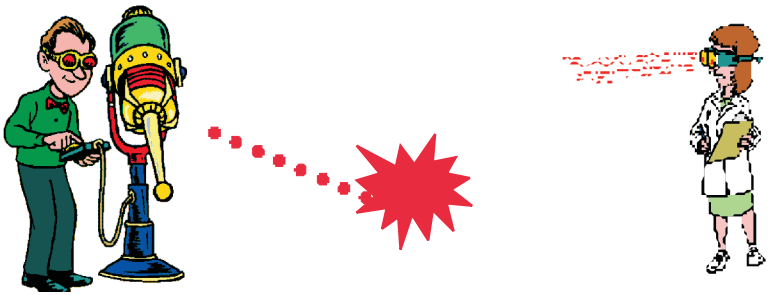
Laser Classes

Class	Laser Power
I	The lowest powered lasers such as Gallium Arsenide. Not considered hazardous. Maximum power: 0.4 micro watt
II	These are low power lasers and pose low risk. Laser power more than 0.4 micro W but not exceeding 1 mW for HeNe
III-A	These are medium power Laser. Laser Power more than 1.0 mW but not exceeding 5.0 mW for HeNe. Pose medium risk.
III-B	These are medium power Laser. Laser Power more than 5.0 mW but not exceeding 500.0 mW for HeNe. Pose medium risk
IV	These are highest-powered lasers and hence pose greatest potential for injury or combustion of flammable materials.

For more details on Laser and Optical Radiation Safety, please refer Rule 88 (Schedule-XIV) of Atomic Energy Factories Rules, 1996.

Laser Caution Sign.

Laser Hazard



Work Safely all the while, go home with the smile.

15. SAFETY IN RADIO FREQUENCY (RF) AND MICRO WAVE (MW) OPERATION

Radio Frequency (RF) and Microwave (MW) are Non-Ionising Radiation.

At sufficiently high intensities, exposure to RF & Microwave electromagnetic fields can produce adverse health effects like cataracts of the eye, overloading of the thermo-regulatory response, thermal injury, altered behavioural patterns, convulsions and decreased endurance. Also, RF and MW exposure may cause heating of metal objects like ring leading to burn injury.

As per ANSI C95.1, Maximum Permissible Exposure (MPE) should not be more than 1 mW/cm^2 or 61.4 V/m (for the 30 – 300 MHz frequency range) for six minutes duration.

Do's

- Access to RF areas shall be limited to qualified and authorized personnel only.
- A fail safe control system shall be incorporated & analysed, which maintains the desired protective function when a single mechanical / electrical component fails, causing the system to go into, or remain in, a safe mode.
- Visible/Audible warning signs shall be used to warn people when RF/MW system is ON.
- Suitable grounding mesh shall be positioned so that energy is harmlessly absorbed and not directed into any occupied area.
- Shielding and other control measures shall be provided to minimise radiation leakage.

Safety is key to progress

- Sharp edges/points on equipment should be eliminated to avoid corona discharge.
- Viewing ports, cooling water/air inlet & outlet, etc. should be designed and/or shielded to limit leakage radiation to acceptable levels.
- Consideration shall be given to potential X-Rays production in high power RF generating equipment. Shields or barriers shall be designed into applicable system to minimise personnel exposure to the ionizing radiation.
- If water cooling is used, ensure water connections are fitted correctly with no change of leakage onto the power supply.
- RF surveys shall be carried out on all new installations and when modifications are made that affect wave-guides, RF generation, RF transmission, etc. and at least annually on all other RF emitting equipment.
- RF emission may interfere electronics control system and may malfunction. So proper shielding on control cables, instruments should be provided.
- Follow safety guidelines mentioned under High Voltage System and Electrical Safety also.

Don'ts

- Personnel shall not be permitted to make close visual examination of energised microwave radiators / reflectors without extra safety precautions.
- Person who wears Pacemaker or other medical implants shall be prohibited from entering or working close to RF systems.
- Do not allow visitors or un-authorised personnel in RF lab or high hazard area without escorting by an authorised person.

A Casual attitude towards safety = CASUALTY.

IEEE Standards for Safe level to human exposure to RF

A. Maximum Permissible Exposure for Controlled Environment			
Frequency Range (f) (MHz)	**Electric Field Strength (E) (V/m)**	**Power Density (S) (mW/cm^2)**	**Average Time (Minutes)**
0.003 – 0.1	614	100	6
0.1 – 3.0	614	100	6
3 – 30	1,842/f	$900/f^2$	6
30 – 100	61.4	1.0	6
100 – 300	61.4	1.0	6
300 – 3, 000		f/300	6
3,000 – 15,000		10	6
15,000 –300,000		10	$616000/f^2$

B. Maximum Permissible Exposure for Uncontrolled Environment			
Frequency Range (f) (MHz)	**Electric Field Strength (E) (V/m)**	**Power Density (S) (mW/cm^2)**	**Average Time (Minutes)**
0.003 – 0.1	614	100	6
0.1 – 1.34	614	100	6
1.34 – 3.0	823.8/f	$180/f^2$	$f^2/0.3$
3.0 – 30	823.8/f	$180/f^2$	30
30 – 100	27.5	0.2	30
100 – 300	27.5	0.2	30
300 – 3, 000		f/1500	30
3,000 – 15,000		f/1500	90,000/f
15,000 –300,000		10	$616000/f^{1.2}$

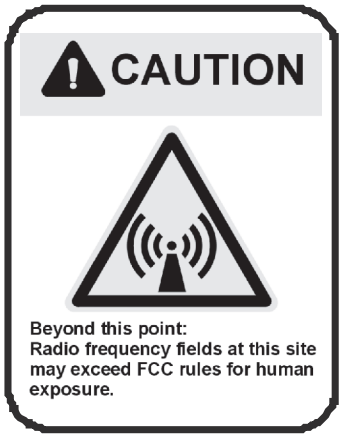
Working without safety is a dead end job.

Uncontrolled Environment: Locations where there is exposure of individuals who have no knowledge or control of their RF exposure.

Controlled Environment: Locations where RF exposure may be incurred by persons who are aware of the potential for exposure and control of their exposure.

RF WARNING SIGN

(Display RF warning signs on entrance and on equipment having RF power more than Maximum Permissible Exposure Level)



Observe Safety in all walk's of Life.

16. MAGNETIC FIELD SAFETY

Electro Magnets are used in Aditya Tokamak and Steady State Superconducting Tokamak to provide the toroidal and poloidal magnetic fields necessary to initiate, contain and control the plasma during the various phases of machine operation.

The energy stored in the magnet is equal to $LI^2/2$, where L: Inductance of the coil & I: current passing through coil. Hence, the quenching of a superconducting magnet can cause a rapid conversion of stored electrical energy to thermal energy and causes rapid heating in the magnet leading to disastrous situation. Keeping this mind quench detection and fail-safe quench protection system shall be incorporated and analysed for the safety of man & machine.

The ACGIH & International Council on Non-Ionising Radiation Protection (ICNIRP) have set guidelines for continuous exposure to static electromagnetic fields as indicated in the table below:

Expect the unexpected. Gear up for safety.

5 G	Highest allowed field for implanted Medical Electronics like cardiac pacemaker, defibrillator, insulin pump etc. Implants such as rods, pins, plates, etc.
10 G	Watches, Credit cards, Magnetic tape, Computer disks may get damaged
30 G	Small ferrous objects present a kinetic energy hazard
200 G	Maximum limit for whole body exposure for ***few hours*** duration
2000 G	Maximum limit for whole body exposure for ***very short duration (few minutes)***
20000 G	No exposure allowed above this limit (Whole body exposure ceiling limit)
50000 G	No exposure allowed above this limit (Extremity ceiling limit)
1 Tesla (T) = 10000 Gauss (G), TWA: Time Weighted Average	

Do's

- All access point to the labs containing magnetic fields in excess of 5G shall be marked with magnetic field hazard signs.
- The 5 G threshold line shall be clearly marked on floor around the machine. As it vary with operating frequency and resulting magnetic fields, take design parameters to decide the line.

Expect Life is Rare – Live with Care.

- Evaluate magnetic field periodically to decide safety procedures.
- Proper access control system shall be implemented to restrict entry in high hazard area.

Don'ts

- Persons with cardiac pacemakers or other implanted medical devices shall not be allowed inside the area where the magnetic field exceeds 5 G.
- Do not allow visitors or persons who are not properly informed about the hazards & safety precautions.
- Ferrous objects can be accelerated toward the magnet with sufficient energy to cause serious injury to persons or damage the other system. Do not use small ferrous objects like screws, tools, paper clips, wristwatches, rings, etc. inside any area where the field exceed 30 G.
- Large ferrous objects like equipments; compressed gas cylinder, fire extinguishers, etc. should not be handled without safety precautions whenever the field approaches 300 G.

