INDIAN SAFETY ENGINEER

SEA (INDIA)

QUARTERLY JOURNAL OF SAFETY ENGINEERS ASSOCIATION

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FROM THE DESK OF PRESIDENT

Dear Members,

Our 57th Executive Committee meeting was held on 21st January 2012 and the 30th Professional Development Programme was held on 25th March 2012. Our journal "Indian Safety Engineer" for the fourth quarter 2011 was released in January 2012 and hopefully first issue for 2012 will reach you soon. We are also scheduling a factory visit during end April 2012.

Mumbai Chapter of SEA is planning their quarterly technical meet and their Executive Committee meeting during April 2012. They also seem to include a factory visit among their activities for the next quarter.

Our second Chapter at Gujarat is now taking shape. Dr. Patanik, our coordinator at Vadodhara (Baroda) has convened their first informal meeting of safety professionals during January 2012. Their second meeting is scheduled in early April 2012 and the Chapter is expected to take a shape during this meeting. Let us wish them good luck.

As you may be aware, SEA has joined the "Federation of Associations to promote Road Safety" which was constituted by the Automobile Association of South India (AASI). As a part of the federation, SEA has participated in the "Road Safety Week" activities during the first week of January 2012.

SEA (India) website, www.seaindia.org is now fully functional and some viewers are using the site to enroll their membership and some of the members are using the site to forward their applications for Nebosh course. Members may advise their Service providers / vendors to advertise their products / services in the exclusive web page available in the site towards mutual benefit.

Tenth Batch of Nebosh IGC course by SEA India was conducted for the March 2012 examination as per the revised syllabus introduced by NEBOSH, UK.

Conducting HSE awareness programmes for the final year students of engineering colleges / poly techniques by SEA is continuing. More colleges / poly techniques are requesting SEA to conduct this programm for their students.

Many useful safety reference books / standards are added to the Library set up at SEA office and full list of these books are made available. I recommend members to visit the library in their free time and make full use of them.

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Inside....

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It is decided to conduct the 11th Anniversary function of SEA and the Annual General Meeting on 27th May 2012. As you will receive more details on the events shortly, please reserve the day for our getting together and to consolidate fraternity.

Best Wishes!

S. Ulaganathan

President, SEA India

NEBOSH Course Update

NEBOSH- Course Provider meeting (India) was held on January 6th, 2012 at Mumbai. Mr Mathew Powel & Graham Collaby of NEBOSH held discussions with course providers. From SEA India, Secretary participated in the meet and expressed our views. Subsequently Mr Graham Collaby visited our SEA India office, Chennai and appreciated our mode of conduct of the NEBOSH International General Certificate Course.

The Tenth International General Certificate Course of NEBOSH was conducted from February 23rd to March 4th 2012 at Sri Ramachandra University, Porur. As more number of safety professionals joined this course, Two batches were conducted this time.

From 2012 January onwards, NEBOSH has revised the syllabus for this I G C course, the contact classes were conducted as per the revised syllabus. The examinations were held on March 7th and 8th of 2012 at Sri Ramachandra University, Porur, the results are expected by May 2012. The candidates expressed satisfaction about the course and we expect Good result.

SEA India encourages its members and other safety professionals to pursue this course to enhance their professional knowledge and career prospects. All those aspiring to join this course are requested to contact the Secretary, SEA India by mail, **info@seaindia.org** for getting admission.

Clockwise from top: **(1) NEBOSH 1st Batch (2012) Students (2) Mr W A Balakumaran, Mr S Ulaganathan, Mr Graham Collaby** & **Mr R Parameswaran at a meeting with NEBOSH official at Chennai** and **(3) NEBOSH 2nd Batch Students (2012)**

The 3rd Executive Committee meeting of Mumbai Chapter was held on November 27, 2011.

The meeting started with the presentation on Industrial Dust explosion by Mr Karthik, B S & B systems India (P) Ltd. The Executive Committee members of the Mumbai Chapter are seen in the picture.

DESIGNING THE EMERGENCY RELIEF SYSTEM

Operational risk mitigation possible through right design

Process / safety engineers and managements need to clearly understand, plan and execute future emergency relief system design work for plant projects, such as Process Hazards Analyses (PHA), unit expansions, debottlenecking studies etc.

This article focuses on the usefulness of Design of Emergency Relief systems (DERS), Hazards and operability (HAZOP) and safety integrity Level (SIL) Tools.

Chemical industry in general, deals with varieties of flammables and toxic materials on day to day basis-wherein the risk of exposure of people to such chemicals is always present. Handling of such chemicals from safety point of view is a major challenge for key decision makers. On one hand the industry has pressure to deliver increased production-and on the other hand it needs to ensure the process safety. Any accidental event, which arises out of failure of safety measures, cause loss of production and affects plant personnel's health. There are various ways to mitigate such incidents, for example, properly designed pressure relief systems can save operating equipment in the event of an emergency, avoiding both capital spending to replace damaged equipment and costly downtime.

Classification of hazardous chemicals

Chemicals are broadly classified into three categories as per schedule I (part 1& Part II) guidelines of ministry of environment and forests (http://envfor.nic.in/legis/hsm/hsm2sch1.html):

Part 1

a) Toxic Chemicals

b) Flammable chemicals

c) Explosives

Part II

There are about 429 chemicals defined as hazardous and toxic chemicals in part II classifications. Some of them are widely used. They are: acetone, acrylo-nitrile, ammonia, ammonium nitrate, aniline, benzene, butance, varbon monoxide, chlorine, lique-fied petroleum gas, nitrobenzene and sulphuric acid, liquefied petrol.

