Industry: Chemical & Agro chemical Industry

Application: This standard is applicable for the manufacture, use and manipulation of Manufacturing, processing, Mercury or Compounds of Mercury, Lead Tetra-ethyl, Manganese, Arsenic, Chrome, Aliphatic series, Beryllium, Phosgene and Isocyanates industries.

Note: As Phosgene is basic raw material for most of the Isocyanates, applicable standards/ guidelines for manufacture, use and manipulation of Phosgene should be followed.

Hazards:

These hazards may be classified as:

(a) Physical, - potential to cause danger arising from slip/trip/falls, equipment operations where there can be excess noise, vibrations, heat radiations, etc. that are harmful to human, cause damage to personnel or fatal.
(b) Chemical, - exposure/ dose to damage to humans arising out of handling chemicals or other hazardous materials such as Phosgene, Isocyanate, solvents acids, alkalis, Mercury & its compounds, Lead Tetra-ethyl, Manganese, Arsenic, Chrome, Aliphatic series, Beryllium etc. that are used in the manufacturing process. As most of the isocyanates are flammable, fire hazard is also prominent.
(c) Biological, - exposure to chemicals and other toxic substances during the process of manufacture of Phosgene, Isocyanate, solvents acids, alkalis, Mercury & its compounds, Lead Tetra-ethyl, Manganese, Arsenic, Chrome, Aliphatic series, Beryllium in different stages, under different operating parameters that may affect the lungs, causes chronic or acute lung diseases, etc.
(d) Ergonomic – man machine hazards such as HMI units, etc. depending on the process / operations, equipment and the persons involved in the operation.

Process Safety:

There shall be procedure for basic planning, methodology, technical and hardware requirement for execution of shut down activities safely and efficiently for both planned and unplanned shutdowns.

RC, DSC, ARC, and Powder test Studies shall be conducted prior to process design as per requirements.

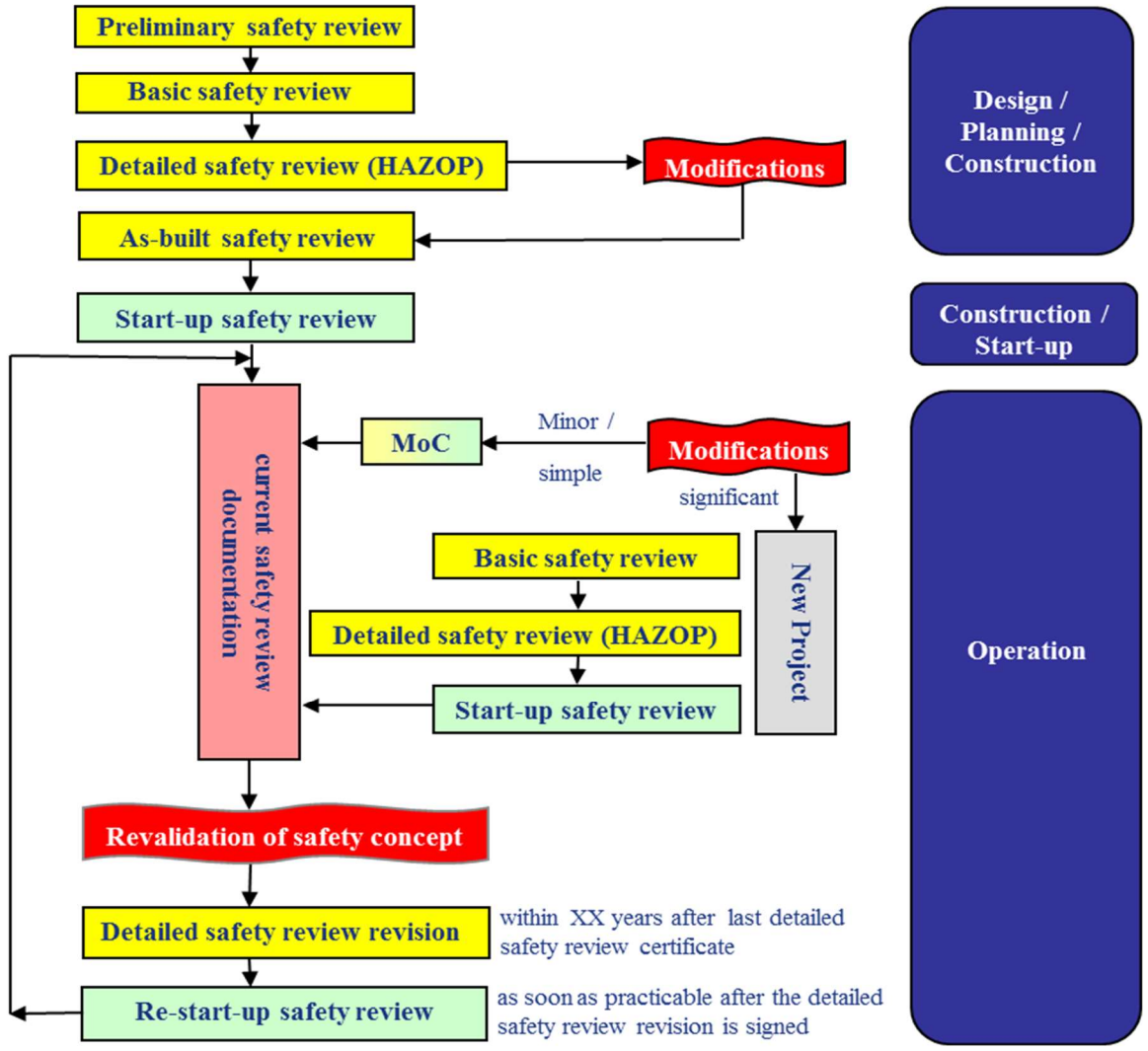
Pre-Start- Up Safety Review shall be conducted prior to installation of any new equipment.