Safety Signs for High Magnetic Field area

CAUTION
Strong Magnetic Field

- People with pacemakers and medical electronic implants must stay out!
- Damage to watches, instruments and magnetic media possible.
- Keep magnetizable tools and objects out of the area!
- Entry for Authorized personnel only

Put Safety on the Top of Your List.

17. SAFE WORKING WITH HIGH VOLTAGE (HV) SYSTEM

Any electrical system operating above 24V has potential to cause electrical shock if favourable conditions available so do not neglect safety precautions while working with any voltage level electrical system.

Severe arcing, flashover and corona discharge are the additional hazards associated with high voltage systems. Any electrical system operated above 600 V (ac or dc) is defined as High Voltage system.

Do's

- Before attempting maintenance on electrical equipment, ensure electrical isolation & earthing. Follow 'Permit to work on electrical system' procedures.
- Ensure earthing of HV system enclosure and all conductive metal around the HV system. Check continuity and low impedance of earthing system periodically.
- Maintain proper clearance from high voltage system by putting nonconductive barriers /fencing. A high voltage apparatus is known to give leakage shock or flash without you having actually touch it !! (Refer Table 1)
- To avoid electric arcing to conducting surfaces from radiating elements maintains proper clearance around the equipment/system.
- Keep insulating rubber mat (confirming ASTM D178 and anti-skid design) before the high voltage electrical panel / switches / breakers.
- Do turn away your face whenever a flash or an arc is expected.

Ignoring a warning can cause much mouring.

- Display High Voltage caution board near the entrance and on the system.
- If water cooling is used, ensure water connections are fitted correctly with no chance of leakage onto HV system.
- Vacuum tubes operated at HV may generate soft X-ray. Proper shielding should be provided.
- Follow other safety precautions marked under the electrical safety.

Don'ts

- Don't work alone in and around high voltage system – in the event of an emergency another person's presence may be essential.
- Do not attempt maintenance on energised equipment.
- Do not touch a circuit with your bare fingers or some other makeshift device to check whether it is alive or dead. Use high voltage rubber hand gloves and insulated hand tools. Use non-contact voltage detector.
- Do not allow visitors to venture into high voltage zones without escorting by an authorized person.

Nominal Voltage to Ground	Minimum clear distance (ft)		
	Condition 1	Condition 2	Condition 3
0 – 150 V	3	3	3
151 – 600 V	3	3.5	4
601 – 2500 V	3	4	5
2501 – 9000 V	4	5	6
9001 – 25000 V	5	6	9
25001 – 75000 V	6	8	10
Above 75000 V	8	10	12

Table 1: Working Space around the live parts

Safety gear – 2 minutes.... Risk assessment – 5 minutes..... A mishap that takes a life – forever.

Condition 1: Exposed live parts on one side and no live parts on other side of the working space.

Condition 2: Exposed live parts on one side and grounded parts on the other side.

Condition 3: Exposed live parts on both the sides of the workspace with the operator between.

Minimum air insulation distances required to avoid flash over between two conductors

300 or less	0.03 in.	15 kV – 36 kV	6.3 in.
300 – 750 V	0.07 in.	36 kV – 48.3 kV	10.0 in.
750 V – 2 kV	0.19 in.	48.3 kV – 72.5 kV	15.0 in.
2 kV – 15 kV	1.5 in.	72.5 kV – 132 kV	25.2 in.

(For more details please refer NFPA 70E)

18. GOOD HOUSE KEEPING – 'A TOOL TO PREVENT ACCIDENTS'

Good housekeeping is not only floor cleaning but also up-keeping of all activities in orderly manner to minimise accidents due to improper planning, placement, arrangement and handling. A good housekeeping means 'A place for everything and everything in its place'.

Do's

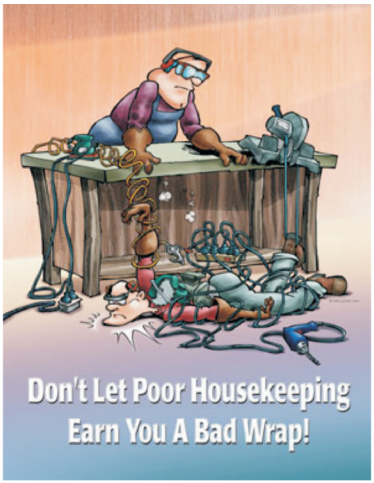
- Provide suitable drip tray wherever oil, chemical, water or other solutions are likely to drop from equipment and dangerous for surrounding area.
- Obstructions free access to safety or fire fighting equipment, electrical control panels, safety equipment, etc. shall be ensured.
- Passages aisles, walkways, staircases or doorways shall be kept clear.
- Ensure adequate illumination and ventilation for the job.
- Maintain all electrical equipment properly and keep combustible material away from them.

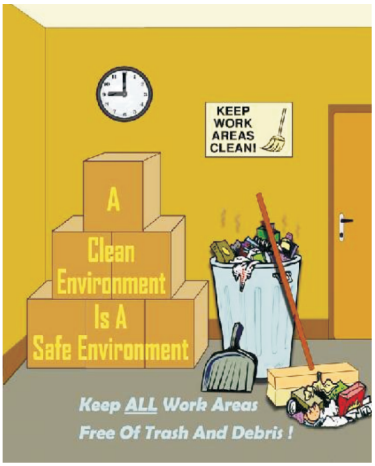
Don'ts

- Do not leave combustible materials like Oil, Chemical, cotton waste, etc. in the work area.
- Waste Collection container of combustible material should not be left open to prevent fire. The receptacles should be cleaned periodically. Do not allow dustbin to overflow.

To avoid Scene, Keep your Workplace Clean

- No pipeline or power cable shall be run across pathways thus constituting a tripping hazard.
- Do not leave cleaning agent like Acetone, Isopropyl alcohol, Kerosene, etc. at the work area after completion of work.





A cleaner Place is a Safer Place

19. SAFETY IN MATERIAL HANDLING ACTIVITIES

- Never attempt to lift load that is too heavy or too bulky for them to handle safely. If the load is too heavy, assign another person to the job.
- Maximise the use of accessories for manual handling like crowbars, rollers, hooks, hand trolley and other lifting tackles having adequate capacity.
- Pulling load is unsafe and conducive to back injury.
- Inspect the load to be lifted for sharp edges, slivers, and wet or greasy spots.
- Wear Crome/ Canvas hand gloves when lifting or handling objects with sharp or splintered edges. These gloves must be free of oil, grease, or other agents that may cause a poor grip.
- Recognize the fact that your gripping power may weaken over long distances. Use hand trolley for long distance.
- Two people carrying a long piece of pipe or lumber should carry it on the same shoulder and walk in step. Shoulder pads should be used to prevent cutting the shoulders and help to reduce fatigue.
- Boxes, cartons, and sacks should be grasped at the opposite bottom corners, drawing the bottom corner towards the lifter's body.
- Lift the load as close to the body as possible. Ideally, the load should pass between the knees during lifting.

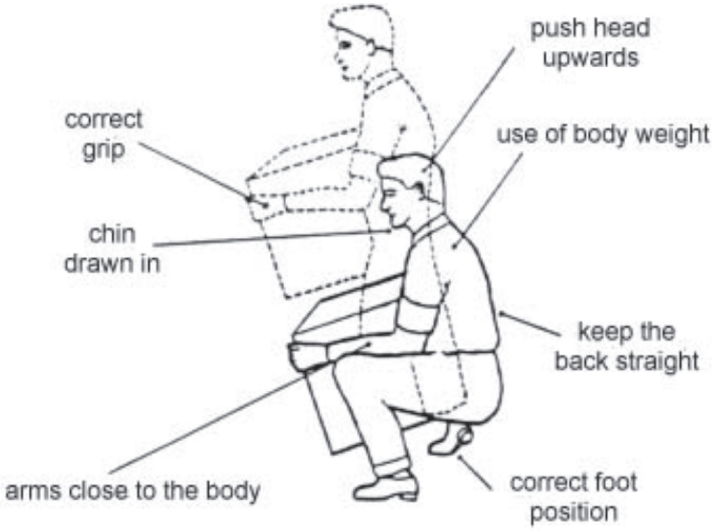
Always think safety no matter what the task.