Process Hazards Analysis

The key to implementation of effective process safety and risk management systems lies in developing a common framework, by including all local regulatory requirements and all corporate standards.

A proactive approach, coupled with properly planned and implemented process safety management system can help minimize loss of life, environmental impact, equipment damage, citations and litigation.

Effective process safety and risk management starts with understanding the hazards that are present in the process. Process Hazard Analysis (PHA) should be conducted throughout the life of a process from initial laboratory trials, through operation, until the process is decommissioned.

At different stages of a process life cycle, different PHA techniques may need to be used. Various current techniques used for conducting PHAs are preliminary or inherent Hazards Analysis and Emergency Relief System (ERS) Design.

ERS Design

Emergency Relief system (ERS) Design is an essential part of process safety management and keystone in achieving process safety. Effective ERS Design helps compliance requirements and sound business practices DIERS (Design institute for Emergency Relief Systems) Technology is an example of good engineering practice for process safety management of highly hazardous chemicals. There are several software like superchems, ioxperss, which are used for conducting risk screening, documenting PHAS and conducting hazards assessments. These tools are essential for any plant manager with safety or risk management responsibility.

Legal compliance of relief system design documentation up to date, and non-conformity of the same results is affected by processing modification, expansion, debottlenecking and other changes, and documentation must be updated accordingly.

Using software tools such as superchems, one can perform sizing calculations, account for header and flare stack hydraulics, and calculate the radiation effects due to flaring.

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Designing ....

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HAZOP Study

A hazard and operability examination of a planned or existing process or operation is done in order to identify and evaluate problems that may represent risks to personnel or equipment.

Hazard means-any operation that could possibly cause a catastrophic release of toxic, flammable or explosive chemicals or any action that could result in injury to personnel.

Operability means-any operation inside the design envelope that would cause a shutdown that could possibly lead to a violation of environmental, health or safety regulations or negatively impact profitability.

The HAZOP process is based on the principle – a team-approach to hazard analysis, identifies more problems than done by an individual. The HAZOP team consists of individuals with backgrounds and skill. The expertise is assembled during HAZOP sessions and through a collective brainstorm-effort that stimulates creativity and new ideas, a complete review of the process under consideration is made.

Safety integrity level

While the Hazard and operability (HAZOP) Study identifies and risk -ranks hazards, safety integrity level (SIL) determination focuses on the adequacy of safeguards to mitigate hazards. The chemical industry relies on Basic process control system (BPCS) and safety instrumented system (SIS). In process plant, the operator supervises the operation and takes necessary action through BPCS. The BPCS is lowest layer of protection and is responsible for normal operation of the plant.

There are four different SIS levels: SIL1 probability of failure on demand between 10-1 and 10-2, SIL 2 -Probability of failure on demand between 10-2 and 10-3, SIL 3probability of failure on demand between 10-3 and 10-4, SIL 4 Probability of Failure on demand between 10-4 and 10-5.

Each level represents an order of magnitude of risk reduction. Higher SIL level indicates higher is the safety level and lower probability that the system will fail to per form the ideal time for SIL. Determination is during the Front -End Engineering Design (Feed) and project definition stages, and typically as a supplement to the HAZOP. But SIL determination may also be used effectively during the plant's life to determine if improvements are needed, and to provide guidance as to the form of the improvements.

SIL level can be identified based on the plant owner's risk tolerance. Plant owner should determine the acceptable level of risk based on corporate strategy, legal requirement, capital and other factors. Selection of appropriate SIL level calls for a careful analysis of costs increase with higher SIL levels. It has been observed that typically the chemical industry has opted to go up to SIL level 2 based on the requirement.

ERS case study

ERS study was carried out in one of the polymer units of a client. As per the present status, the AO Butyl Stearate Tank is currently protected by a rupture disk of 8", Set at 4-7 psig@50C. the purpose of this Emergency Relief System (ERS) Design package was to examine the adequacy of the existing installation with regards to overpressure protection. Also it included, if found inadequate, SIS would design a relief system to protect the AO-Buty stearate tank from unallowable overpressure.

Pressure rating of equipment: 70 Psig @122^{o} F two phase Vessel Dynamics was carried out in order to establish the relief rate. The relief rate was 159 lb/sec. piping was analysed to find out maximum flow it could take.

Then it was found that the piping was able to take flow rate more than 159 lb/sec maximum flow possible through piping was 180.5 lb/sec.

Afterwards the complete study report was submitted to the client regarding the existing relief device and adequacy of piping to prevent the vessel from overpressure during external fire case.

Risk Assessment

This can be done both qualitatively and quantitatively and varying levels of detail. To carry out qualitative risk assessment, ioMosaic's iofirst software supports risk screening activities, while risk survey approach guides more detailed assessments. Fault-tree/ event-tree analysis may be done to determine the frequency of potential incidents and evaluate risk for quantitative review. Superchems-hazard assessment modeling software includes source term and vapour dispersion models. ■

HARMFUL CHEMICALS IN OUR ENVIRONMENT

Over the past century humans have introduced a large number of chemical substances into the environment. Some are the waste from industrial and agricultural processes. Some have been designed as structural materials and others have been designed to perform various functions such as healing the sick or killing pests and weeds. Obviously some chemicals are useful but many are toxic and their harm to the environment and our health far outweighs their benefit to society. We need to manage the risks better by only using chemicals, which are safe.