Management of Change needs to be followed for installation of new equipment, modification of existing equipment, process or discard of unused equipment, etc.

Hazard identification studies such as QRA, PHA, HAZOP, HAZID, etc. whichever applicable, shall be conducted by a with an expert agency.

Job safety analysis and HIRA for all manual handling activities and wherever direct or indirect physical contact of chemicals such as Lead, Mercury, Arsenic, Manganese, Chrome, Aliphatic series, Beryllium, Phosgene and its compounds, Isocyanates is possible, shall be conducted.

Safety Review Flow chart



Operational requirements:

Safe Operating Procedures: it is of basic requirement to develop a Safe Operating Procedure (SOP) both for normal and abnormal working condition of plant by management considering national and international safety standards, safety philosophy etc. Safety procedures, instructions and methods should be prepared in co-operation with the people who are required to follow them.

Standard operating procedures should include procedures for:

- Start-up (e. g. after turnarounds or maintenance shutdowns)
- Shutdown (prior to turnarounds or maintenance activities)
- Rate changes

 Process upsets

 Response to process deviations

 Definition of key process parameters (including alarm and interlock settings)

 Definition of key process Safety parameters (including alarm and interlock settings)

Sampling:
General requirements: Reduced sampling will minimize the potential for releasing phosgene to the environment. It is very important that when phosgene-containing samples are taken, appropriate safety systems are in operation and that written procedures are available and followed.
Proper PPE including supplied air is required for personnel taking any phosgene-containing sample, not only in production units but also in laboratories and pilot plants. Safety is increased when sample points are easily accessible, ergonomically sound and when spot ventilation is used to remove any escaping vapours.

For liquid samples, such as phosgene solutions, the best option for a sampling station is an enclosure (box) that is equipped with a venting system, connected to a phosgene destruction system, and a means to ensure that the venting system is working prior to taking any samples.
Self-contained sample stations with fixed volume samplers, have been used successfully and are considered excellent examples of a contained sampling station. It is important that the sampling process follows a written procedure that has been reviewed and approved for safety.

Gas sampling: It is recommended to analyse gas streams using online analysis and fixed pipe connections

For Powder samples, Sampling collection tools to be used with appropriate safety systems are in operation and that written procedures are available and followed.

Phosgene solutions: Minimize sampling of pure phosgene solutions (i.e. phosgene and solvent only) by using on-line analysis. If a phosgene solution must be sampled, the best way to obtain the sample is with a sampler that neutralizes the phosgene at the source.