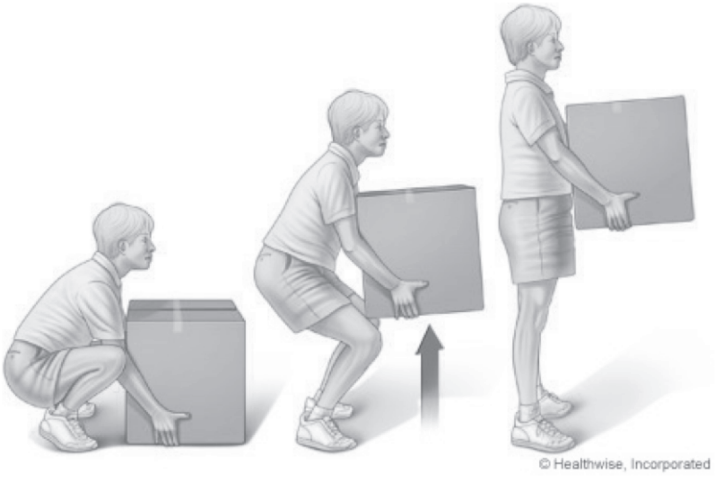
Use of Hand Trolley

- Inspect & test all the lifting tools & tackles regularly as per Atomic Energy (Factories) Rules.
- Keep the centre of gravity of the load as low as possible. i.e. Place heavy objects below lighter objects.
- Place the load well forward so that the axles will carry the weight, not by the handles.
- Position the load so that it will not slip, or fall. Load only to a height that will allow a clear view ahead.
- Let the trolley carry the load. The operator should only balance and push.
- Never walk backwards with a hand trolley.
- When going down an incline, keep the trolley in front of you. When going up, keep the trolley behind you.
- While shifting cylinders/drums/barrels, they should be tied with rope and wedge back should be kept to prevent falling.
- Place Dewars of liquid Nitrogen or Helium vertically upward and tie with chain.
- Use standard hand trolley to shift cylinder or Dewar designed specifically for the same.
- While shifting Dewars of liquid Nitrogen or Helium, move trolley at controlled rate.

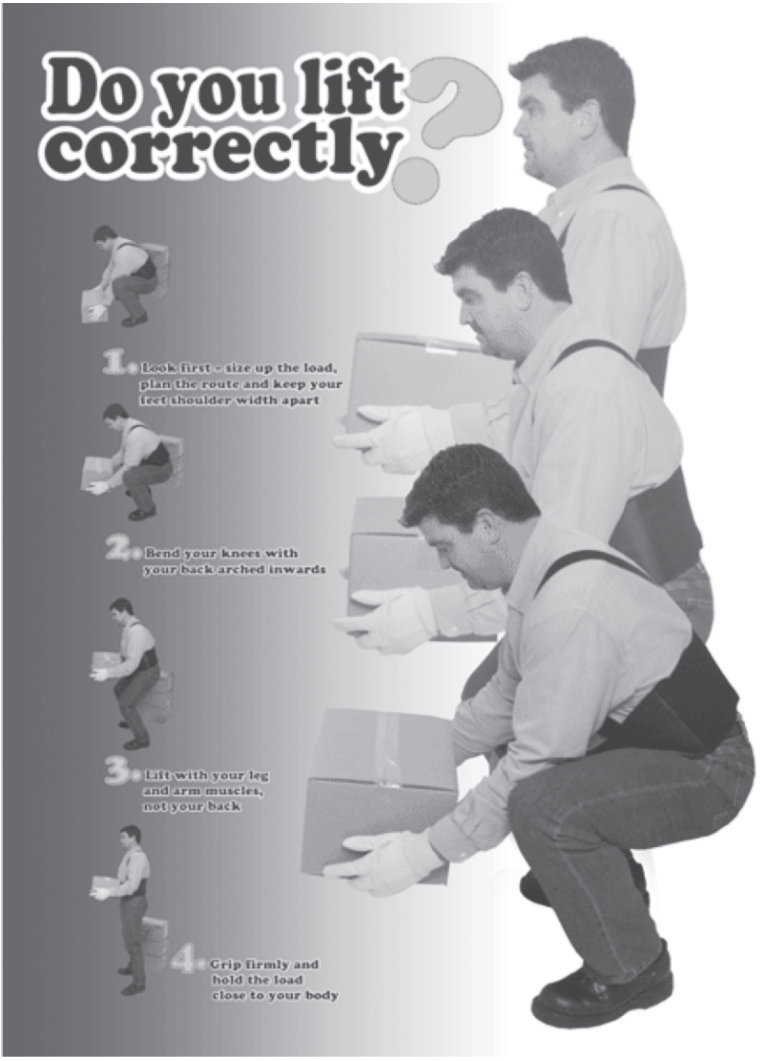
CORRECT METHOD FOR LOAD LIFTING

To prevent back illness - Bend your knee not back!!





Always Small Sector or Large Sector,
Safety is the Common Factor



Shoes First, Step Next

20. RADIATION SAFETY

In the TOKAMAK device, plasma is generated and confined for couple of seconds before it is ultimately lost to the torus walls. The radiation emitted are mainly in the form of Soft X-ray and Hard X-ray bremsstrahlung.

Radiations are broadly classified into two categories: Non-Ionisation Radiation & Ionisation Radiation.

Non-ionizing radiation:

It is the term given to electromagnetic radiation emitted in the energies less than 13.6 eV.

It includes infrared, radiowaves, microwaves, and other electromagnetic radiation fields. Generally, tissue damage from non-ionizing radiation is directly related to heating effects.

Ionising Radiation:

It is the radiation having sufficient energy to cause ionisation of matter or body tissue/fluid. Energy for ionisation is greater than 13.6 eV. The X-ray in the energy range below 50 keV is known as "Soft X-ray" and above 50 keV-1 MeV is called "Hard X-ray".

The soft X-ray is detected by using semiconductor diodes like surface barrier diodes, PIN diodes and other types of photodiodes. The hard X-ray is detected by using a combination of inorganic scintillators like NaI (Tl) and Photo Multiplier Tube (PMT).

The biological effects of ionisation radiations can be classified into three categories:

Better to be Safe than to be Sorry Afterwards.

Somatic: Effects occurring in the exposed person. The manifestation may be prompt or delayed. Examples are cataract induction, blood cancer (Leukemia).

Genetic: Abnormalities occurring in the future children of exposed persons and in subsequent generation (mutational effects).

Developmental or Teratogenic: Effects observed in children who were exposed during the fetal or embryonic stages of development.

Atomic Energy Regulatory Board (AERB), the national regulatory authority is the competent authority to grant approval for construction and radiological status of any radiation facility. In accordance with the recommendations of International Commission on Radiation Protection (ICRP), AERB sets the national limits on various practices to be carried out in DAE and non-DAE facilities.

For the Radiation Protection follow Time, Distance and Shielding method

Three primary means of eliminating or reducing radiation exposures are:

TIME

Minimize the time of exposure to radiation generating machine or that radioactive materials are handled. Since the amount of exposure occurs as a function of duration of exposure, less time means less dose. Do not allow unnecessary personnel to radiation hazard area by installing access control system.

DISTANCE

Maximize the distance from the radioactive materials or radiation-generating machine by controlling operation remotely. Dose is inversely proportional to distance; therefore, greater distance means less dose. Do not increase the distance to the point wherein dexterity or control of the materials is jeopardized.

SHIELDING

Use shielding wherever it is necessary to reduce or eliminate exposure. By placing an appropriate shield between the radioactive source or radiation generating machine and the worker, radiation is attenuated and exposure may be completely eliminated or reduced to an acceptable level. The type and amount of shielding needed to achieve a safe working level varies with the type and strength of radiation generated. The HVL (half value layer) may be used as guide to the thickness of the shielding necessary to block the radiation. The HVL is the thickness of the shielding necessary to reduce the radiation dose rate to half of the original or unshielded dose rate.

- Personnel who directly or indirectly exposes to radiation hazard should wear personnel dosimetry devices TLD card.
- Do not enter in machine hall while it is energised state.
- Under no circumstances it is permissible to dispose of any radioactive material into the non-radioactive trash or into any drains.

Dose limits for Ionising Radiation	
1. For Occupational Workers	**Annual Dose Limit**
• Whole body	**20 mSv (2 Rem)**
• Eye Exposure	**150 mSv (15 Rem)**
• Skin exposure	**500 mSv (50 Rem)**
2. For Member of Public	**1 mSv (100 mRem)**
Note: 1 Sievert (Sv) = 100 Rem	

While working in radiation hazard area, always display personal dosimeter

Accident do not just Happened, They are Caused

Accidents Big or Small, Avoid them All.

21. SAFE USE OF SEALED RADIOACTIVE SOURCE

Radioactive material that is encased in shield material is called as sealed source. It does not have significant contamination hazard under normal conditions but it may present an external exposure hazard, depending on the properties of the radioisotope used to calibrate or check instrumentation or for experiments purposes.