Chemicals enter air as emissions and water as effluent. Industrial and motor vehicle emissions of nitrogen and sulphur oxides cause acid rain, which poisons fish and other aquatic organisms in rivers and lakes and affects the ability of soil to support plants. Carbon dioxide causes the greenhouse effect and climate change. Chlorofluorocarbons (CFCs) cause the destruction of ozone in the stratosphere and create the possibility of serious environmental damage from ultraviolet radiation. Chemical fertilisers and nutrients run-off from farms and gardens cause the build up of toxic algae in rivers, making them uninhabitable to aquatic organisms and unpleasant for humans. Some toxic chemicals find their way from landfill waste sites into our groundwater, rivers and oceans and induce genetic changes that compromise the ability of life to reproduce and survive.

The impact of human activities on the environment is complex and affects a chain of interconnecting ecosystems. The extinction of species all along the chain may mean the loss of useful genetic material or life saving cancer drugs or safer alternatives to the dangerous chemicals in use at the moment.

Organochlorines

Organochlorine compounds such as polychlorinated biphenyls or PCBs were developed originally for use in electric equipment as cooling agents and are very dangerous chemicals. During the manufacture and disposal of products containing PCBs, and as a result of accidents, millions of gallons of PCB oil have leaked out. Although their manufacture in the United States was halted in the 1970s and they are being phased out, they are difficult to detect, are nearly indestructible and large quantities remain in existence and they will remain in the environment for a long time. They accumulate in the food chain and significant levels of them have been found in marine species, particularly mammals and sea birds, decades after their production was discontinued. They are carcinogenic and capable of damaging the liver, nervous system and the reproductive system in adults. When PCBs are burned, even more toxic dioxins are formed.

Dioxins

Dioxins, are a class of super-toxic chemicals formed as a by-product of the manufacture, moulding, or burning of organic chemicals and plastics that contain chlorine. They are the most toxic man-made organic chemicals known. They cause serious health effects even at levels as low as a few parts per trillion. Only radioactive waste is more toxic. They are virtually indestructible and are excreted by the body extremely slowly. Dioxins became known when Vietnam War veterans and Vietnamese civilians, exposed to dioxin-contaminated Agent Orange, became ill.

Dioxins enter the body in food and accumulate in body fat. They bind to cell receptors and disrupt hormone functions in the body and they also affect gene functions. Our bodies have no defence against dioxins which may cause a wide range of problems, from cancer to reduced immunity to nervous system disorders to miscarriages and birth deformity. The effects can be very obvious or subtle. Because they change gene functions, they can cause genetic diseases to appear and they can interfere with child development. Attention Deficit Disorder, diabetes, endometriosis, chronic fatigue syndrome, rare nervous and blood disorders have been linked to exposure to dioxins and PCBs.

Over the past 40 years there has been a dramatic increase in the manufacture and use of chlorinated organic chemicals in plastics, insecticides and herbicides. Dioxins have been found in high concentrations near to the sites where these chemicals have been produced and where insecticides and herbicides have been heavily used, such as on farms, orchards, or along electric and railway lines. They have also

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Harmful....

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been found downstream from paper mills where chlorine chemicals have been used to bleach wood pulp.

In the last few years we have begun to discard our unfashionable household plastic products, together with industrial and medical waste by burning them in incinerators. Dioxins formed during the combustion process have been carried for hundreds of miles on tiny specks of ash and contaminated the countryside. They settle on pastures and crops and get eaten by cows, pigs and chickens. They get into lakes, streams, and ocean and are taken up by fish. They go through the food chain and appear in meat and milk and accumulate in the fat cells of our bodies.

Cadmium

Cadmium occurs naturally in the earth's crust combined with other elements. It is usually formed as a mineral such as cadmium oxide, cadmium chloride, or cadmium sulphate and although these compounds are highly toxic they are less harmful when bound to rocks. They are present in coal and in the soil.

Cadmium is useful because it doesn't corrode easily. It is used in batteries, plastics, pigments and metal coatings. Cadmium gets into the environment through landfills, poor waste disposal methods and leaks at hazardous waste sites. It is produced by mining and other industrial activities. Cadmium particles enter our air when we burn coal for energy and incinerate household waste. The particles can travel far before falling to the ground or water. Each year many tonnes of cadmium are discharged into our seas and oceans. Animals and plants take up cadmium when it is in the environment. If we consume food contaminated with cadmium it can irritate our digestive system and cause vomiting and diarrhoea. If inhaled it can damage our lungs. Even when levels of exposure are low, over time, cadmium accumulates in the body and it can be difficult to get rid of. Accumulated cadmium can cause kidneys and bone disease.

