A Quarterly Loss Prevention Digest

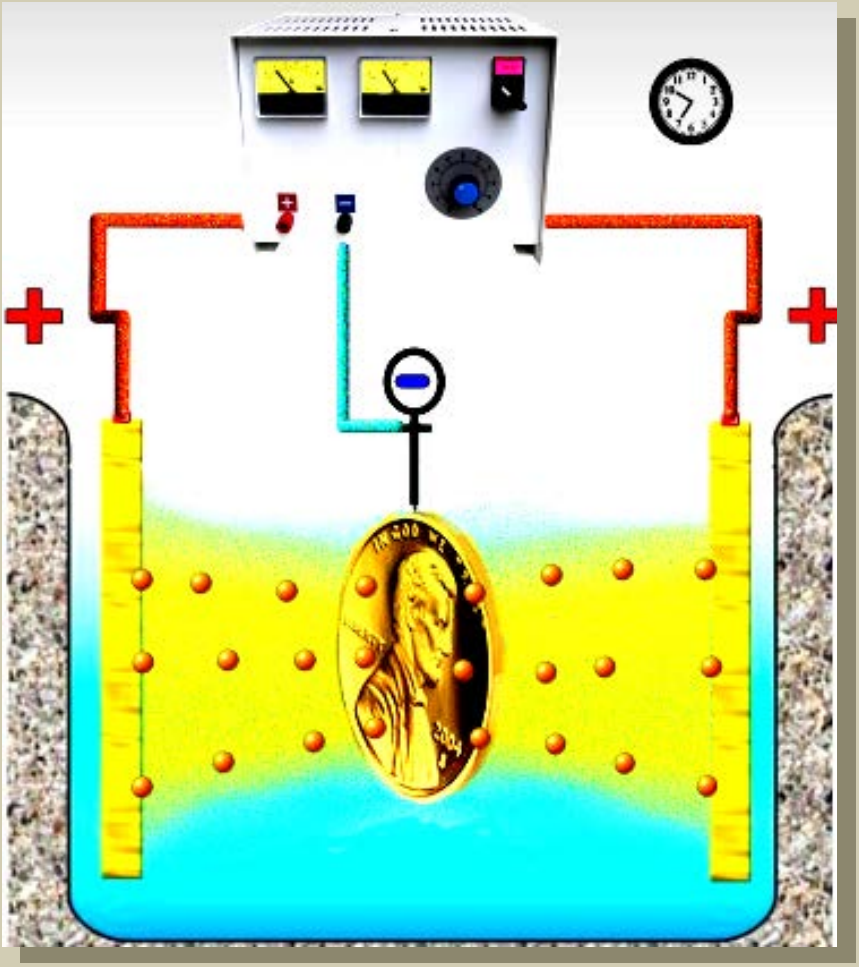
Fifth Edition

Feb 2012

IN-SIGHT

Lead Article:

Loss Prevention in Electroplating Operations



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Dr. Amarnath Ananthanarayanan

CEO & MD

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Message from CEO & MD

As we bid goodbye to the year that has gone by we realise that this has been a particularly painful year in terms of losses both to property and human life. The total economic losses in 2011 (insured and uninsured) due to disasters reached an estimated USD 350 billion, compared to USD 226 billion in 2010. The Japan earthquake besides economic losses also accounted for about 30 000 lives that were lost in the first 11 months of the year. As far as insured losses are concerned preliminary estimates of leading re-insurers reveal that the losses suffered by global insurance industry in 2011 is around USD 108 billion which is more than double the loss of USD 48 billion in 2010. The Indian general insurance scenario is no different as the data released by IRDA shows that underwriting losses suffered by General Insurance companies in 2010-11 in India is about INR 9,969 crores as compared to the previous year's figures of about INR 5,944 crores signifying a quantum jump of 67.72%. In these tough times faced by insurance industry and humanity, safety and loss prevention has an important role to play in risk mitigation and one of the primary aspects of this would be to create risk awareness amongst the population.

Let us all join hands in contributing to a greener and safer world and the way forward towards this would be by creating risk awareness amongst the society.

Subrahmanyam B.

VP & Head, Health and Commercial Lines

Bharti AXA General Insurance Company Limited

From the Editor's Desk

'In-Sight' - our quarterly risk engineering newsletter on safety and loss prevention has now completed its first full year of issues, since its launch in February 2011. We had in these issues focused on SME segment in general and engineering industries in particular where in addition to providing a general overview of the risks in such industries covered specific operations such as Spray Painting, Heat Treatment and Foundry operations. Continuing with the trend set in the previous year the lead article for this issue would focus on hazards and mitigation measures associated with electroplating operations.

Electroplating operations have inherent fire, injury and health hazards associated with them as the process involves generation of hazardous fumes, inflammable gas, and the use of hazardous chemicals and electricity.

In the context of cyclone 'Thane' that struck Tamil Nadu Coast in December 2011 the special article this time is on 'Cyclone Safety'. The issue also contains a safety quiz that helps check your safety quotient.

Wishing you all a very happy and safe year ahead as well as a happy and enjoyable reading experience!