- Before procuring any radioactive source, details of the source should be given to Safety Officer/Safety Committee to ensure adequate planning, storage and security & will not constitute a violation of pertinent rules and regulations.
- Maintain proper log / record of radioactive isotope, activity, manufacturing date, half-life, leak test date etc. For each sealed radioactive sources.
- Minimize the exposure time while handling a source or working in the vicinity of a source. Give priority to remote operation.
- Handle high activity sources with handling tools, such as tongs or remote-handling tools. Use appropriate protective hand gloves, aprons etc.
- Do not touch the active surface of a plated source with your fingers.
- Although the risk of contamination is low, it is prohibited to smoke, eat, drink or apply cosmetics while working with radioisotopes or

in an area, which may be contaminated with radioactive materials. Wash hands after handling a plated source or open source.

- High activity sources in storage must be shielded appropriately when or use or in storage.
- Sources should be stored away normally occupied area.
- Do radiation monitoring by a calibrated radiation survey meter regularly.
- Leak test of the sealed source must be performed to ensure that the integrity of the source encapsulation is intact. Such leak test is required at three or six month intervals depending on the nature of the source.
- If you suspect that a sealed or plated source has been damaged, do not use the source until it has been leak tested.

SECURITY

- It is important to pay extra attention to ensuring that sealed and plated sources are secured.
- Sealed sources must be locked in a secured container or secured storage area when not in use.
- Any room in which a sealed source is being used must be locked when unattended.
- Only authorised & trained persons shall be allowed to handle radioactive sources.

CAUTION SIGNS AND LABELS

- Radioactive symbols must use the conventional radiation caution colors: magenta or purple on yellow background.
- A sign or sign bearing the radiation caution symbol and words "CAUTION RADIOACTIVE MATERIALS" must be posted in each area or room in which any radioactive material is used or stored.
- In addition to signs and labels, additional information that identifies the isotopes used, responsible party and emergency procedure must be displayed on the door of the permitted facility.
- Follow other safety precautions mentioned in Radiation Safety Section.
- Follow other safety precautions mentioned in Radiation Safety Section.

Don't Make Safety a Thing to Remember –
From January to December

22. HIGH PRESSURE EQUIPMENT SAFETY

At IPR, Helium Storage Tanks, Compressed Air Storage Tanks, and other vessels handling compressed gas or liquid above 1 atm. gauge pressure are consider as Pressure Vessels. Damage potential for a compressed gas handling pressure vessel is very high compared to that of a liquid handling pressure vessel due to high compressibility factor of gas.

- For the better safety management of high-pressure equipment, it shall be designed, constructed and tested in accordance with the relevant Indian standards mentioned in the Static Mobile Pressure Vessel (SMPV) Rules or code approved by Chief Controller of Explosive (CCE), Nagpur.
- For the isolated storage tank having capacity more than 1 m3 and pressure more than 1 atm. shall have gas storage license from Chief Controller of Explosive (CCE), Nagpur.
- Every pressure vessel shall have legible marking regarding name of chemical/gas for which vessel is to be used, design pressure, hydrostatic test pressure, normal storage pressure, date of last hydrostatic test & next due date for hydrostatic test.
- Every pressure relieving (Safety) valve shall be tested once in a year and also marking of pressure testing date & next due date for the testing shall done on it.

- Never bypass any pressure relieving/safety devices given on the pressure vessel system.
- Never change setting of any pressure relief valve /devices given on the pressure vessel system.
- Relief devices shall be capable to vent the contents of the vessel without exceeding the Maximum Allowable Working Pressure by more than 10% under all conditions.
- For non-rated components safety factor of pressure rating should be taken as 4.0. i.e. for 2 Kg/cm2 Operating pressure ordinary rubber hose should be designed for 8 Kg/cm^2 bursting pressure.
- All high-pressure equipment shall be periodically pressure tested and inspected in accordance with the requirements of the designer's of manufacturer's guidelines.
- Before making any change in design/modification in high-pressure system, it shall be approved by the competent authority.

23. ELECTRIC TRANSFORMER SAFETY

Transformer fires are not frequent but they prove costly and pose very high hazard when they occur. It would not be out of place to recall here a Cinema Hall tragedy in New Delhi, where fire broke out from the transformer resulting in the death of 59 persons and injuring about 100 persons. Incident discloses seriousness of transformer fire. Potentiality of human injury and material damage increases manifold when oil filled transformer installed in a lab/public building.

Most of the oil filled transformer has conventional mineral oil. Conventional mineral oil when set on fire, generates very dense smoke making area very dark and depletion of Oxygen level in the affected area.

As per the policy of IPR, for new upcoming projects, oil filled transformers shall be kept out door. If it is not possible to keep it outside, it shall be dry type or it shall be filled with silicone oil or oil having high flash point, fire point (more than 300^{0}C) and low smoke shall be used with prior approval of safety committee.

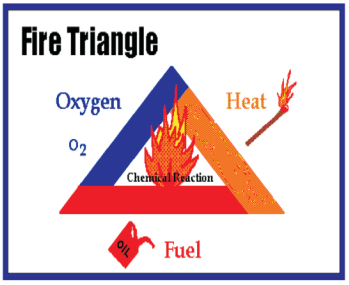
- Ensure that oil temperature relay, over current relay and other relays given for transformer protection shall be in line and in healthy state.
- For indoor transformers, oil soak pits shall be provided under the transformer with proper drainage arrangement.
- Oil filled transformers shall not be located in the basement where proper drainage arrangement cannot be provided.

Do your work with Pride,
Put Safety in every Stride

- Oil filled transformer shall not be housed on any floor above the ground floor.
- For outdoor oil filled transformer, soak pit of approved design shall be provided where the aggregate oil capacity transformer does not exceed 2000 liters. Where the oil capacity exceeds 2000 liters, a tank of RCC construction of capacity capable of accommodating the entire oil of transformer shall be provided at a lower level to collect the oil from the catch-pit in case of emergency.
- If two or more transformers are installed side by side, they shall be separated b fire separation wall, to a height point of any of the transformer, to minimise damage.
- Fencing of at least 2.5 mtr. Height with proper locking system shall be provided around the transformer. Fencing shall be earthed properly.
- Transformer's Neutral & Ground earthing shall be given in separate earth pit and maintain lowest resistance of the earth pits.
- Transformer oil quality shall be checked periodically for its dielectric strength, moisture content, acidity, sludge content, etc. and ensure that these parameters should be within acceptable limit.
- Appropriate fire fighting system shall be installed to mitigate the transformer fire hazards.
- For more details about transformer safety requirements, refer Rule 88 Schedule VII of Atomic Energy Factories Rules 1996.

Work Together for Safety,
it is Everybody's Responsibility

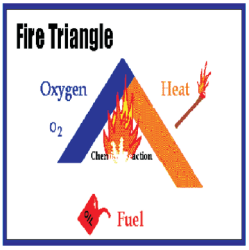
24. FOR FIRE: 'PREVENTION IS BETTER THAN CURE'



- In the presence of Air, when combustible material comes in contact with ignition source, fire initiates. Once fire initiates it spreads very fast. So do not allow fire to start at all.

By eliminating either one of the three components, fire can be prevented.

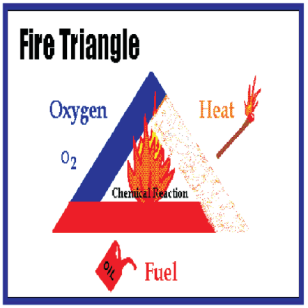
Elimination of Fuel:



- Ensure Offices / Labs are free from excess combustible material like papers, cartons, oil, etc. Dispose it regularly at designated place.
- Keep lowest possible inventory of flammable liquids/ solvents in the workplace and, when not needed, return it to safe storage.
- Provide drip trays to collect oil leakage from vacuum pump and other equipment and clean on a regular basis.
- Clean spilled solvent immediately and provide sufficient ventilation to dilute vapour. Check for leak from flammable gas cylinder.

Adopt Fire Prevention and Save Destruction

Elimination of Heat / Spark:



- Do not allow spark-producing jobs like welding, gas cutting, grinding, etc. near the flammable materials.
- Minimise temporary wiring and joints in cables. Do not overload electric circuit.
- Ensure regular inspection and maintenance of all electrical systems and machines for any hot spot/ sparking/arcing.
- Ensure installation, testing and functioning of overload and fault protection gadgets in circuits.
- Turn off electrical appliances while leaving the offices.

Do Respect 'NO SMOKING' Signs

Fire destruction is one man's job,
Fire prevention is everybody's job

25. FIRE EXTINGUISHERS -'A FIRST AID' TOOL TO FIGHT FIRE'

Fire can be extinguished by removing any one of the three elements: Air, Fuel & Heat. Fire Extinguishers (FE) work on this principle.

A portable fire extinguisher is a "first aid" device and is very effective only for small (incipient) fire. Effectiveness of FE depends on proper method of operation and right selection.

Selection of FE is done based on the **Class of fires.**

Class A Fire: Ordinary solid combustibles such as wood, cloth, paper, rubber and many plastics.