We take cadmium into our body by:

- Inhaling it when working in factories that make batteries or do welding, brazing or soldering
- Inhaling it when near power stations or factories burning of fossil fuels
- Eating foods in which it accumulates such as shellfish, liver and kidney
- Drinking water that is contaminated
- Smoking cigarettes

Conclusion

Potentially dangerous chemicals such as these are being introduced into the environment all the time. As in the case of PCBs their effect on living things may not be known until many years after their release. Hundreds of thousands of different chemicals are marketed worldwide. Of these 5000 are produced in quantities over 10 tonnes a year and 1500 are produced in quantities over 1000 tonnes year.

We do not have enough information about the environmental effects of these industrial chemicals and their effects on humans. The balance between human activity and ecological sustainability is wrong.

What you can do

Use biodegradable products. Make your own cleaning agent using safe materials. Dispose of chemical waste carefully. Do not put them down the sink. Be wise with home maintenance and in the garden. Do not burn plastics.

Avoid all organic chemicals that have "chloro" as part of their names including wood preservatives, herbicides and insecticides. Avoid chlorine bleach (sodium hypochlorite) and products containing it. Use oxygen bleach instead. Use unbleached paper products.Avoid "Permethrin" flea sprays for pets. Avoid products made of or packaged in polyvinyl chloride (PVC). Avoid cling flim plastic wraps unless they are clearly identified as non-chlorinated plastic.

To minimise your risk of dioxins accumulating in your body avoid all full-fat dairy products and fatty meats such as beef or pork. Wash all fruits and vegetables to remove chlorophenol pesticide residue. Avoid grapes and raisins unless they are clearly labelled as organically grown. Avoid soaps, toothpaste and deodorants containing "triclosan," a chlorophenol.

We can reduce the dioxins if we stop producing PVCs and other chlorinated chemicals.

People who work with cadmium should take care not to inhale cadmium-containing dust and should avoid carrying it home from work on their clothes, skin or hair. ■

HEALTH EFFECTS ON THE USAGE OF TOLUENE

What is toluene?

Toluene is also known as methylbenzene, phenylmethane and toluol. It was originally extracted from the tropical Colombian tree of Myroxylon balasamum which has an aromatic extract known as tolu balsam. However, toluene is also a naturally occurring compound in crude though in very low levels. It is also a by-product in the production of gasoline and coke (fuel) from coal.

Toluene is a colorless and clear liquid with a distinct smell, characteristic of the aromatic hydrocarbon family of chemical compounds including benzene.

What are the chemical properties of toluene?

Toluene is typically stable under normal usage and storage conditions but the container may burst when heated or subjected to high temperature and mishandling.

It can be highly reactive especially in the presence of heat and flame. It is chemically incompatible with strong oxidizing agents, sulfuric and nitric acids, nitrogen tetraoxide, and chlorine. When heated and made to react with a nitro group, toluene can give rise to dintrotoluene and eventually, into the volatile and explosive trinitrotoluene. It reacts strongly with oxidizing agents and may produce heat or potentially ignite or explode when not handled properly.

Where is toluene commonly used?

Toluene is a vital chemical used in the adhesive, laboratory, paint, pesticide, pharmaceuticals, and rubber industries. It is usually used as a solvent for dilution, extraction, and electroplating. The largest use for toluene, however, is in benzene production.

Toluene is usually used as solvent due to its ability to dissolve paints, silicone sealants, lacquers, adhesives, rubber, printing ink, leather tanners, and disinfectants.

This substance is also used as an enhancer and octane booster in gasoline, as a coolant in nuclear reactor systems because of its natural heat transfer properties, as well as in biochemistry experiments where toluene is used to rupture red blood cells for hemoglobin extraction.

What are the potential hazards of toluene?

Risk to Human Health

Low to moderate levels of toluene inhalation can cause confusion, tiredness, weakness, nausea, loss of memory, loss of appetite, as well as color vision and hearing loss. When exposure to toluene is discontinued, these symptoms typically disappear. On the other hand, unconsciousness, or even death, can result due to inhalation of high concentrations of toluene.

Ingestion and swallowing can cause abdominal pain and spasms and other symptoms akin to those of toluene inhalation. Direct skin contact can cause irritation and toluene can be absorbed through the skin. Toluene causes severe irritation with redness and pain when it makes contact with the eyes.

There have been reports of anemia, bone marrow disorders, and decreased blood count due to constant exposure to toluene even in small concentrations. It also has a defatting capacity which results to redness and drying of the skin as well as dermatitis. Toluene is also known to aggravate existing medical conditions such as those with skin disorders and kidney or liver disorders. Alcohol consumption is known to enhance the toxic effects of toluene. It is also very harmful to pregnant women.

Risk to the Environment

Toluene has been known to have moderate toxicity to aquatic organisms although there is no significant risk for bioaccumulation. Since this substance has strong reactivity properties, when it is released into the soil, water or air, toluene evaporates to a reasonable extent. But it is expected to filter into the water table.

Toluene is a largely unstable and toxic substance when mishandled. Therefore, the need for proper handling as well as storage practices must be stressed out. Those who are constantly exposed to toluene must be given proper protection gear, since prolonged exposure to toluene vapor can be very unhealthy and, in the most extreme cases, fatal.

LEAD POISONING

Lead poisoning is a medical condition caused by increased levels of the heavy metal lead in the body. Lead interferes with a variety of body processes and is toxic to many organs and tissues including the heart,bones, intestines, kidneys, and reproductive and nervous systems.