Storage and managing incompatibility of isocyanates with other chemicals

The following controls should be used to eliminate or minimise risks, so far as is reasonably practicable, when storing isocyanates or polyurethane foams:

- Keeping the levels of isocyanates stored to a minimum.
- Storing isocyanates in bunded areas. Incompatible material should not be stored in the same bund. Isocyanate pre-polymers may not need to be segregated from other chemicals because of their reduced reactivity. Always refer to the SDS to assess incompatibility issues.
- Ensuring storage areas are isolated as far as reasonably practicable from work areas where isocyanates are used e.g. stored on the surface of an underground mine when used underground.
- Ensuring chemicals not in use are returned to dedicated storage areas.

- Regular checks to ensure containers are not leaking, are tightly sealed and their labels are clearly visible and legible.
- Keeping storage areas moisture free and where reasonably practicable, covered. Drum covers should be used where the storage is not undercover to prevent water entry. Isocyanates react slowly with water to produce carbon dioxide which produces a risk of pressurisation in containers and a subsequent explosion hazard.
- Blanketing TDI with an inert gas like nitrogen or argon when stored in tanks. Transfer systems for isocyanates in bulk storage should be fully enclosed and pump or vacuum systems should be used for transferring the isocyanates.
- Ventilating buildings sufficiently to ensure the workplace exposure standard for isocyanates and other chemicals is not exceeded.
- Supplying areas where polyurethane foam products are stored with good ventilation because residual amounts of unreacted TDI or MDI may be present in the finished foam.
- Leaving sufficient space between foam blocks to allow heat to dissipate and reduce the risk of fire.
- Where isocyanates are stored at elevated temperatures to prevent solidifying—implementing adequate controls to prevent the temperature exceeding 30° C in the case of TDI. Precautions against fire should also be taken.
- Monitoring atmospheric contamination and temperature levels in storage areas.
- Ensuring flammable isocyanates are stored away from possible ignition sources.
- Limiting access to chemical storage areas to authorised workers only.

In case of Spills and leaks

To ensure the correct remedial steps are taken quickly workers should be familiar with decontamination procedures if spills or leaks happen. This includes:

- immediate evacuation and ventilation of the affected area
- only permitting trained personnel equipped with appropriate PPE to deal with the spill
- keeping supplies of absorbent materials and decontaminants nearby to quickly deal with spillages or leaks, and
- neutralising spills or leaks by spreading solid decontaminant over the area. This should be left for at least 10 minutes and then collected and placed in a reserved bin that is kept outdoors. These bins must not be sealed as carbon dioxide will be released as the isocyanate reacts. The affected area should then be thoroughly washed with liquid decontaminant and rinsed well with water.
- Contaminated clothing should be removed immediately and not re-worn until it is decontaminated. Clothing that is highly contaminated should be properly disposed of.

In case of Fire

Fires involving isocyanates or polyurethane products are likely to produce toxic fumes.

- Workers should be trained before attempting fire-fighting in these situations. Suitable fire-fighting and emergency equipment should be readily available for use.
- If there is a fire where isocyanates are used or stored. Evacuate the area and call emergency services. Keep upwind to avoid inhaling smoke and fumes.
- Anyone entering the area must wear self-contained breathing apparatus and full protective clothing including boots.
- Use suitable fire-fighting equipment if trained, and it is safe to do so. Automatic extinguisher systems should be used to fight fires.

Emergency Preparedness and Response:
Management should have prepared an Emergency Preparedness and Response (EPR) plan for un-fortunate event of loss of containment of Mercury or Compounds of Mercury, Lead Tetra-ethyl, Manganese, Arsenic, Chrome, Aliphatic series, Beryllium, Phosgene and Isocyanates industries and any emergency situations arising post release of it. A comprehensive EPR should contain all the information and what to do instruction in case of on-site or off site emergency. Effectiveness of EPR should be checked by carrying out mock drills at regular interval of time
Table top drills to be used to train company and contract employees to create awareness about emergency preparedness and response
It is recommended to develop the scenario of effect of leakage by dispersion modelling and consider the responses in case of emergency preparedness.
The following considerations may be of assistance in case of a plant emergency:
- One or more safe assembly point is needed so as to ensure that at least one assembly point is not downwind from the phosgene emission point
- Emergency coordinators to direct all personnel on the plant to a safe assembly point.
- A weather vane which indicating wind direction and velocities in the control room.
- A system for head count of all personnel (operations, maintenance, lab personnel, service personnel, contractors, visitors) on the plant in case of a plant emergency.