Lead Article: Loss Prevention in Electroplating Operations

1.0 Introduction

Surface treatment is a sub-discipline of material science that deals with the surface of solid matter and finds extensive application in fields of chemistry, mechanical, electrical and electronics engineering. Surface treatment operations are carried out in engineering industries to alter the surface phase properties of materials as this helps in reducing its degradation over time by making the material surface robust to the environment in which it is to be used.

Matter in its solid state (other states of matter being liquid and gaseous) is characterized by structural rigidity and is composed of bulk material covered by a surface. The bulk material is called *bulk phase* and the surface which binds the bulk is called *surface phase*. The surface phase of a solid interacts with the environment surrounding it and is hence subject to degradation over time due to wear & tear, corrosion and fatigue. This degradation can however be mitigated when the surface properties of solids are altered through surface treatments. Alterations in surface properties are achieved through change in chemical, physical and mechanical properties of the work pieces on which surface treatments are carried out.

Surface treatments are also used to improve adhesion and surface finish (remove burrs and surface flaws), improve aesthetic appearance of material and in the manufacture of printed circuit boards in electronics industry.

2.0 Types of surface treatments

Surface Treatment/Finishing is a broad range of industrial processes that alter the surface of a work piece to impart the desired property.

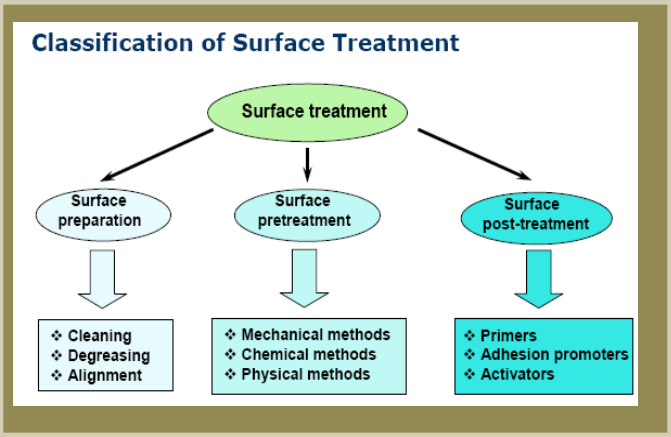
Based on the effect surface treatments have on work pieces, the processes can be grouped as:

- Those which alter the work piece / those to which material get added
- Those which reshape the work piece / those from which material gets removed

Blanching (whitening of metal by soaking in acid or coating with tin) and Case Hardening (surface hardening by infusing elements into the metal that helps in formation of harder alloy at the surface) are processes which alter the surface properties of the work piece. Glazing, painting, electroplating, galvanizing are processes that make elements get added to the work piece.

Reshaping and removing of material from work pieces are achieved through mechanical processes such as blasting (abrasive/sand blasting), grinding, polishing, buffing and through non-mechanical processes like CMP (Chemical Mechanical Planarization), Flame Polishing, Gas Cluster Ion Beam, Etching, etc.

Irrespective of the type of surface treatment that is being carried out on a work piece, the processes involved in these operations are primarily categorized into 3 steps namely – Surface Preparation, Surface Pre-treatment and Surface Post-treatment.



- **Surface Preparation:** This initial step in surface treatment is carried out to prepare the material for surface treatment and includes processes such as cleaning (degreasing) and preparation of substrate surface (deburring)
- **Surface Pre-treatment:** This step has processes such as mechanical (grinding, jet-cleaning), chemical (etching in metals, gas-phase fluorination in plastics) and physical methods (low pressure plasma in plastics) to remove strongly absorbed surface layers and activate the surface or alter the structure and/or chemical composition of the surface relative to the starting base material.
- **Surface Post-treatment:** This final step covers all techniques that serve to preserve the treated surface and includes application of adhesion promoters that improve and protect the surface.

As hazards and loss prevention issues related to heat treatment and spray painting operations were covered in our previous issues the focus of this newsletter is on loss prevention related to electroplating processes.

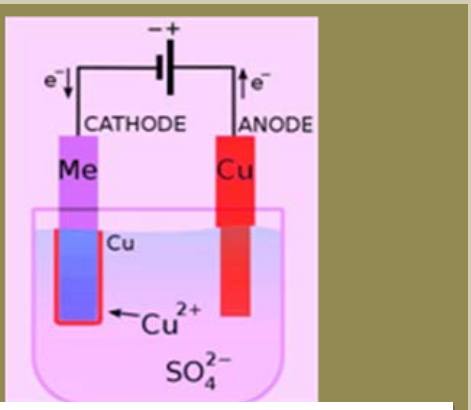
3.0 Electroplating

'Electroplating' by electrolysis is one of the most popular and extensively used surface treatment processes. This can be conveniently grouped into:

- One that provides heavy coatings of hard metal like chromium to machine parts
- Other that provides light coatings to personal/domestic items like ornaments, hobby items, motor vehicle parts and electronic components.

3.1 Process

The process uses electric current to reduce cat ions of a desired material from a solution and coat a conductive object with a thin layer of material such as a metal. Zinc, Copper, Brass, Chromium, Nickel, Gold, Silver, Cadmium and Lead are metals that are normally used in the electroplating process.



Metal ions in a solution are moved by an electric field to coat an electrode

This deposition bestows certain desired properties such as abrasion & wear resistance, corrosion protection, aesthetic appearance, etc. which the surface otherwise lacks. It is also used to build up thickness on undersized parts.