Routes of exposure to lead include contaminated air, water, soil, food, and consumer products. Occupational exposure is a common cause of lead poisoning in adults. The main tool for diagnosis is measurement of the blood lead level. When blood lead levels are recorded, the results indicate how much lead is circulating within the blood stream, not the amount being stored in the body. There are two ways that blood lead level numbers can be reported. One is in micrograms per deciliter (μg/dl), and the other is micrograms per 100 grams (μg/100 g) of whole blood, which is about equal to the first measurement, μg/dl. The Center for Disease Control has set the standard elevated blood lead level for adults to be 25 (μg/dl) of the whole blood. The major treatments are removal of the source of lead and chelation therapy (administration of agents that bind lead so it can be excreted).

"Lead poisoning" or "lead intoxication" has been defined as exposure to high levels of lead typically associated with severe health effects. Poisoning is a pattern of symptoms that occur with toxic effects from mid to high levels of exposure; toxicity is a wider spectrum of effects, including subclinical ones (those that do not cause symptoms). However, professionals often use "lead poisoning" and "lead toxicity" interchangeably, and official sources do not always restrict the use of "lead poisoning" to refer only to symptomatic effects of lead.

The amount of lead in the blood and tissues, as well as the time course of exposure, determine toxicity. Lead poisoning may be acute (from intense exposure of short duration) or chronic (from repeat low-level exposure over a prolonged period), but the latter is much more common. Diagnosis and treatment of lead exposure are based on blood lead level (the amount of lead in the blood), measured in micrograms of lead per deciliter of blood (μg/dL). The US Centers for Disease Control and Prevention and the World Health Organization state that a blood lead level of 10 μg/dL or above is a cause for concern; however, lead may impair development and have harmful health effects even at lower levels, and there is no known safe exposure level. Authorities such as the American Academy of Pediatrics define lead poisoning as blood lead levels higher than 10 μg/dL.

Signs and symptoms

Lead poisoning can cause a variety of symptoms and signs which vary depending on the individual and the duration of lead exposure. Symptoms are nonspecific and may be subtle, and someone with elevated lead levels may have no symptoms. Symptoms usually develop over weeks to months as lead builds up in the body during a chronic exposure, but acute symptoms from brief, intense exposures also occur. Symptoms from exposure to organic lead, which is probably more toxic than inorganic lead due to its lipid solubility, occur rapidly. Poisoning by organic lead compounds has symptoms predominantly in the central nervous system, such as insomnia, delirium, cognitive deficits, tremor, hallucinations, and convulsions The main symptoms in adults are headache, abdominal pain, memory loss, kidney failure, male reproductive problems, and weakness, pain, or tingling in the extremities.

Early symptoms of lead poisoning in adults are commonly nonspecific and include depression, loss of appetite, intermittent abdominal pain, nausea, diarrhea, constipation, and muscle pain. Other early signs in adults include malaise, fatigue, decreased libido, and problems with sleep. An unusual taste in the mouth and personality changes are also early signs.

In adults, symptoms can occur at levels above 40 μg/dL, but are more likely to occur only above 50-60 μg/dL. The lead levels at which symptoms appear vary widely depending on unknown characteristics of each individual. At blood lead levels between 25 and 60 μg/dL, neuropsychiatric effects such as delayed reaction times, irritability, and difficulty concentrating, as well as slowed

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Lead Poisoning....

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motor nerve conduction and headache can occur. Anemia may appear at blood lead levels higher than 50 µg/dL In adults, Abdominal colic, involving paroxysms of pain, may appear at blood lead levels greater than 80 µg/dL. Signs that occur in adults at blood lead levels exceeding 100 µg/dL include wrist drop and foot drop, and signs of encephalopathy (a condition characterized by brain swelling), such as those that accompany increased pressure within the skull, delirium, coma, seizures, and headache. It is rare to be asymptomatic if blood lead levels exceed 100 µg/dL.

Acute poisoning

In acute poisoning, typical neurological signs are pain, muscle weakness, paraesthesia, and, rarely, symptoms associated with encephalitis. Abdominal pain, nausea, vomiting, diarrhea, and constipation are other acute symptoms. Lead's effects on the mouth include astringency and a metallic taste. Gastrointestinal problems, such as constipation, diarrhea, poor appetite, or weight loss, are common in acute poisoning. Absorption of large amounts of lead over a short time can cause shock (insufficient fluid in the circulatory system) due to loss of water from the gastrointestinal tract. Hemolysis (the rupture of red blood cells) due to acute poisoning can cause anemia and hemoglobin in the urine. Damage to kidneys can cause changes in urination such as decreased urine output. People who survive acute poisoning often go on to display symptoms of chronic poisoning.

Chronic poisoning

Chronic poisoning usually presents with symptoms affecting multiple systems, but is associated with three main types of symptoms: gastrointestinal, neuromuscular, and neurological. Central nervous system and neuromuscular symptoms usually result from intense exposure, while gastrointestinal symptoms usually result from exposure over longer periods. Signs of chronic exposure include loss of short-term memory or concentration, depression, nausea, abdominal pain, loss of coordination, and numbness and tingling in the extremities. Fatigue, problems with sleep, headaches, stupor, slurred speech, and anemia are also found in chronic lead poisoning. A "lead hue" of the skin with pallor is another feature. A blue line along the gum, with bluish black edging to the teeth, known as Burton line is another indication of chronic lead poisoning.