Medical assistance:
Mercury or Compounds of Mercury, Lead Tetra-ethyl, Manganese, Arsenic, Chrome, Aliphatic series, Beryllium, Phosgene producing facilities should have adequate numbers of First Aid centres or Occupational Health Centre. Timely administered first aid to victim of chemical exposure is of much importance. Management should also focus to train as much as possible first aider. Antidotes & specific medicines stocks are maintained at OHC.

Medical Examination:
The following examinations to be done twice in year with regular interval to check indications (if any) of development of pulmonary edema due to long term Phosgene exposure:

- Auscultation : Wheezing, asthma-like symptoms
- Pulse oximetry : Decreased oxygen saturation
- Blood-gas analysis : Decrease in pO2
- Airway resistance : Increase

- Chest X-ray : Blurred hili/perihilar edema

The following examinations to be done twice in year with regular interval to check effects due to long term Mercury exposure:

- Physical examination: Complete blood count, Liver function test, Renal function test, Urine routine analysis, Blood mercury level, Urine mercury level

The following examinations to be done for suspected cases to check effects due to beryllium exposure:

- Beryllium lymphocyte proliferation test (BeLPT)

The following examinations to be done twice in year with regular interval to check effects due to long term Arsenic exposure:

- Physical examination: Complete blood count, Liver function test, Renal function test, Urine routine analysis, Blood mercury level, Urine Arsenic level

Personal protection

Besides the usual protective equipment (e.g. safety shoes, adequate gloves, safety glasses or goggles, work suits, in some situations coveralls), respiratory protection in 4 levels is key for personal protection.

 Level 1: Escape masks

It can be considered that each worker carry an escape mask, although the strong recommendation is for filter masks. Visitors to a phosgene plant must always carry an escape mask.

 Level 2: Filter masks

Each worker should have a personal filter mask with a cartridge giving protection from phosgene/ Chemical powder for the time required to escape from a contaminated area, at least for 5 minutes. The filter masks and cartridges must be regularly checked and replaced if necessary.

 Level 3: Breathing air lines

For routine work potentially involving opening lines, flanges or vessels, a breathing air system for use with full-face masks can be installed throughout the plant

 Level 4: SCBA.

For emergencies, and also for routine work potentially involving breaking containment if no breathing air system has been installed, SCBA is mandatory.

Arsenic Risk Management:

Arsenic is a toxic material and a known human carcinogen. Arsenic is a silver-gray or white metallic, odorless, brittle solid. It is used as an alloying agent for heavy metals, and in solders, medicines and herbicides. It is ubiquitous in the environment in low concentrations, but when handled in concentrated form presents a significant health hazard.

Arsenic and arsenic-compounds can be classified as:

- the metalloid (As);
- trivalent compounds (As[III]);

- pentavalent compounds (As[V]); and
- organoarsenic compounds.

Arsenic compounds in occupational settings occur predominantly as As(III) and As(V) compounds as mists, fumes, vapours, or dusts. Organoarsenic compounds are primarily found in seafood. Arsine is formed when arsenic comes in contact with an acid and is a highly poisonous and flammable gas. Arsenic pentoxide, arsenic trioxide and arsine are also chemicals of security concern, refer to the Chemicals of Security Concern Procedure.

In nature, it is found as a metal in mineral ores, particularly some copper, lead and zinc ores. The most common arsenic mineral is arsenopyrite.

Precautions must be taken to minimise exposure and eliminate the risk of arsenic poisoning. Persons working with arsenic and its compounds, must complete a risk assessment prior to ordering the substance or mineral ores containing arsenic and its compounds, to identify and reduce or eliminate the associated hazards. The risk assessment should also include reviewing if persons working with arsenic are pregnant, as work with arsenic is associated with adverse pregnancy outcomes and infant mortality.

If the arsenic or arsenic-compound are not able to be eliminated or substituted, then engineering controls, e.g. control of airborne arsenic compounds with local exhaust ventilation (fume cupboards), along with training, supervision and appropriate PPE must be used. It may also be appropriate to include an administrative process by which other workers in the area are formally advised when work with arsenic is planned to take place so that they can avoid the area.

Risk controls for the main routes of exposure of Arsenic:

Where there is a likelihood of worker exposure to arsenic or arsenic-compounds, steps should be taken to minimise that exposure as far as reasonably practicable and a thorough examination of work practices is essential. Procedures should be adopted to ensure that workers are not unnecessarily exposed to the hazard and that they are not working alone.