The process used in electroplating is called *electro deposition*. It is analogous to a galvanic cell acting in reverse. The part to be plated is the cathode of the circuit. In one technique, the anode is made of the metal to be plated on the part. Both components are immersed in a solution called electrolyte containing dissolved metal salts & other ions that permit flow of electricity. A power supply supplies a direct current to the anode, oxidizing metal atoms that comprise it, allowing dissolving in the solution. At the cathode, the dissolved metal ions in the electrolyte solution are reduced at the interface between the solution and the cathode, such that they 'plate out' onto the cathode. The rate at which the anode is dissolved is equal to the rate at which the cathode is plated.

3.2 Hazards

Electroplating workplaces are exposed to hazardous substances affecting human health mainly in the form of fumes, vapors, mists or metal dusts.

Use of electricity, wrong operational procedures and manual handling are the operational hazards involved in this process.

Hazards mainly arise by use of hazardous materials in the process like Solvents (methylene chloride, phenol and cresylic acid), Gases (hydrogen cyanide), Acids (chromic and dichromic acid, sulphuric acid and hydrochloric acid), Alkalis (sodium hydroxide), Cyanides (sodium and potassium cyanide), Heavy Metals (nickel, chromates and dichromate, chromium, cadmium and lead) and Toxic Wastes.

3.2.1 Fire Hazard

Excessive hydrogen or oxygen is emitted during electrolysis, causing the likely presence of an explosive or flammable atmosphere. If local exhaust ventilation fails or is inadequate to handle the escaping gases, fumes and mists, an explosion could occur.

3.2.2 Health Hazards

'Hydrogen' carries with it other chemicals in a 'Toxic Mist' which can be injurious to human health when not safely contained or ventilated.

Chemicals used in electroplating can cause various health related problems to persons exposed to these. These include short term health issues related to the respiratory system, skin, eye irritation and burns as well as long term effects causing asthma, lung and nerve disorders, and in some cases even cancer.

3.3 Loss Prevention Measures

3.3.1. Layout and Machinery

- ❑ The room housing electrolyser and all attendant equipment shall be well ventilated. The ventilation exhaust fan shall preferably be of flame proof type.
- ❑ Motor generator sets and/or separate generators and rectifiers together with necessary switch and control gear should be separated by blank walls or located sufficiently away from the electrolyser.
- ❑ Circulating pumps and electrical equipment thereof, where mounted in close proximity to electrolyser, should be specially treated with anti-corrosive paint at frequent intervals. The electrical apparatus shall be of totally enclosed type or approved as equivalent.
- ❑ Windings and insulation generally should be specially treated to resist the corrosive effects of the electrolytic fumes.

3.3.2 Storage

- ❑ Store hazardous substances in cool, lockable, enclosed area with adequate ventilation
- ❑ Ensure flammable, explosive, toxic substances are stored away from possible sources of electric spark, heat or flame
- ❑ Ensure all labels remain intact on containers and packaging
- ❑ Store incompatible substances separately, e.g. cyanides to be stored away from acids to avoid risk of mixing/ cross contamination
- ❑ Check all containers for leakage or seepage and ensure that lids & caps are tightly sealed
- ❑ Ensure that there is a method to collect and treat any spilled chemicals. Measures for this would include using pallets with bunds or having concrete bunds around stored material

- Limit access to chemical storage areas to authorized persons only
- Strictly prohibit smoking in storage
- Forklift and other mobile plant operators to be formally trained in safe procedures for handling chemical containers
- Monitor atmospheric contamination and temperature levels in storage areas where a risk assessment indicates that there could be a problem
- Maintain a register of hazardous goods along with their MSDS and ensure that this is readily available to anyone who could be exposed to these chemicals

3.3.3 Process

Electroplating

- Substitute hazardous substances with less hazardous ones
- Where possible, pump chemicals into plating tanks rather than pouring them manually from containers
- Clean pumps before use with a different chemical
- Use local exhaust ventilation on sides of the tank to remove mists and vapors
- Use a suppressant to minimize the amount of mist generated during electroplating
- Attach items to lifting equipment securely and train operators in safe procedures to minimize the risk of items accidentally getting dropped into tanks and splashing on operators
- Use monitoring systems to ensure that tanks do not overheat
- Ensure that the level of electrolyte in the electrolysis tank is adequately maintained at all times

Cyanide

- Acids and cyanides are an explosive combination and should be clearly labeled and stored in locked, dry places, well away from each other
- Articles treated in acid baths should be thoroughly rinsed with water before being placed in plating tanks
- Drainage should be designed to ensure that there is separation of acid spillage from cyanide spillage or effluent

Buffing, Grinding and Polishing operations

- Local exhaust ventilation should be fitted to grinding and buffing machines to remove dust as it is generated. Where there is still a hazard, respiratory protection must be selected and worn in accordance with the standard rules. Where carcinogenic substances are used, exposure levels should be kept as low as reasonably possible

Manual Handling

- ❑ Identify all hazards associated with manual handling
- ❑ Assess the risk arising from hazards
- ❑ Use appropriate control measures