Exposure routes

Lead is a common environmental pollutant. Causes of environmental contamination include industrial use of lead, such as is found in facilities that process lead-acid batteries or produce lead wire or pipes, and metal recycling and foundries. Lead exposure can occur from contact with lead in air, household dust, soil, water, and commercial products.

Occupational exposure

In adults, occupational exposure is the main cause of lead poisoning. People can be exposed when working in facilities that produce a variety of lead-containing products; these include radiation shields, ammunition, certain surgical equipment, fetal monitors, plumbing, circuit boards, jet engines, and ceramic glazes. In addition, lead miners and smelters, plumbers and fitters, auto mechanics, glass manufacturers, construction workers, battery manufacturers and recyclers, firing range instructors, and plastic manufacturers are at risk for lead exposure. Other occupations that present lead exposure risks include welding, manufacture of rubber, printing, zinc and copper smelting, processing of ore, combustion of solid waste, and production of paints and pigments. Parents who are exposed to lead in the workplace can bring lead dust home on clothes or skin and expose their children.

Paint

Some lead compounds are colorful and are used widely in paints, and lead paint is a major route of lead exposure in children. It has been found that 38 million housing units had lead-based paint, down from the 1990 estimate of 64 million. Deteriorating lead paint can produce dangerous lead levels in household dust and soil. Deteriorating lead paint and lead-containing household dust are the main causes of chronic lead poisoning. The lead breaks down into the dust and since children are more prone to crawling on the floor, it is easily ingested. Many young children display pica, eating things that are not food. Even a small amount of a lead-containing product such as a paint chip or a sip of glaze can contain tens or hundreds of milligrams of lead. Eating chips of lead paint presents a particular hazard to children,

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Lead Poisoning....

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generally producing more severe poisoning than occurs from dust.

Complications

Lead affects every one of the body's organ systems, especially the nervous system, but also the bones and teeth, the kidneys, and the cardiovascular, immune, and reproductive systems. Hearing loss and tooth decay have been linked to lead exposure, as have cataracts. Intrauterine and neonatal lead exposure promote tooth decay.

Renal system

Kidney damage occurs with exposure to high levels of lead, and evidence suggests that lower levels can damage kidneys as well. The toxic effect of lead causes nephropathy and may cause Fanconi syndrome, in which the proximal tubular function of the kidney is impaired. Long-term exposure at levels lower than those that cause lead nephropathy have also been reported as nephrotoxic in patients from developed countries that had chronic kidney disease or were at risk because of hypertension or diabetes mellitus.

Cardiovascular system

Evidence suggests lead exposure is associated with high blood pressure, and studies have also found connections between lead exposure and coronary heart disease, heart rate variability, and death from stroke, but this evidence is more limited. People who have been exposed to higher concentrations of lead may be at a higher risk for cardiac autonomic dysfunction on days when ozone and fine particles are higher.

Reproductive system

Lead affects both the male and female reproductive systems. In men, when blood lead levels exceed 40 μg/dL, sperm count is reduced and changes occur in volume of sperm, their motility, and theirmorphology. A pregnant woman's elevated blood lead level can lead to miscarriage, prematurity, low birth weight, and problems with development during childhood. Lead is able to pass through theplacenta and into breast milk, and blood lead levels in mothers and infants are usually similar. A fetus may be poisoned in utero if lead from the mother's bones is subsequently mobilized by the changes in metabolism due to pregnancy; increased calcium intake in pregnancy may help mitigate this phenomenon.

Nervous system

Lead affects the peripheral nervous system (especially motor nerves) and the central nervous system. Peripheral nervous system effects are more prominent in adults and central nervous system effects are more prominent in children. Lead causes the axons of nerve cells to degenerate and lose their myelincoats.

Diagnosis

Diagnosis includes determining the clinical signs and the medical history, with inquiry into possible routes of exposure. Clinical toxicologists, medical specialists in the area of poisoning, may be involved in diagnosis and treatment. The main tool in diagnosing and assessing the severity of lead poisoning is laboratory analysis of the blood lead level (BLL).

Blood film examination may reveal basophilic stippling of red blood cells (dots in red blood cells visible through a microscope), as well as the changes normally associated with iron-deficiency anemia (microcytosis and hypochromasia). However, basophilic stippling is also seen in unrelated conditions, such as megaloblastic anemia caused by vitamin B12 (colbalamin) and folate deficiencies.

Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high, with a delay of a few weeks. Thus EP levels in conjunction with blood lead levels can suggest the time period of exposure; if blood lead levels are high but EP is still normal, this finding suggests exposure was recent. However, the EP level alone is not sensitive enough to identify elevated blood lead levels below about 35 μg/dL. Due to this higher threshold for detection and the fact that EP levels also increase in iron deficiency, use of this method for detecting lead exposure has decreased.

Blood lead levels are an indicator mainly of recent or current lead exposure, not of total body burden. Lead in bones can be measured noninvasively by X-ray fluorescence; this may be the best measure of cumulative exposure and total body burden. However this method is not widely available and is mainly used for research rather than routine diagnosis. Another radiographic sign of elevated lead levels is the presence

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FEW TIPS TO PREVENT FALLS IN THE WORKPLACE

It is a fact that more than 16 percent of all workplace falls result in injuries or illness that affect the productive environment of a workplace. It becomes essential to employ means to prevent falls at the workplace. Falls at the workplace are mainly of two kinds: those that happen in single-story structures and those that occur from a higher level.