Class B Fire: Flammable liquids, such as solvent, oil, grease, tar, oil-based paint,

Class C Fire: Flammable Gases, Energized electrical equipment, including wiring, fuse boxes, circuit breakers, machinery and appliances.

Class D Fire: Combustible metals such as sodium, lithium, magnesium, titanium etc.

Kill Fire before it kills you

Types of Fire Extinguishers (FE) at IPR:

CO_2 TYPE FIRE EXTINGUISHER

- Liquefied Carbon Dioxide Gas filled in the cylinder at high pressure.
- It is widely used for Type B & C fires. It is the best for electrical equipment fires.
- It is a stored pressure gas type FE. It has horn/bugle type design on discharge nozzle.

HOW TO OPERATE:

1. **Pull out Safety Clip.**
2. **Open Wheel valve by turning anti clockwise.**
3. **Direct Gas at the base of fire.**

DCP TYPE FIRE EXTINGUISHER

- Dry Chemical Powder (Sodium bicarbonate powder) filled in the cylinder. CO_2 gas cartridge is installed inside the cylinder to expel powder with pressure.
- Used for Type A and B type fires. It does not have horn/bugle on discharge nozzle.
- Do not use in very confined spaces as powder reduces visibility.

Fire Easy to Prevent, Difficult to Control

HOW TO OPERATE:

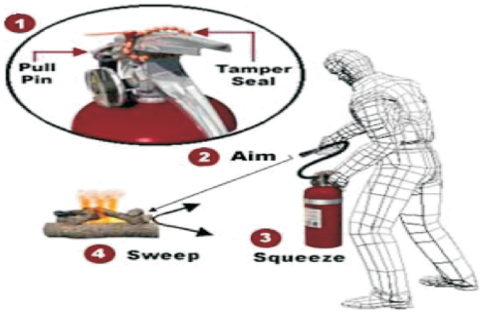
1. **Remove Safety Clip.**
2. **Press plunger down hard.**
3. **Aim at the base of fire.**

ABC TYPE FIRE EXTINGUISHER:

- Mono Ammonium Phosphate powder filled in the cylinder & pressurised by inert gas.
- It has Pressure Gauge & squeeze grip valve. It is stored pressure powder type FE.
- Widely used for Type A, B & C Fires.
- For ABC Fire Extinguishers pressure gauge indicator in green zone indicates fire extinguisher is ready to use state. If indicator is in red zone fire extinguisher needs refilling.

HOW TO OPERATE:

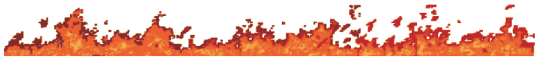
1. **Remove Safety Clip.**
2. **Squeeze Operating Lever.**
3. **Aim at base of fire.**



Know the roots of Fire Safety- Enjoy the fruits of Duty

CLEAN AGENT (CA) TYPE FIRE EXTINGUISHER:

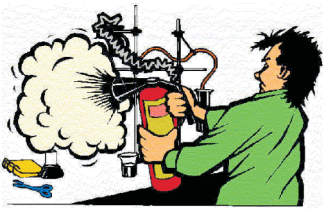
- Hydro fluro carbon gas filled in the cylinder & pressurized by inert gas.
- It has Pressure Gauge & squeeze grip valve
- Widely used for all type of fire but most effective for electronics equipment and computer centre.
- For Clean agent type Fire Extinguishers pressure gauge indicator in green zone indicates fire extinguisher is ready to use state. If indicator is in red zone fire extinguisher needs refilling.



Reminder : You are not expected to be Firefighters! Do not take unnecessary risks!

Fire Safety goes, Danger grows

26. HOW TO OPERATE FIRE EXTINGUISHERS?



In case of fire, fast response to extinguish fire is very important because few minutes delay is sufficient for fire spread and become uncontrollable.

Operation of fire extinguishers is very easy only when you know the method of its operation.

For the operation of FE remember: P A S S

1. Pull the safety pin: This will allow you

- to squeeze the handle for ABC/CA FE
- to rotate the wheel for CO_2 FE &
- to push the knob for DCP FE in order to discharge the content from FE

2. Aim at the base of the fire:
Aiming at the middle will not be effective because the agent will pass through the flames & does not serve the purpose. Aim the discharge jet on the base of the fire

3. Squeeze the handle :
Squeeze the handle for ABC/CA FE or rotate valve wheel anti-clockwise for CO2 FE or push the knob for DCP FE. This will release the pressurized extinguishing agent

4. Sweep side to side
Cover the entire area that is on fire by sweeping the nozzle side to side. Continue until fire is extinguished. Keep an eye on the affected area for re-lighting.

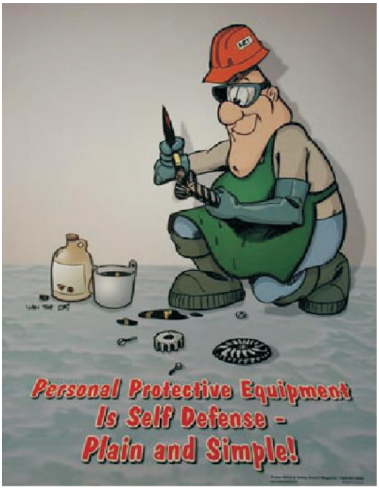
While operating any type FE keep it vertical upward position.

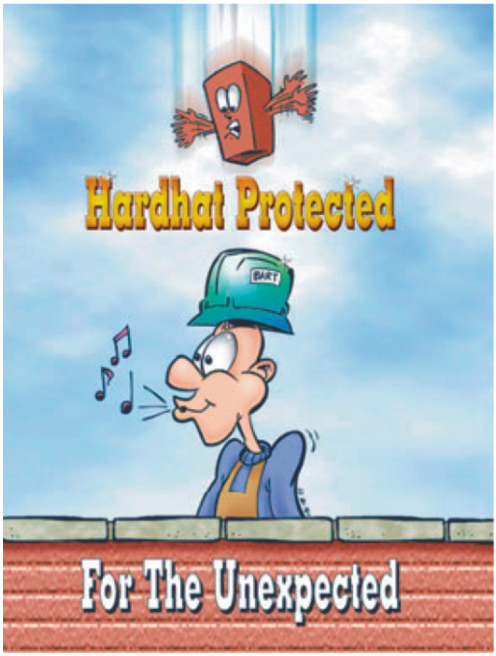
Fire Safety On, Accident Gone

27. PERSONAL PROTECTIVE EQUIPMENT

It is statutory requirement to protect employees from workplace hazards such as machines, work procedures and hazardous substances that can cause injury. The preferred way to do this is through engineering controls or work practice and administrative controls, but when these controls are not feasible or do not provide sufficient protection, an alternative or supplementary method of protection is to provide workers with personal protective equipment (PPE) and the know-how to use it properly. Hence, PPE is taken as third line of defence / protection.

Personal Protective Equipment is self Defence





Hearing Protection is a Sound Investment

28. FIRST AID TREATMENT GUIDE

Four thumb rules for Emergency First Aid

- Assess the situation and determine what is wrong with the victim.
- Set priorities based on consciousness of the victim. Don't leave victim alone. Try to help with calm and cautiously.
- Check for ABC: Airway, Breathing & Circulation of blood.
- Give first aid treatment as per nature of injury. Do not give anything to drink/eat to an unconscious victim.

Eye Injury:

- In case of chemical splashing, flush the eyes with clean water, occasionally lifting the lower and upper eyelids. Do not rub the affected eyes.
- If foreign body falls into eye, lift the eyelids and gently remove it with sterilized/clean cloth or flush the eyes with clean water.
- Do not apply pressure but cover the injured eye with a soft pad and seek medical help immediately.
- Do not wear contact lenses while handling chemicals.

Bleeding (External):

- Sever bleeding can be life threatening.
- Apply pressure directly over the wound using sterilized cotton pad to stop blood flow.

Every second counts!... Know First Aid


ELEVATION

- If possible elevate the bleeding area. Otherwise, lay the victim flats and elevates the legs.
- When bleeding is controlled, secure dressings with a bandage. Check circulation below the injury before and after bandaging. Maintain elevation and immobilize the injured limb.

Burns:


IMMERSE IN COOL WATER

- Flush the affected body parts with clean water.
- Do not apply butter, cream or ointment on a burn.
- Do not attempt to remove frozen/adhered clothing from frostbitten/burnt areas.
- Cover the burned area with dry, sterile dressings.
- If the victim is conscious, provide non-alcoholic fluids.

Fracture:

- Do not move the casualty unless he/she is in danger.
- Do not attempt to straighten a misshapen bone or joint or to change its position unless circulation appears hampered.
- Dress any wound to stop bleeding and prevent further contamination.
- Secure the limb to a padded splint / bandage ensuring the joints above and below the injury have been immobilized. Check for circulation beyond the fracture or joint injury before and after splinting.