Control measures for each of the main routes of exposure include, but are not limited to:

Inhalation

- Work is performed in a dedicated and functionally certified fume hood whenever possible.
- Work is undertaken with a fit for purpose dust extraction system for crushed ores.
- Where work with arsenic is carried out outside a fume hood, respirator appropriate to the form of arsenic contaminate being generated (e.g. dust, fume, or gas) should be worn.
- Work is carried out in a well-ventilated area.
- Creating aerosols and gases when using arsenic and its compounds must be avoided (note: arsine is formed when arsenic comes in contact with an acid).

- Good housekeeping should be practiced to avoid dust accumulation on surfaces.
- Use a vacuum or a wet method to reduce dust during clean- up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum

Skin exposure

- Work is undertaken in dedicated and functionally certified fume hood whenever possible and the worker must wear appropriate PPE where the risk assessment determines such as lab coat, apron, chemical protective gloves, safety glasses with side shields or goggles etc.
- Regular hand washing and showers on the completion of the workday to ensure dust and solutions are removed from the skin surface before leaving the work area.
- Launder all clothing which has been exposed to these substances separately and it is recommended workers change into clean clothes between each work session and showering.
- Earphones or earbuds must not be worn while handling these compounds.
- Hair must be tied back while handling these compounds.
- The integrity of all containers must be checked regularly and ensure containers are sealed and stored appropriately after use.
- Good housekeeping practices must be implemented to avoid dust accumulation on surfaces.

Ingestion

- Hands must be washed regularly, including before leaving the work area and before eating, drinking, or smoking.
- Gloves compatible with the substance being used are worn. PPE should be removed before leaving the work area and hands washed.
- Do not eat or drink while handling these compounds.
- These compounds must not be stored in food containers or facilities used for food preparation.
- Good housekeeping practices must be implemented to avoid dust accumulation on surfaces.

Health Monitoring Procedure

For arsenic exposure, the specific health monitoring procedures used will be determined by a health professional such as an occupational physician but may include the following:

- Collection of demographic, medical and occupational history.
- Records of personal exposure.
- Physical examination with emphasis on the peripheral nervous system and skin.
- Urinary inorganic arsenic by speciation (inorganic arsenic plus methylated metabolites).
- Seafood may contribute to a worker's urinary total urinary inorganic arsenic levels. Seafood consumption, particularly over the previous few days prior to sample collection, should be noted.
- Smokers may also have higher background total urinary inorganic arsenic levels. Smoking status should be noted.
- Other tests to consider a worker's possible exposure to arsenic may include:
  - urinary total arsenic (without speciation);
  - blood arsenic levels; or
  - hair and nail arsenic levels.

Health monitoring frequency and duration will be determined by an occupational physician or appropriately qualified medical practitioner and should include the following:

- Before staring work to establish a baseline so that changes to the worker's health can be detected.
- Post exposure if any recent excessive exposure has occurred (e.g. spills).
- Urine testing every 90 days unless levels are consistently low and workplace exposure levels are stable, then reduced frequency on the advice of a medical practitioner.
- At termination of work involving arsenic.

If Arsenic is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Collect powdered material in the most convenient and safe manner, or use a HEPA-filter vacuum for clean-up, and deposit in sealed containers.
- Ventilate area of spill after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of Arsenic as a HAZARDOUS WASTE.

Handling & Storage of Arsenic

- A regulated, marked area should be established where Arsenic is handled, used or stored.

- Arsenic reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions.
- Arsenic reacts with ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and HYDROGEN GAS to produce toxic Arsine gas.
- Arsenic is not compatible with powdered METALS (such as ZINC, LITHIUM, RUBIDIUM and PLATINUM); BROMINE AZIDE; LEAD MONOXIDE; and MERCURY OXIDE.
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES and HEAT.
- DO NOT store in metal tanks.

Beryllium:

It is a hard, brittle, gray-white metal. It is used in making x-ray tubes, as a moderator and reflector in nuclear reactors, and in aircraft brakes.

Workplace control & Good Safety Practices

ENGINEERING CONTROLS are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure.