Most falls occurring from slips and trips at the same level are caused due to slipping on an icy surface or tripping over an object. A fraction of the falls occurring from different levels happen when people fall off ladders, steps or a higher floor. It is also a fact that falls at the workplace can be prevented. Although accidents are not easy to guess, it's still quite possible to prevent them from happening. Doing away with unsafe acts and conditions can control such accidents. Look for ways to prevent slips, trips and falls from occurring at the workplace. Once these hazards are eliminated you can usually prevent accidents from taking place.

Some of the precautions you can take to avoid "fall" accidents are:

- Ensure that all spills and wet surfaces are immediately cleaned up from the floor. Do not allow any residual slimy leftovers to be lying around on the floor as it could be a cause for a potential slip or fall.
- See to it that all walking pathways in the office are clutter-free. Do not allow normal walkways to be littered by any object that might result in people tripping and falling over.
- In case you need to reach up to something that's high up in the office, always use a safe stepladder. Never use chairs or desks to climb up to access things above your head.
- Make sure that you only carry loads that you can safely handle. While carrying objects, make sure that your line of vision is not affected and that you are not carrying a load that is too heavy-weighty objects may make you stumble under their weight.
- Always have good illumination around the office space. Whether indoors or near to the exteriors, ensure that lighting is adequate and visibility is not affected.
- Always wear good footwear when you are walking about. We may not have control over the condition of the surface that we walk on. But we do have control over what we choose to wear on our feet. Increasing friction between the soles of your shoes and the surface on which you are walking greatly reduces the risk of slip-injuries.
- Follow safety tips to choose the right shoes for the prevailing conditions. Wear hard rubber soles for greasy, concrete or wood flooring. Soft rubber shoes are good for dry surfaces. Crepe soles are best for rough concrete surfaces, dry or wet, and neoprene soles are good and safe on most wet or dry surfaces. ■

Lead Poisoning....

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of radiodense lines called lead lines at themetaphysis in the long bones of growing children, especially around the knees. These lead lines, caused by increased calcification due to disrupted metabolism in the growing bones, become wider as the duration of lead exposure increases. X-rays may also reveal lead-containing foreign materials such as paint chips in the gastrointestinal tract.

Fecal lead content that is measured over the course of a few days may also be an accurate way to estimate the overall amount of childhood lead intake. This form of measurement may serve as a useful way to see the extent of oral lead exposure from all the diet and environmental sources of lead.

Reference values

The current reference range for acceptable blood lead concentrations in healthy persons without excessive exposure to environmental sources of lead is less than 10 μg/dL for children and less than 25 μg/dL for adults. In 2012 there were recommendations to reduce the value for children to 5 (μg/dl). The current biological exposure index (a level that should not be exceeded) for lead-exposed workers in the U.S. is 30 μg/dL in a random blood specimen. Blood lead concentrations in poisoning victims have ranged from 30->80 μg/dL in children exposed to lead paint in older houses, 77-104 μg/dL in persons working with pottery glazes, 90-137 μg/dL in individuals consuming contaminated herbal medicines.

Coutesy: WIKIPEDIA

CASE STUDIES

CASE STUDY 1

Failure Analysis of Furnace Shell Plate

The boiler is an 8 TPH oil fired one. It is a three pass wet back boiler. The furnace shell plate had failed in a repetitive manner. The furnace shell plate had bulged inside two times in a six month period. The location was seen to be about 1.5 meter from the front tube sheet. The orientation of failed portion was at 6.00 O' clock position. The plate had caved towards the furnace due to internal steam pressure. The plate was locally replaced during the first failure. The second failure was also in the same location. After the bulging had taken place, the water started seeping from the repair weldment itself. After observing black smoke in chimney, the boiler was stopped by the boiler operators.

Observations during the visit

1 The failed portions of the plates were seen to be bulging towards the axis of the furnace. Scale was seen underneath the plates on water side. The extent of scales for the first failure was not known. However this time the scaling was found to be about 0.5 mm.

2 Apart from this, the boiler showed a small layer of hardness scale over the tubes. The scale is seen to be very high where the water is fed in to the boiler. There is definitely slipping of hardness to boiler.

3 The boiler water TDS reports confirmed that the TDS had been as high as 10000 ppm before first failure. After the chemical cleaning, instructions were given to operators to increase the blow down and maintain 5000 ppm of TDS in boiler water. Even then, the water TDS was seen to increase along with pH as reported by operators. In fact the pH booster dosage was stopped seeing the pH going to 11. This could have happened due to high dosage rate of anti scalant.

4 The chemical was being added through a small plastic tank with a cock for regulation. This could result in non-uniform dosage rates. The system would be dependent on skill of the persons.

5 The burner was seen with a baffle plate inside the wind box. It was suspected that there may not be uniform air flow in the burner.

Possible Causes for shell plate failure

1 The plate had failed at the same place twice. This clearly pointed out chances of flame impingement. Incidentally on flame impingement, the scale formation would be more. On increase in metal temperature, the plate would swell and would lead to failure.