- Elevate the limb, if possible. Ice packs may be applied to ease pain and swelling.

Frostbite:

- Frost bite occurs when body tissues freeze after exposure to below zero temperatures due to splashing of liquid Nitrogen, Helium etc. The signs and symptoms are; white waxy-looking skin that turns grayish-blue as the frostbite progresses, skin that feels cold and hard and a complete lack of feeling in the affected area.
- Flush the affected body part with warm water.
- Do not rub the frozen part and keep the casualty as still as possible. Make the casualty warm and comfortable.
- Gently remove clothing from the affected part.
- Seek medical help immediately.

Incase of person inhale chemical vapour or Gas:

- If person inhaled large amount of chemical vapour or Nitrogen or Helium gas, shift the exposed person to fresh air.
- If breathing has stopped, perform artificial respiration.
- Give Oxygen therapy. Keep the affected person warm and at rest.

Unconsciousness:

- Unconsciousness can be caused by many conditions such as a blow to the head, shock, stroke or diabetes. When you find a casualty unresponsive send or go for

medical help immediately. If injuries permit, put the casualty into recovery position before you leave.

- Loosen constrictive clothing at the person's neck, chest and waist. Keep the casualty warm.
- Do not give anything in mouth.
- Assess airway, breathing and circulation. If the person is not breathing, begin artificial respiration immediately.

Cardio Pulmonary Resuscitation (CPR) for Electric Shock or Heart Attack or trauma:

- For the victim of electrocution, first isolate electrical energy and take victim away from the system.
- Call for medical help / arrange for ambulance to send the victim to hospital, meanwhile.

OPEN THE AIRWAY

- Place the victim on his back. Open the victim's airway by placing one hand on the forehand and one hand under the chin and tilting the head back.
- If victim is not breathing, pinch the victim's nose closed and use mouth to mouth breathing technique to give two slow, deep breaths.

BREATHE INTO CASUALTY

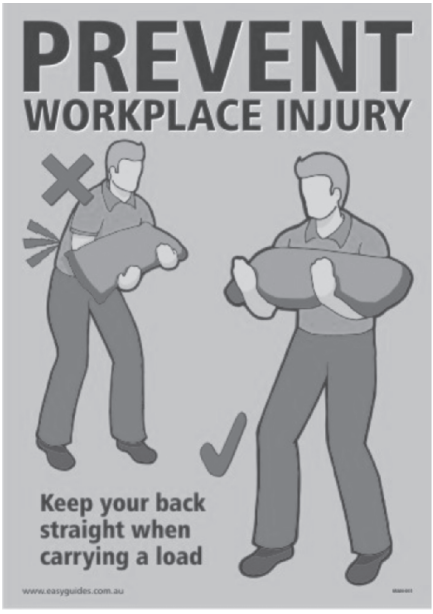
- Check the carotid pulse and look, listen & feel for breathing.
- If a pulse is present but the victim does not start breathing continue rescue breathing one breathe every three seconds.

Safety is Success by
Purpose - Not by Accident

- If a pulse is not present (no blood circulation) give chest compression to restore blood circulation.

1. Take position on the right side of victim near right upper arm.
2. Trace the sternum bone and place your right hand on the lower part of the sternum. Put left hand over the right hand and lock the fingers.
3. Count compressor loudly and give 15-chest compression. Then again give two breaths.
4. Check the responsiveness of heart & lungs. If they have not responded repeat the cycle again and again to sustain the life.

- Continue this procedure until the expert medical help available.



Make your workplace safe and comfort

First Aid Boxes available at IPR

1. Near Admin. Security Point
2. SST Hall Entrance
3. Aditya Tokamak Hall
4. Utility building - Ground floor.
5. Negative ion & source lab.
6. LVPD/BETA lab.
7. Neutronics lab.
8. AC / WC plant
9. MEL lab.
10. APPS lab.
11. Workshop
12. RF Lab.
13. PDD Lab.
14. Hostel Block – 1.
15. Hostel Block – 2.
16. Hostel Block – 3.
17. Guest House.
18. ITER-India Bldg. - First Floor
19. FCIPT – Main Building
20. FCIPT – R&D Building

Do not make delay to send victim to hospital

Life is a Gift, Wrap it in Safety

29. EMERGENCY PROCEDURES

A workplace emergency is an unforeseen situation that threatens every body, disrupts or shut down operation; or cause physical or environmental damage. Emergency may be natural e.g. flood, hurricanes, tornadoes, earthquake etc. Or manmade e.g. major fires or explosion, major leakage of Nitrogen or liquid Helium in a building etc.

Effectiveness of emergency planning should be done based on preparedness to respond an emergency. Emergency planning should be done based on worst scenario. One should think on following and prepare emergency procedure for his / her Lab.

1. What can go wrong in my lab / workplace?
2. What will be worst scenario?
3. Have I prepared combat the worst scenario?

Each lab member should be aware about the location of fire extinguisher, location of emergency exit & escape routes. Also remember telephone numbers of emergency services.

EMERGENCY DUE TO MAJOR LEAKAGE OF LIQUID NITROGEN OR LIQUID HELIUM

- SST-1 machine hall, Cryogenic hall, NBI Bay area and He/N_2 Storage Tank yard are the probable area of emergency.
- Emergency may arise due to catastrophic failure of storage vessel or total rupture of liquid transport pipe due to over pressurisation or due to other reasons like earthquake or mishaps.

Learn from others mistakes;
don't have learn from you.

Emergency scenario:

In case of major leakage of liquid Helium and liquid Nitrogen, there will be immediate evaporation and dispersion of Helium or Nitrogen gas in form of white fog. Wet gases immediate get dried due to heat exchange with atmosphere and losses it's 'White Fog' characteristics. Dry Nitrogen and Helium gas are odourless, colourless and tasteless. One cannot detect presence of Nitrogen or Helium gas by just smelling but it requires Oxygen monitor.

Nitrogen and Helium are not toxic but it reduces availability of Oxygen by displacing air. Environment containing Oxygen less than 19.5% is defined as 'Oxygen Deficiency Hazard Area' and working in such area is very dangerous.

Emergency Actions:

If you notice major leakage of liquid Nitrogen or liquid Helium or incase of Oxygen deficiency siren blow, take following actions.,

1. Inform concerned person who is looking after operation and control of the plant/lab. Simultaneously, inform SST Data Acquisitions & Control Room (SST- Central Control Room) about the scenario. Announcement should be made through announcement system from SST-control room to warn the people about the emergency and also leave the affected area safety. Safety, Security and Administration should be informed about the emergency scenario.
2. Open the rolling shutter and operate the roof extractors/exhaust system, if any, to vent out Helium/Nitrogen Gas from the affected area.
3. Open the glass window and air makeup window provided in Air Handling Unit (AHU) room to

introduce fresh air in the hall through Air Conditioning duct.

4. Except essential person needed for safe shutdown of the system, all person should leave the affected area and go in fresh air (open) area.

5. Essential person should invariably wear the Breathing Air Set and other protective appliances while performing emergency activities.

6. Emergency search operation should be carried out in the affected area to find any casualty in the affected area. Emergency search operation should only do with wearing Breathing Air Set. Shift the victim if any to fresh air and give Oxygen therapy and artificial resuscitation. Seek medical help immediately.

7. If liquid Helium or liquid Nitrogen splashes on the body, wash affected body party with plenty of water.

8. Don't allow anybody to enter in the affected building without Breathing Air Set unless 20% oxygen in the air is confirmed.

9. In case major leakage of liquid Helium/liquid Nitrogen in the NBI bay area (Ground Floor)

- Open ground floor shutter from the outside. Open the glass window and make-up air window provided in AHU Room (Second Floor) for fresh air inputs.
- Die to stack effect, there may be high concentration of Helium/Nitrogen gas in the lift passage. So do not uses lift for evacuation. Use staircase only.
- For evacuation from the NBI Control Room, use RF side exit to escape. Do not go downward or upward through lift.

Price of an Accident is always high.

- Evacuate people from the Magnet Power protection system floor also.
- Follow other emergency actions as indicated above.

INCASE OF FIRE EMERGENCY.....

- It is very easy to fight fire in its incipient stage. Once fire starts it spreads very fast. So attack immediately on small fire without any delay or waiting for anybody.
- Keep all fire fighting equipment well maintained and accessible. Know how to operate them.
- Know the fire escape routes and keep them clear.
- Keep emergency telephone numbers on tip of tongue.
- Report used, missing or damaged fire extinguishers to Safety Officer.

What Should I Know While Fighting A Fire?