The following safe work practices are recommended:

- Workers whose clothing has been contaminated by Beryllium should change into clean clothing promptly.
- Do not take contaminated work clothes home.
- Where possible, automatically transfer Beryllium from drums or other storage containers to process containers.
- Before entering a confined space where Beryllium powder may be present, check to make sure that an explosive concentration does not exist.
- Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to Beryllium.
- Eye wash fountains should be provided in the immediate work area for emergency use.
- If there is the possibility of skin exposure, emergency shower facilities should be provided.
- On skin contact with Beryllium, immediately wash or shower to remove the chemical. At the end of the shift, wash any areas of the body that may have contacted Beryllium, whether or not known skin contact has occurred.

- Do not eat, smoke, or drink where Beryllium is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.
- Use a vacuum to reduce dust during clean-up. DO NOT DRY SWEEP.
- When vacuuming, a high efficiency particulate air (HEPA) filter should be used, not a standard shop vacuum.

Handling and storage

- Prior to working with Beryllium workers should be trained on its proper handling and storage.
- A regulated, marked area should be established where Beryllium is handled, used, or stored.
- Beryllium may react with WATER or MOISTURE to produce heat.
- Beryllium is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); PHOSPHORUS; CHLORINATED HYDROCARBONS (such as CARBON TETRACHLORIDE and TRICHLOROETHYLENE); METALS; and MOLTEN LITHIUM.
- Store in tightly closed containers in a cool, dry, well- ventilated area away from HEAT and COMBUSTIBLES.
- Sources of ignition, such as smoking and open flames, are prohibited where Beryllium powder is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Mercury:

Elemental mercury (or liquid mercury) is an extremely toxic substance used in electricity, lighting (compact or tubular fluorescents), scientific research application and instrumentation. All forms of mercury (inorganic and organic) are toxic. Liquid mercury is 1000X less volatile than water at room temperature but can still generate enough toxic vapors if stirred or placed close to a heat source.

Mercury and mercury vapors are highly toxic. The effects of exposure may not be noticed until long after serious damage has been done. All forms of mercury are toxic and mercury poisoning can result from inhalation, ingestion, and injection or absorption through the skin. Chronic exposure may lead to teratogenic and systemic effects.

Safety Precautions for Mercury Use

Training

Employees who handle mercury must have read the Material Safety Data Sheet (MSDS) and receive training on the hazards of mercury from their respective

department. They must know what to do in the event of a spill or an exposure incident.

Ventilation

All operations involving open sources of liquid mercury or any mercury-containing organic/inorganic compounds must be carried out in a certified chemical fume hood.

Eye Protection

Chemical goggles or a face shield MUST be worn when handling liquid mercury. Safety glasses are sufficient when handling solid mercury-containing organic /inorganic compounds or materials.

Gloves

It is recommended to wear highly resistant, flexible, plastic-laminate gloves when handling dimethyl mercury and other similarly dangerous substances. For increased protection, such thin gloves can be worn under long-cuffed, heavy-duty outer gloves made of neoprene.

Protection Clothing

A lab coat (full sleeves) along full-length pants and close-toed shoes MUST be worn when handling mercury and other mercury-containing compounds.

Respiratory Protection

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EHS. Only mercury (Hg) vapor cartridges must be used with half-face and full-face respirators. Respirators should be used only under any the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted);
- When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded (see Table 1);
- Regulations or SOP require the use of a respirator;
- As PPE in the event of a chemical spill, clean-up process.

Safe Work Practice

- Always work in a well-ventilated area when handling mercury or mercury-containing materials.
- Absolutely no eating, drinking or chewing gum where mercury is used.
- The area must be equipped with an emergency shower, an eyewash station and a first aid kit.
- A mercury spill kit should be available in areas where mercury is being used.

- Whenever possible, less hazardous materials should be substituted for mercury. Mercury thermometers can be replaced with alternatives. Vacuum gauges can be used to replace manometers and oil diffusion pumps can replace mercury diffusion pumps.
- Never add water to mercury.

Storage, Spill and Waste Issues
Storage:

Keep mercury stored in a tightly closed container at all times in a cool, well-ventilated area. As a part of hazard communication, clearly label mercury storage area as 'Mercury storage area – HIGHLY TOXIC'. Always store in a Nalgene/polypropylene secondary container. Even the secondary containment must be clearly labeled. Do not store above temperatures of 25°C. Store away from acids, oxidizers and metals.