Waste Disposal

- ❑ Ensure all containers of waste are labelled correctly and labels are kept intact, where hazardous substances are decanted into smaller containers for storage, the new container must also be labelled. As a bare minimum, label must contain name of the product as well as concerned risk and safety phrases in full text
- ❑ Wastewater disposal into sewers must be in accordance with Pollution Control Board (PCB) regulations which would require that any discharge should be treated to meet the prescribed norms
- ❑ Similarly solid chemical waste should also be disposed of in line with the states PCB norms even if this is to be used as landfill

3.3.4 Utilities and Machinery

Electrical

- ❑ The design and maintenance of electrical systems are critical. The system and items such as transformers and heaters should be checked regularly for problems such as:
  - Damaged insulation
  - Exposed live high voltage conductors
  - Corrosion of system parts
- ❑ Electrical equipment in workplace must be subject to appropriate checks, tests and inspections necessary to reduce the risk of injury or harm occurring to a person at the workplace
- ❑ Portable electrical tools must be protected by Earth Leakage Circuit Breaker's (ELCB) to minimize the risk of electric shock

Machinery

- ❑ Proper maintenance of plant and equipment is necessary
- ❑ Ensure overhead cranes, hooks and slings are regularly inspected, tested and well maintained
- ❑ Moving or hazardous machinery and parts such as gears, pulleys and belts need to be adequately guarded
- ❑ Safe work system and procedures should be implemented for forklifts

3.4 Fire Protection

This type of occupancy is grouped under light hazard category as per industrial hazard segmentation worldwide. Similarly 'Electro Plating Works' has also been grouped under 'Light Hazard Occupancy' by 'Tariff Advisory Committee' (TAC) of India.

As the probability of fire is generally due to the presence of flammable liquids, gaseous substances, reactive fumes etc; chemical extinguishers like Carbone Dioxide and Dry Chemical Powder would be the most suitable hand appliances to be deployed along fire water hose reel.

Recommendations with regard to fixed fire protection systems are a well designed fire hydrant system as per TAC regulations supplemented by a CO2 flooding system designed as per NFPA 12 that should be provided over the electroplating section.

3.5 Safety Management

Proper training of operators is an integral part of safety management. In addition to posting Standard Operating Procedures (SOP) at workstations other factors which enhance safety are:

- Carrying out frequent inspections of plant, workplaces and equipment
- Ensuring that packaging or container labels and MSDS are there
- Conducting periodic toolbox meeting among workers, supervisors and employers regarding likely hazards
- Checking previous incident and injury records for recurring situations
- Periodical review of tasks and procedures

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Ten Loss Prevention Commandments for Electroplating Operations

1. **Layout:** Room housing electrolyser & attendant equipment to be ventilated. Motor generator sets, separate generators and rectifiers with necessary switch& control gear to be separated by blank walls/located away from the electrolyser.

2. **Storage:** Store hazardous substances in cool, lockable, enclosed area with ventilation. Store flammable, explosive/ toxic substances away from sources of electric spark, heat/flame. All labels to remain intact on containers & incompatible substance separated from each other.

3. **Cyanides:** Acids & cyanides are an explosive combination and should be clearly labelled, stored in locked, dry places away from each other. Articles treated in acid baths should be thoroughly rinsed with water before placing in plating tanks. Drainage should be designed to ensure separation of acid & cyanide spillage or effluent.

4. **Fire Prevention**: Hydrogen is emitted during electrolysis. It is a highly explosive gas and its accumulation can lead to an explosion when ventilation fails or is inadequate to handle the escaping gases, fumes & mists. Hence, ensure that exhaust/local exhaust ventilation over electroplating area is adequate and is working at all times.

5. **Health Hazards:** Chemicals used in electroplating operations can cause various health related problems: Short term health issues related to respiratory system, skin, eye irritation, burns. Long term effects causing asthma, lung & nerve disorders and in some cases cancer. Use of local exhaust ventilation on sides of the tank to remove mists and vapours and suppressant to minimize the amount of mist generated are mitigation measures. Appropriate Personal Protective Equipment (PPE) where relevant should also be used.

6. **Material Handling:** Attach items to lifting equipment securely & train operators in safe procedures to minimize risk of items accidentally getting dropped into tanks and splashing on operators. Ensure that overhead cranes, hooks and slings are regularly inspected, tested and well maintained.

7. **Housekeeping:** Accidental spillage of toxic and corrosive chemicals used in electroplating process should be immediately attended to and it is necessary to have in place a standard operating procedure for attending to chemical spills.

8. **Waste Handling:** Ensure that all containers of waste are labelled correctly and labels are kept intact. Where hazardous substances are decanted into smaller containers for storage, the new container must also be labelled. As bare minimum, the label must contain the name of product and concerned risk & safety phrases in full text. Disposal of wastewater and solid chemical waste must be done in accordance with Pollution Control Board (PCB) norms.

9. **Safety Management:** Periodic safety inspections, ensuring that packaging or container labels and MSDS are available as appropriate and conducting periodic toolbox meeting amongst workers, supervisors and managers are measures that will help in better safety management.

10. **Fire Protection:** Protect the premises by a well designed fire hydrant system in line with TAC regulations for light hazard occupancies, supplemented by a CO2 flooding system designed as per NFPA 12 provided over the electroplating section.