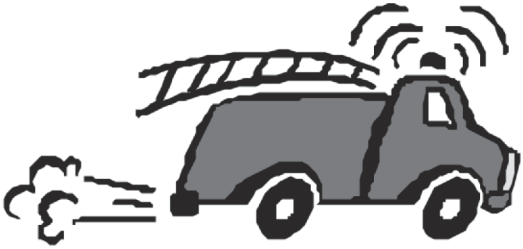
- Don't be panic. Act cautiously.
- Inform other people working in the affected area & evacuate affected area by shouting or activating a fire alarm.
- Turn Off electrical equipment in the immediate area, if it is safe to do so.
- Select right type of fire extinguisher to fight the fire. Water can be used on electrical fire only after electrical power isolation in the affected area.
- Keep an exit to your back for easy escape.
- Do not fight fire yourself-only, if it has spread in large area and your instincts tell you get out!!
- Inform Lab In-charge, Security, Safety and Administration department.

- Call fire services for major fire and guide them by right information.
- Don't make affected area crowded. Assemble at safe location (assembly points).
- In case of emergency like earthquake, major fire, major leakage of liquid Helium or liquid Nitrogen etc. Leave the affected area safely and go to the nearest assembly point. Don't make affected area crowded.

Assembly Points at IPR are:

1) Administrative Building Porch Area
2) On road opposite APPS Lab
3) On road near Battery Room / Switch yard
4) On road near Water Pump House / Compressor Hall

30. EMERGENCY CONTACT DETAILS



For Fire Services

Gandhinagar Fire Station: 101, 23222742
Ahmedabad Main
Fire Station: 22148465, 22148466
Naroda Fire Station: 22200715

For Ambulance / Medical Services

Ambulance:	**108, 1066 (Apollo Hospital)**
Kanoria Hospital:	**23969274, 23969298**
Apollo Hospital:	**66701800 / 1801 / 1802**
Civil Hospital, Gandhinagar:	**102, 23221931/32**
Civil Hospital, Ahmedabad:	**22680656**

Safety is like Lock - but you are the Key

IMPORTANT INTERNAL CONTACT NUMBERS

Director Office:	2050
Dean:	2075
Chief Admn. Officer:	2098
Asst. Admn. Officer:	2012/2013
Transport / Vehicle Requirement:	2018
Medical / First Aid Requirement:	2015
Electrical Maintenance:	2183 / 2286
Stores:	2262/2263
Admn. Security:	2041
Main Gate Security:	2255/2266
Reception:	2000/2001

Safety Committee (SC) Members:

Dr. C.V.S Rao – Chairman:	2053
Mr. C.N. Gupta:	2097/2270
Dr. L.M Awasthi:	2180/2237
Mr. K. Sathyanarayan:	2147
Mr. Sunilkumar:	2088
Mr. Devendra Modi – Safety Officer:	2152

Start today's work trip with a full tank of Safety

31. ROAD SAFETY

Do's

- Keep the left on the road.
- Keep your vehicle; particularly brake, in good condition.
- Keep safe distance from vehicles ahead to avoid collision.
- Always use a helmet if you are driving a two-wheeler and always see that when you use the helmet, the strap is fixed properly.
- Always wear seat belt while driving four wheelers.
- In place where it is indicated as accident-prone areas, you must drive very carefully.
- Avoid turning your vehicle abruptly.
- Be watchful and cautious while overtaking.

Don'ts

- Never drive in Zig-Zag manner.
- Never exceed speed limit.
- Do not drive under the influence of liquor or drugs.
- Do not drive without a valid license.
- Do not use cell phone while driving.

Follow Traffic rules, save your Future

Don't Drink and Drive

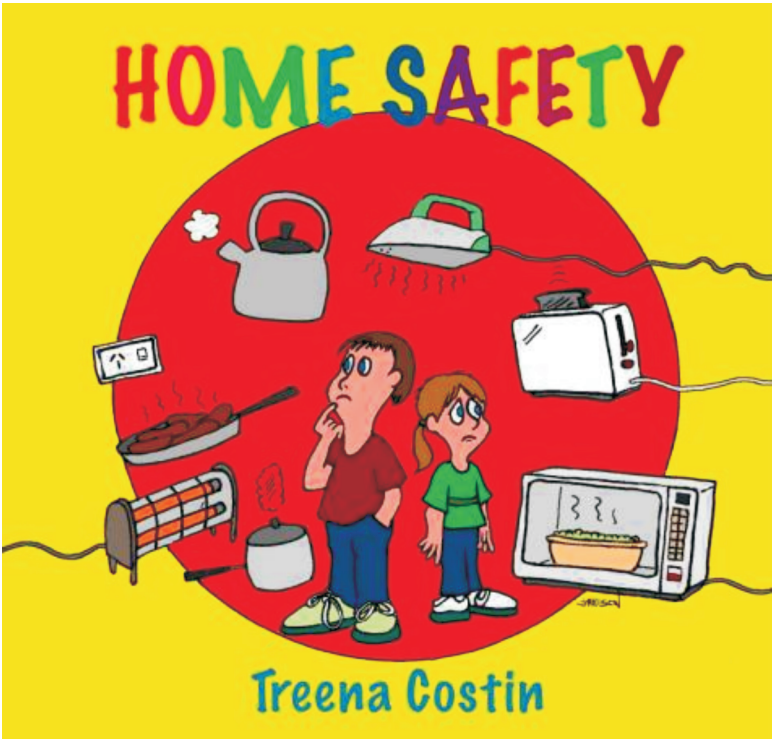
32. HOME SAFETY

A man feels the best protection and piece in his home. It is most desirable that our home should be the most peaceful & pleasant and safe place. Nobody wishes accidents and injuries in homes.

Do's

- Maintain good house-keeping at home.
- Keeping the floor non-slippery and safe.
- Keeping flammable & dangerous thing safely and out of the reach of the children.
- Identify all drugs & medicines by proper label and keep them in safe cupboard.
- Checking electrical lines, gas lines & other fittings by a qualified & competent person.
- Keep first-aid box with appropriate medicines always handy.
- Providing ELCB and proper earthing in electrical supply.

Your Safety means Safety of your Family



Working together gets the job done safely.

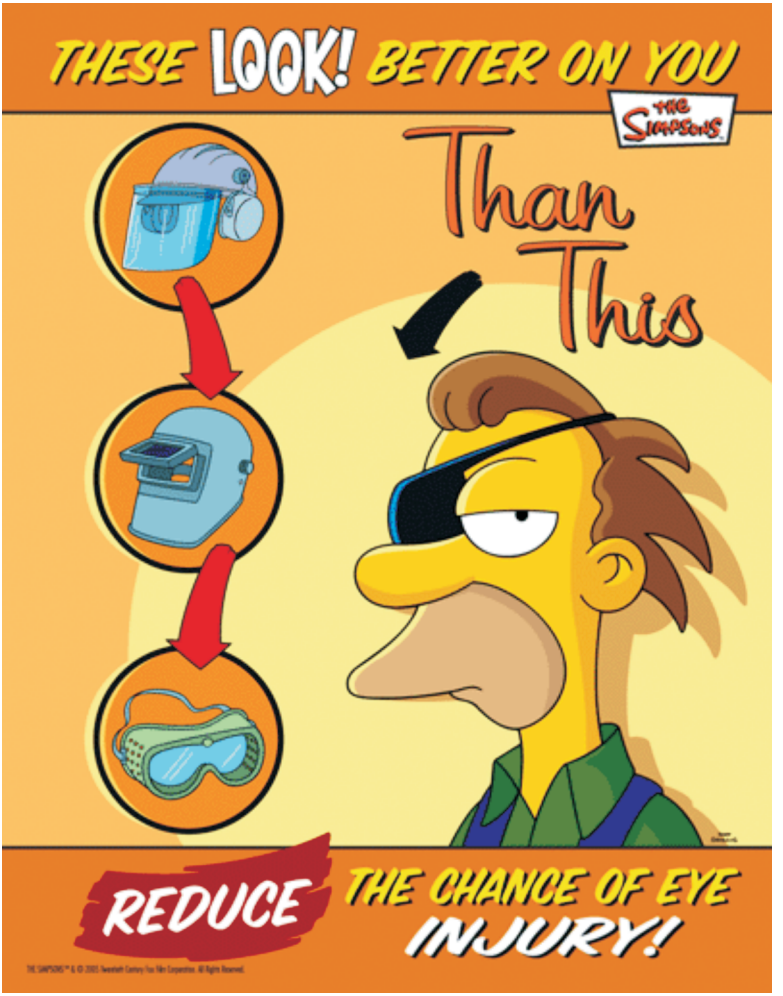
33. CONSTRUCTION SAFETY

- All persons shall wear Safety Helmet and Safety Shoes (ISI Mark) at construction site.
- Appropriate Personal Protective Equipment (PPEs) (ISI Mark) depending on working conditions shall wear. It is mandatory to wear the Full Body Safety Harness while working at 2 mtr. or more height.
- Safety Induction Training shall undergo by each worker priors to depute them for any kind of work at site and its record to be maintained.
- Ensure that a systematic Hazard Identification for Safety Critical Activities is to be carried out with its control measures.
- Daily Tool Box Talk shall be conducted by concerned work supervisor / work in-charge for safety critical activities like Working at height, Material Handling, Excavation, Hot work, Electrical Work, Erection, Scaffolding preparation, other civil work etc. and its record to be maintained.
- Employ only persons who are fit and skilled in the work to be performed.
- Use and maintain equipment that is safe to operate.
- Scaffolders shall ensure that access platforms are constructed in line with all safe practices before allow to commence work on the platform.
- Good Housekeeping practice needs to be implemented.
- All work to be efficiently supervised by experienced and responsible personnel.