Spills:

If the spill is small and occurred on a non-porous area such as linoleum or hardwood flooring, it can probably be cleaned by trained lab personnel. If the spill occurred on a porous item that can be thrown away (like a small rug or mat), this item should discarded readily as mercury waste.
Mercury spill-kit must be readily available in the labs that store and/or handle mercury for research purposes. Spill clean up must be performed if and only if the lab personnel are trained and feel comfortable cleaning up Mercury (Hg) spill. Mercury spill-kits are commercially available. They usually include gloves, sponges impregnated with a material to absorb mercury, absorbent powder that reacts with mercury to form a harmless amalgam, and plastic bags for disposal. Some kits may include a small hand held pump/ syringes

In the event of a small spill:
A thermometer contains about 1.5 grams of mercury. A spill from a broken thermometer can be cleaned-up by laboratory personnel.
1. Clean-up the spill immediately after it has occurred.
2. Prevent the spread of the spilled mercury. DO NOT allow people to walk through spill area.
3. Wear disposable gloves and shoe covers or place double plastic bags over your shoes during the clean up.
4. Push the mercury droplets together into a bead using an index card or rubber squeegee.
5. Aspirate the beaded mercury into a disposable syringe, or use a disposable Pasteur Pipet attached with tubing to a vacuum flask to aspirate the mercury into the flask. The flask should contain water. Always have a second vacuum flask between the mercury flask and the house vacuum.
6. Chemically inactivate any residual mercury. There are several methods to inactivate the residual mercury:

- Use a commercial inactivating powder following its directions for use.

- Sprinkle zinc powder over the spill area, and then moisten the zinc with a 5 to 10 percent sulfuric acid solution until a paste is formed. Scour the contaminated surface and allow the paste to dry. Sweep up the dried paste. Wash the contaminated area with a detergent solution. Rinse and then swab the area with a calcium polysulfide solution containing two to four tablespoons of calcium polysulfide per gallon of water. Residual mercury can also be removed by wiping with a vinegar-soaked swab followed by peroxide.

7. Place the collected mercury and materials used in the clean up into a clear plastic bag. Double bag and label the waste.

8. Discard in haz. Waste as per applicable rules.

Never use a regular vacuum to clean up mercury or to go over spill areas after they have been cleaned up. Do not use a broom during cleanup.

Waste Handling

Never put mercury contaminated material in regular waste. Furthermore, mercury waste should be placed in a chemically compatible container with a sealed lid separated from other chemical waste. Mercury waste is treated differently than other types of hazardous waste. All waste containers must be labeled with a hazardous waste label with the full chemical name written out.

Fire, Incompatibilities and Explosion Hazard

Liquid mercury in is non-flammable; use agent most appropriate to extinguish surrounding fire (water spray, dry chemical, carbon dioxide or appropriate foam). At high temperatures, mercury oxide is formed and reaches a maximum effect around 350°C. Decomposition occurs around 400°C.

Ground mixtures of sodium carbide and mercury, aluminum, lead, or iron can react vigorously.

Mercury is incompatible or reacts violently with: acetylinic compounds ,ammonia, boron diiodophosphide, ethylene oxide, metals (aluminum, potassium, lithium, sodium, rubidium, calcium), metal oxides, methyl azide , methylsilane, oxidants (bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonynickel, nitromethane, silver perchlorate, chlorates, sulfuric acid, nitrates), oxygen, tetracarbonylnickel

Corrosive Effects

The high mobility and tendency to dispersion exhibited by mercury, and the ease with which it forms alloys (amalga) with many laboratory and electrical contact metals, can cause severe corrosion problems in laboratories. Mercury can attack copper and copper alloy materials.

NOTE:

For safety guideline for Lead -Schedule VI of Gujarat Factory Rules & Maharashtra Factory Rule can be referred which includes Lead-tetra ethyl.

For safety guidelines for Chrome- Schedule II &X of Maharashtra Factory Rules and Schedule X of Gujarat Factory Rules can be referred.

For Safety guidelines of Manganese- Schedule XVIII of Maharashtra Factory Rules can be referred.

For safety guidelines for dangerous Pesticides- Schedule XV of Gujarat Factory Rules can be referred.

For safety guidelines for Aliphatic Compounds chemical works- Schedule XIX of Gujarat Factory Rules can be referred.