4.0 SAFETY QUIZ

1. **Which one of the following is considered as the first step towards fire prevention?**
   a. Douse the fire
   b. Keep enough water sources
   c. Keep enough fire extinguishers
   d. Keeping heat sources and combustibles separate

2. **Flash point is related to:**
   a. Expansion limits
   b. Explosion limits
   c. Ignition limits
   d. Vaporization limits

3. **Heterogeneous explosions are of 2 types: Deflagration & Detonation. The main difference is:**
   a. In detonation explosion zone moves at a very low speed and for deflagration flame speed is high
   b. In detonation explosion zone moves up at a high speed and for deflagration the flame spreads around at a low speed
   c. In detonation explosion zone moves at a supersonic speed and for deflagration the flame speeds are low
   d. No significant difference between the two exists

4. **Hot work such as welding is controlled by:**
   a. Authorized hot-work areas
   b. Cold water sprays
   c. Hot work permits
   d. Both a and c above

5. **While issuing a permit for entry into confined spaces - permission/ precaution required during issue of such permits would be:**
   a. Management permission
   b. Testing of atmospheric samples inside the confined space
   c. Ensuring that an attendant is available at the entrance
   d. All of the above

6. **On the multi-colored chemical hazard label,** BLUE represents:
   a. Fire Hazard
   b. Health Hazard
   c. Reactivity Hazard
   d. Personal Protective Equipment

7. Hazard associated with equipment:

a. Amputation
b. Electric Shock
c. Noise
d. All of the above

8. If a machine guard is missing, worker should:

a. Not use the machine
b. Put a temporary cover over the area
c. Tell supervisor
d. Both A and C

9. Liquefied petroleum gas is a mixture of:

a. Methane and Ethane
b. Ethane and Butane
c. Methane and Butane
d. Butane and Propane

10. LPG forms of flammable mixture with air in concentrations between:

a. Between 2% and 10%
b. Between 10% and 20%
c. Between 20% and 30%
d. Between 30% and 40%

Answers

1	2	3	4	5	6	7	8	9	10
d	c	c	d	d	b	d	d	d	a

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5.0 Cyclone Safety

Cyclone is a storm accompanied by high speed whistling and howling winds. It brings torrential rains. Cyclonic storms develop over tropical oceans like the Indian Ocean, Bay of Bengal and the Arabian Sea. Its strong winds blow at great speeds.

Features : Tropical cyclones develop from large scale clusters of thunder storm cells that are often witnessed over tropical oceans. They get their energy from the evaporation of warm surface water from a temperature of more than 27° C. The storm systems can effect over large areas, with a storm field usually 100 – 500 KM in diameter and wind speeds exceeding 250 KM/hr and in individual cases even 300 KM/hr

Terminology used across the world

The description of various windstorm types depends on the area in which they occur. Hurricane & typhoon are just 2 names for strong tropical storms. Names of windstorms across the globe are:

Hurricane	**North Atlantic, Northeast Pacific**	**Hurricane**
Typhoon	**North-West Pacific**	**Typhoon**
Severe Tropical Cyclone	**South-West Pacific, South-East Indian Ocean**	**Severe Tropical Cyclone**
Severe Cyclonic Storm	**North Indian Ocean**	**Severe Cyclonic Storm**
Tropical Cyclone	**South-West Indian Ocean**	**Tropical Cyclone**

5.1 Hazards associated with cyclones

Primary Hazards

- **Wind:** Hurricanes are associated with strong winds. To be classified as a hurricane wind speed has to exceed 74mph
- **Rain:** Because hurricanes suck up large amount of energy and moisture from sea, they are associated with intense rainfall, up to 500mm in 24 hours

Secondary Hazards

- **Landslides:** Because hurricanes bring very intense rainfall, they can cause hillsides to become saturated very quickly increasing the stress on them and the likelihood of landslides
- **Flooding:** The intense rainfall can also cause severe flooding. The rainfall may also be combined with a storm surge making the flooding even worse
- **Storm Surges & Heavy Seas:** Because of the friction between wind and water surface, large waves can be created. Also the hurricane can literally drag water in land, causing coastal flooding. Storm surges can be especially bad if they coincide with high tides (especially spring tides).

5.2 Cyclone Intensities

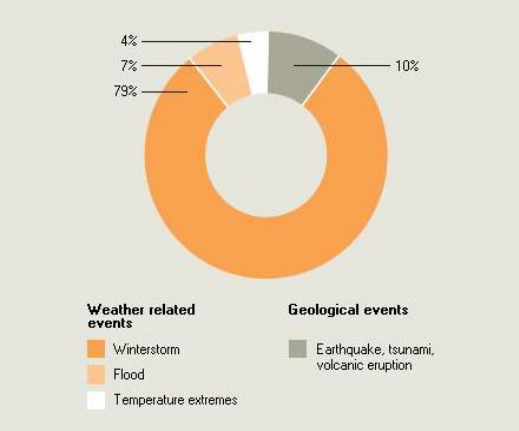
- **Visible signs of a cyclone:** When a cyclonic storm approaches, the skies begin to darken accompanied by lightning and thunder and a continuous downpour of rain.
- **Categorizing the intensity:** A rating of 1-5 based on a hurricane or cyclone's present intensity, is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region.