Safety is a Full time Job, don't make it a part time Practice

- Suitable barriers shall be erected below the work area and signs displayed to advise personnel of the potential hazard.
- Obvious hazards at work place and surrounding shall be observed and take appropriate actions to avoid any eventuality.
- Ensure lifting equipment and devices are in safe condition and follow safe working load (SWL). SWL must mention on each lifting devices.
- Restrict the personnel movement under the lifting load.
- Lifting equipment to be operated by authorized persons only.
- Persons are trained for safe lifting procedure and aware of hazards.
- Check crane / chain pulley / sling / ropes / shackles etc. for their test certification and testing date before using at site. Its certificates shall also available at construction site.
- Personnel shall ensure that all materials/tools and/or equipment are kept secure at all times.
- Report all near misses and incidents. Also, detail investigation to be done to avoid recurrence.
- Report any sign of dizziness - vertigo, immediately to the supervisor.
- Safety posters to be displayed to create the safety awareness among the workers.

Hard hats, they are not just for Decoration.



Safety – a good friend to take home.

Small sector or Large sector,
Safety is the Common Factor

34. ENERGY CONSERVATION

Energy Conservation:

Energy Conservation is the deliberate practice or an attempt to save electricity, fuel oil or gas or any other combustible material, to be able to put to additional use for additional productivity without spending any additional resources or money.

Why Conservation of Energy?

Energy is a scarce commodity; Energy in any form is a scarce commodity and an expensive resource. However, if we look at the predicted future human population figures and consider the probability that the individual life expectation will increase, we see that energy could, in the future, be in short supply. Unless that supply is increased it will be a source of friction in human affairs.

Tips to conserve energy by following way: -

Office Equipment:

- Purchase energy-efficient office machines, e.g. photocopiers and laser printers bearing the energy label.
- Adopt paper-reducing strategies such as double-sided printing, reusing paper and using e-mail instead of sending memos or faxing documents.
- Always switch off office equipment such as personal computers, printers and photocopiers when they are no longer needed, e.g. during night time and at weekends.

Make your planet the best –
safer than all the rest.

Lighting:

- Make use of daylight whenever possible.
- Replace incandescent light bulbs with compact fluorescent lamps (CFL) which are 70% to 80% more energy efficient.
- Replace electromagnetic ballasts with electronic ballasts which are 20% to 30% more energy efficient.
- Install lighting zone control wherever applicable to switch off unnecessary lighting in unoccupied areas.
- Install occupancy sensors to automatically control lighting in areas infrequently used. e.g. seminar room, committee room, video conference room.
- Install parabolic-type lighting reflectors to reflect sufficient light and use fewer fluorescent tubes.
- Install appropriate dimmers to adjust lighting.
- Remove excess lighting in areas that are unnecessarily bright and maintain only those lights needed for safety, security or other specific purpose in the areas that are frequently un occupied.
- Clean lighting luminaries regularly and avoid switching on unnecessary lights.

Heating, Ventilating & Air-conditioning (HVAC) system:

- Replace aging HVAC equipment with new energy-efficient equipment.

- Install variable-speed drives wherever applicable to control chilled water flow and fan speed based on actual demand.
- Use heat recovery chillers or heat pumps to recover waste heat that can be used for heating up the hot water supply while providing cooling at the same time.
- Install occupancy sensors to automatically switch on and off the air-conditioning in those areas infrequently used e.g. in Seminar room, Committee room and Video Conference room.
- Increase chiller evaporator temperatures and decrease the chiller condensing temperature according to the chiller manufacturer's recommendations so as to achieve higher chiller cooling efficiency.
- During cool seasons, raise the chilled water supply temperature according to the cooling demand. This improves the efficiency of the chillers running at part load.
- When outside conditions are suitable and the outdoor air is cool and dry enough, increase the intake of outdoor air as much as possible.
- Regularly clean condenser tubes, cooling coils and air filters in order to maintain cooling efficiency.

Other Machinery and Equipment:

- Install energy-efficient motors and avoid using oversized motors because motors are inefficient when running at part load.
- Operate machines at maximum efficiency. Always run fewer machines at full load rather than more machines at part load.
- In applications in which loads fluctuate, install variable-speed drives to control motor speed to meet demand.
- Lubricate motors and drive bearings frequently to avoid overheating and power loss.
- Adhere to proper maintenance schedules recommended by manufacturers.
- Regularly clean the heating coils in the electric boilers.
- Reduce the number of lifts and escalators in service after normal working hours and on holidays.

Save Today, Survive Tomorrow

35. REPORTING SYSTEM

Purpose: To establish a system for incident, near miss reporting and analysis and find out the root cause of the incident / near miss for initiating actions to prevent the same in future.

Definitions:

Incident: An unplanned event, which has the potential to cause injury to people and / or damage to assets, and /or damage to the environment.

Note: *An accident is an incident, which has given rise to injury, damage to property or harm to environment.*

First aid case: Cases, which require simple first aid treatment and a victim, back to his duties.

Medical Treatment case: Cases which are more severe than requiring simple first-aid treatment. It includes treatment of injury administered by physicians & registered medical professional**.**

Near Miss: It means any unplanned, sudden event that could have caused injury to man or damage to plant or equipment or harm to environment, or any activity, which if allowed to continue, could have the potential to cause an incident.

Methodology:

Near Miss Reporting: Any person seeing or anticipating a *near miss* can fill up the Near Miss Reporting Format and submit a copy to Chairman - Safety Committee within specified time.

Every Near Miss is warning

Initial Incident Reporting (IIR): In the event of an incident, it is the responsibility of the employees involved in the incident or the work in-charge to complete an Initial Incident Reporting (IIR) format & submit to Group/Project Leader. Then, this would submit to the Chairman - Safety Committee within specified time limit.

Investigation Reporting (IR): Incident investigation will be carried out by independent investigation team appointed by Director/Dean/Safety Committee. The investigation report would submit to Chairman - Safety Committee.

Reporting Time Frame:

- Near Miss Report to be submitted to the Safety Committee within 48 hours (2 days) of the incident happened.
- Initial Incident Report (IIR) to be submitted to the Safety Committee within 72 hours (3 days) of the incident happened. Verbal notification given immediately.
- Investigation Report (IR) to be submitted as decided by Director/Dean/Safety Committee.

Note: All the formats may download from the e-office website.


All accidents must be reported.
. . . explain exactly what happened
ACCIDENT REPORT
?
ZOO

Apply your good intention to Accident Prevention

Hazardous Material Safety Information System (NFPA)

NFPA Rating Explanation Guide

RATING NUMBER	HEALTH HAZARD	FLAMMABILITY HAZARD	INSTABILITY HAZARD
4	Can be lethal	Will vaporize and readily burn at normal temperatures	May explode at normal temperatures and pressures
3	Can cause serious or permanent injury	Can be ignited under almost all ambient temperatures	May explode at high temperature or shock
2	Can cause temporary incapacitiation or residual injury	Must be heated or high ambient temperature to burn	Violent chemical change at high temperatures or pressures
1	Can cause significant irritation	Must be preheated before ignition can occur	Normally stable. High temperatures make unstable
0	No hazard	Will not burn	Stable

RATING SYMBOL	SPECIAL HAZARD
ALK	Alkaline
ACID	Acidic
COR	Corrosive
OX	Oxidizing
☢	Radioactive
W	Reacts violently or explosively with water
W OX	Reacts violently or explosively with water and oxidizing

This chart for reference only - For complete specifications consult the NFPA 704 Standard

NFPA-Chart_1 www.ComplianceSigns.com

Safety is everyone's responsibility

Hazardous Material Signs

Safety is the first gate to success

Celebration of National Safety Day at IPR

Administration of Safety Pledge

Accident hurts - Safety doesn't

Employees participated in Safety Walk

First aid Fire Fighting Equipments Exhibition

Safety Rules are your best tools.

Fire Demonstration for Employees and Security Guards

Put Safety on the top of your list

Training on 'Wearing of Breathing Apparatus Set'

Safe Behaviours today = Happy Family tonight.

NOTES

NOTES