Intensity	Description
Category 1	**Minimal: Winds 74-95 mph** (64-82 knots or 119-153 km/hr): Storm surge generally 4-5 ft above normal, no real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage.
Category 2	**Moderate: Winds 96-110 mph** (83-95 knots or 154-177 km/hr): Storm surge generally 6-8 ft above normal. Roofing material, door & window damage of buildings. Considerable damage to shrubbery & trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs and piers. Coastal & low-lying escape routes flood 2-4 hrs before arrival of the hurricane centre. Small craft in unprotected anchorages break moorings.
Category 3	**Extensive: Winds 111-130 mph** (96-113 knots or 178-209 km/hr): Storm surge generally 9-12 ft above normal. Some structural damage to small residences & utility buildings with minor amount of curtain wall failures. Damage to shrubbery and trees with foliage blown off trees and large tress blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water 3-5 hrs before arrival of the hurricane centre. Flooding near coast destroys smaller structures with larger structures damaged by battering of floating debris. Terrain continuously lower than 5 ft above mean sea level may be flooded inland 8 miles (13 km) or more. Evacuation of low-lying residences with several blocks of the shoreline may be required.
Category 4	**Extreme: Winds 131-155 mph** (114-135 knots or 210-249 km/hr): Storm surge generally 13-18ft above normal. More extensive curtain wall failures with some complete roof structure failures on small residences. Shrubs, trees & all signs blown down. Complete destruction of mobile homes, extensive damage to doors & windows. Low-lying escape routes may be cut by rising water 3-5 hrs before arrival of hurricane centre. Major damage to lower floors of structures near shores. Terrain lower than 10 ft above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles (10 km).

Category 5	**Catastrophic: Winds greater than 155 mph** (135 knots or 249 km/hr): Storm surge generally 18 ft above normal. Complete roof failure on many residences & industrial buildings. Some complete building failures with small utility buildings blown away. All shrubs, trees and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3-5 hrs before arrival of the hurricane centre. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of shoreline. Massive evacuation of residential areas on low ground within 5-10 miles (8-16 km) of the shoreline may be required.

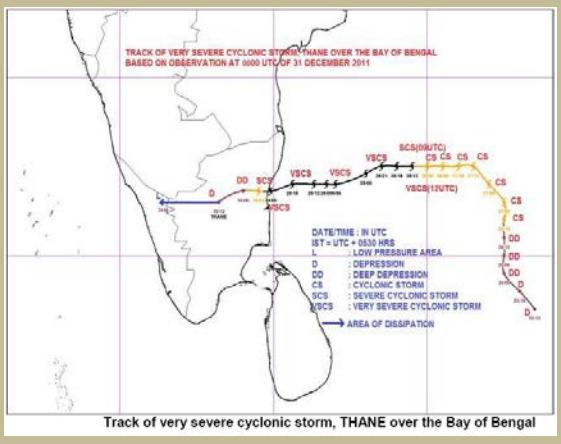
5.3 Loss Potential

Wind storm has become the highest destroyer in terms of frequency, area affected and scale of damage in recent decades. Percentage damage due to various geological events is illustrated below:



- Windstorm – 79%
- Earthquakes, tsunami, volcanic eruption – 10%
- Flood – 7%
- Temperature Extremes – 4%

5.4 An account of Cyclone THANE that recently struck South India

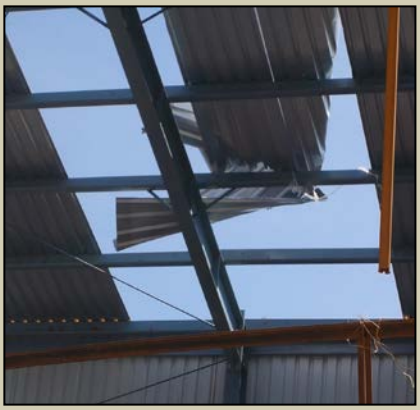


Track of very severe cyclonic storm, THANE over the Bay of Bengal

Incident: A very severe cyclonic storm developed over the Bay of Bengal during last week of December 2011. It crossed north T.N. and Pondicherry coast between Pondicherry and Cuddalore within 0630-0730 hrs IST of 30th Dec with a wind speed of 120-140 km/hr.

A depression formed over southeast Bay of Bengal in the evening of 25th Dec and lay centered about 1000 km southeast of Chennai. It gradually moved north-north westwards and intensified into a deep depression in the early morning of 26th Dec and into a cyclonic storm 'THANE' in the same midnight. It then moved west-northwestwards and intensified into a severe cyclonic storm in the afternoon and into a very severe cyclonic storm in the evening of 28th Dec. It then moved west - south westwards and crossed north T.N. & Pondicherry coast between Cuddalore and Pondicherry within 0630-0730 hrs IST of 30th Dec with a wind speed of 120-140 km/hr. After landfall, the system rapidly weakened into a severe cyclonic storm over north coastal T.N. at 08.30 hrs IST of 30th Dec and into a deep depression around noon and into a depression in the same evening over the north interior T.N. It weakened further and lay as a well marked low pressure area over north Kerala and neighborhood in early morning of 31st December, 2011.

Impact: Pondicherry UT and districts of Cuddalore & Villupuram are those that were severely affected. Other coastal districts namely Kancheepuram, Tiruvallur, Nagapattinam, Thiruvarur and Thanjavur were moderately affected.



The main damages were found to be trees uprooting, roof damages to non RCC buildings having Kuthca/ACC & metal sheet roofs, road damages due to fall of trees, damages to standing crop.

There also happens to be loss of production in many industries due to factors such as road blockage, failure of electric supply and damages to stock & machineries. Industries most affected are those in the SME segment as well as the sugar and textile industries in the region.

5.5 Risk Mitigation

Even if your business is not located in a cyclone prone area, tornados or high winds can happen anywhere. Most of the recommendations given here would be common for other perils such as fire or flood. So any investment you make, particularly when it comes to business continuity planning and making sure your building is sound will help you in other loss scenarios as well.

5.5.1 Emergency Action Plans

If you have property in tropical storms prone region, always have an up-to-date hurricane or typhoon emergency action plan in place. Hurricane or typhoon-prone regions are primarily located in the tropical zones north and south of the equator.

A Cyclone emergency action plan should be reviewed & updated each year before the season begins and after any major storm. It should address actions to take:

- ❑ Before hurricane season begins
- ❑ 48 hours before hurricane landfall
- ❑ 36 hours before hurricane landfall
- ❑ During a hurricane
- ❑ After a hurricane

Hurricane seasons occur at different times around the globe. The below grid summarizes the typical seasons for the various hurricane prone regions of the world.

North Atlantic	June 1 to November 30
Northeast Pacific	May 15 to November 30
Northwest Pacific	All year with main season from July to November
North Indian Ocean	April to December
Southwest Pacific	October to May
Southeast Indian Ocean	October to May

5.5.2 Characteristics of an effective hurricane plan

A hurricane plan should be quick, simple and practiced.

- **Quick** means the plan must fit into a reasonable timeframe. A reasonable timeframe will begin no more than 48 hours before estimated hurricane landfall and needs to wrap up with sufficient time to allow for personnel evacuation. For example, if a location requires more than two days installing shutters on windows, it is probably best to leave the shutters in place during hurricane season.
- **Simple** means a series of checklists to facilitate implementation. The checklists should be backed up with more detailed documentation as needed. However, keep in mind that as a hurricane approaches, no one will have time for the details.
- **Practiced** means you have actually conducted a full-scale implementation test of your plan. You know how many people are needed, what tools and supplies are needed and how long each task will take. In short, you know the plan will work because you have tried it.

5.5.3 Integrating the Cyclone plan

When implementing a cyclone plan, consider other emergency plans and systems/ practices that will support surviving and recovering from a storm. For example:

❑ **Emergency Power**

- Review emergency power systems: are they sized & arranged to carry appropriate loads? Apart from traditional emergency loads, the system should carry loads needed to maintain the internal building environment, such as chillers and HVAC systems. For multi-story buildings, emergency power should carry elevators so all floors will be accessible for service and repairs. The fuel supply for the emergency power system should be sufficient to support the system for the anticipated duration of normal power interruption and the anticipated time frame to resume fuel deliveries.
- Have spare generators located and available in a protected location. Generators may be in great demand after a hurricane. Ensure sufficient fuel which will be needed to operate them.

❑ **Business Data**

- Ensure there is a program in place for routine backup of critical computer data. The data should be backed up to a location that will not be affected by the hurricane.
- Identify vital business records (e.g. technical drawings, electronic files, paper files). Make plans to protect them or relocate them to a protected location.

❑ **Utilities, Medical Gases and Process Gases**

- Verify if the location of utility disconnects and confirm that shutoffs are identified with suitable markings. This includes electric and fuel gas utilities, but also applies to medical gases in healthcare facilities.
- For heavy industrial (chemical and petrochemical) facilities that rely upon nitrogen, will there be sufficient nitrogen available to maintain inert atmospheres in tanks and piping until normal deliveries resume? Nitrogen may be in very short supply in the days and weeks following a hurricane if local suppliers experienced the same hurricane conditions.

❑ **Equipment and Stock**

- Know the elevations of critical equipment including rotating equipment (motors) and electrical equipment (transformers and switchgear). This may help you identify equipment that may be

exposed to damage due to storm surge or flooding. Relocating this type of equipment before a storm is difficult. Protecting or sparing the equipment may be the only realistic option. Maintain critical equipment spares in a protected location.

- Verify practices for installing important electronic equipment like computers, LAN, telephone systems, healthcare facilities and medical diagnostic equipments. To reduce exposure to water damage, electronic equipment should be located above any anticipated flood elevation including hurricane storm surge and at least 10 cm (4 in) above any floor.
- Ensure skidding stock is at least 10 cm (4 in) above the floor to reduce water damage exposure

❑ **Vendors**

Develop relationships with equipment suppliers. Arrange in advance to obtain supplies, services or spare equipment quickly. After a storm, there will be a demand surge for all resources. Established relationships improve access to priority service.

❑ **Personnel**

Verify there is a contact list for all facility personnel including contact information for the most likely destination in the event of an evacuation. This will assist in locating personnel after a storm.

5.5.4 Before hurricane season begins

❑ Review hurricane plan and make sure it is current.

❑ Verify there is a designated person on site at all times during hurricane season with the authority to implement the hurricane emergency action plan. This includes ordering process shutdowns and facility evacuations.

❑ If responsibilities are assigned to specific individuals, update the assignments if positions or personnel have changed.

❑ Ensure hurricane supplies & equipment is handy. Order replacement materials as needed.

❑ Conduct annual drills to test all aspects of hurricane emergency plan. Ensure plan reflects current conditions at the location. After each drill, request feedback from involved staff and Emergency Response Team members to assess the plan effectiveness and identify areas for improvement.

- ❑ Maintain a roofing company under contract to respond quickly. Having a contract in place will allow faster access to critically needed repair services.
- ❑ Schedule an inspection of the building envelope. Have the roofing contractor check condition of roof coverings and flashing. Verify rooftop equipment is secure and that connections and fasteners holding equipment in place are not corroded. Consider adding strapping or bracing to reinforce rooftop equipment. Verify the condition of all glazing systems & weather seals and confirm windows and doors are secure and they close tight.
- ❑ Inspect and test if all emergency generators are up-to-date & well maintained. Check the entire fuel system including centralized bulk fuel storage tanks and fuel transfer pumps.
- ❑ Inspect and test all dewatering pumps & sump pumps controlling water that could otherwise inundate the building during a storm. Ensure they are connected to emergency power and operate correctly. Where manual storm shutters, plywood coverings or flood gates are used to protect the building during a hurricane, verify that all needed materials are handy and in good condition. Ensure presence of personnel needed to install or ensure availability of manual protective systems at all times during hurricane season. Verify all personnel involved with installing these manual systems have received training and have practiced before hurricane season begins. Know how long each manual operation will take & how many people needed, based upon actual timed practice drills.
- ❑ Establish and maintain emergency contact information and evacuation contact information for all personnel to assist restoring contact with employees after a hurricane event.

Special note for Chemical and Petrochemical Industry

Are safety systems such as flare stacks designed to operate in a safe and reliable manner under anticipated hurricane conditions? "Is your flare ready for hurricane season?"

5.5.5 When hurricane season begins

During hurricane season, it is important to maintain awareness of developing and approaching hurricane activities. Websites are available for all hurricane-prone regions that provide this information.

5.5.6 World Meteorological Organization - tropical storm watches, warnings and forecasts

The map at Severe Weather Information Center web page provides links to hurricane advisories and warnings. These links include maps showing:

- ❑ Past hurricane track
- ❑ Current hurricane location
- ❑ Region of 30+ knot (56 kph, 35 mph) winds – yellow circle
- ❑ Region of 50+ knot (93 kph, 57 mph) winds – red circle
- ❑ Storm warning cone
- ❑ Storm path forecast for next 3 days

5.5.7 Quick Tips to Protect your Business during a Windstorm

5.5.7.1 What to do during a windstorm

- ❑ Your first concern during a severe storm is personal safety. Depending upon your type of business, you may decide to keep some employees on site during a storm. Hotels, hospitals and other types of facilities may also have others besides employees on site. If you decide to allow employees to volunteer to remain onsite as an Emergency Response Team (ERT), ensure that local authorities will allow it. You should follow all mandatory evacuation orders.
- ❑ If you keep an ERT onsite during the storm, you may want to consider the following:
  - Carefully determine whether the location, design and building construction make it a safe place for ERT members to remain during the storm
  - The ERT members should be trained in all aspects of the emergency action plan and include representatives with decision-making authority as well as knowledge of facility operations
  - Security personnel may also be required on the ERT
  - Prepare an ERT supply kit that includes items necessary after the storm, including:
    - Two-way radios
    - Portable AM/FM radios
    - Flashlights and lanterns with plenty of batteries
    - Rubber boots & gloves, blankets or sleeping bags
    - First-aid kit
    - Spare clothing
    - Adequate supply of shelf-stable food & water to last at least 72 hrs

- ❑ Anticipate loss of electrical power and municipal drinking water for several days following the storm
- ❑ Conduct drills to test all aspects of the action plan on at least an annual basis. Ensure the plan reflects current conditions at the location. Request feedback from ERT members to assess the effectiveness of the plan and identify areas for improvement.
- ❑ Develop storm-tracking procedures and ensure the ERT is capable of monitoring conditions using various media and equipment (e.g., radio, TV, Internet and portable phone)
- ❑ If the facility is in an area exposed to flooding or storm surge, develop specific response procedures as part of the emergency action plan to manage the water exposures.
- ❑ During the height of the storm, the ERT personnel should remain in a location that has been secured from wind and flood

5.5.8 After A Windstorm

Getting back in business after the storm

Once the storm is over, you begin the task of getting your business running again as soon as possible. Your primary focus should still be on personal safety. Secondly, you should be doing everything possible to mitigate further damage/property losses. You may consider the below steps after a wind storm:

- ❑ Check with local authorities if the area around your building and the building itself are safe to enter
- ❑ Conduct a hazard assessment
- ❑ Report fire protection system outages to consultant or expert
- ❑ Perform emergency repairs like boarding up broken windows/openings, placing tarps where needed to prevent water damage and restoring water service
- ❑ Separate damaged contents from non-damaged
- ❑ Report your claim as soon as possible

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Response Invite:

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