2 There was scale present all over the boiler. It meant that there was deviation in water quality. Yet the scale thickness was not alarmingly high. The boiler was cleaned off to dislodge hardness scales inside the boiler shell. Yet the quantity of dislodged scales which were lying outside the boiler house was seen to be meagre.

The feed water hardness was not monitored properly. The hardness of the feed water also would have contributed for this failure

Suggested Remedial actions:

1 The furnace shell repair was not done to satisfactory level. Hence it was advised to carry out radiography test. But this could delay the boiler starting as there are procedures in bringing the radioactive source. Hence it was suggested to have an ultrasonic test so as to ensure that the weldment do not have cracks.

2 The furnace shell can be covered with 65 mm thick refractory brick layer to protect the weakened plate. Also this would prevent the flame impingement.

3 Furnace shell is considered to be most vulnerable part of the boiler. For safety reasons, procedures should be followed. Manufacturer only should attend to such failure. Tube replacement is a different matter and it can be attended by a boiler repairer.

4 Burner flame shape should be checked by the suppliers' service technician only. There should not be any impingement.

5 Water softener must be checked periodically.

6 Hardness levels should be checked before regeneration.

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Case Studies....

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This is an important aspect of the water chemistry.

CASE STUDY 2

Description:

A mock fire drill was conducted at a garment factory. A senior welfare officer who was engaged in the mock drill fell down from a height of nearly 15 metres as the rope snapped plummeting to her death, since she fell head first onto the concrete floor below. The coworkers rushed to the spot and took her to the nearby hospital where she was declared dead.

Cause of the accident:

The rope which the employee has used to come down could not withstand her weight.

Risk assessment has not been carried out before the conduct of the mock drill.

The welfare officer was not competent and trained to be engaged in the mock drill.

Mock drills are also harmful if suitable precautions are not taken.

Remedial actions suggested:

The lifting appliances such as the rope which has been used for lifting the employee should have been tested to carry the safe load by a competent person atleast once in 6 months.

- Risk assessment is to be carried out on the activities planned during the mock drill.
- Mock drills are also a form of training, only competent and well trained persons shall alone be used for performing the activities .
- Mock drill activities are to be coordinated and controlled by well trained and competent personnel.

CASE STUDY 3

FIRE ACCIDENT

Description

A dangerous occurrence (fire accident) which did not result in death or bodily injury except property damage occurred in a Mosquito coil/mat manufacturing unit.

On the day of the occurrence nearly 10 employees of the first shift had arrived at the factory after a two days break being holidays when a fire broke out. They could not ascertain the exact cause of the fire. During investigation all the witnesses were interrogated and the sequence of events based on statements made by these witnesses were taken into consideration. It was concluded that the fire started from the chemical storage area from where the smoke was first observed. It was noted that this factory uses, various chemicals having various flash points and the minimum flash point of certain chemical is 66° C. Since the time of the incident was early in the morning and the burner used for drying purpose was not yet started, the room-temperature around that area was much below the above said flash point temperature 66° C. However, prior to the incident the factory was closed for two days as mentioned above. Hence accumulation of chemical vapours around chemical storage area could not be ruled out. Also, there must be a source of ignition or spark to start the fire Thus, current leakage or electrical short circuit producing spark in presence of chemical vapours was presumed to be the cause of fire producing fog like smoke which quickly turned black smoke as seen by one of the witnesses. A fire with tremendous heat in that area was caused as it was evident from the bent steel truss of the roof. It may be mentioned that since the fire had started from the chemical storage area all the burnt chemicals must had already been evaporated by the time the fire-fighting personnel arrived at the scene. Otherwise, the consequences and after effect of these chemicals on them would have been serious if they were not equipped with proper personal protective equipment like SCBA, etc.

Had the, chemicals been stored separately away from the work floor a huge fire would not have been caused inspite of the electrical short circuit or spark.

Remedial Actions suggested

1. All chemicals should be kept separately away from the 'work floor area in a cool, dry and well ventilated room/place away from any source of ignition, heat, etc. Information from the MSDS should be strictly followed while handling & storage of such chemicals.
2. Storage of finished products and raw materials should be kept away from the machineries or from aisle ways taking into consideration the flash point of the chemicals.
3. Sufficient ventilation should be ensured in the storage area where chemicals are stored.
4. Safety Audit should be carried out. ■

IN THE NEWS

Safety Training Centre at Sivakasi

Mr K. Ayyanu, Chief Inspector of Factories, Government of Tamil Nadu, has informed that the State Government will soon set up an Industrial Safety Training centre at Sivakasi.

He told press persons after a seminar on “Safety and Health for Stakeholders in Factories,” organised by Inspectorate of Factories and National Safety Council, that accidents had gone up in firework and match work factories during the last one year. In an effort to improve safety of workers in these factories, a training centre would be started next month and training programmes would be organised regularly in association with the local industries at Sivakasi.

The Inspectorate of Factories was also collecting data on the number of workers from the northern States. This would help plan industrial safety training programmes for these workers.

Inaugurating the seminar, he said that training the employees would establish a safety culture in the industries.

Dust from industrial-scale processing of nanomaterials carries high explosion risk

Paul Amyotte and colleagues explain that dust explosions are among the earliest recorded causes of industrial accidents - dating back to a 1785 flour warehouse disaster - and are still a constant threat at facilities that process fine particles of various materials. Despite significant research, there is still much for scientists to learn about the risks of dust explosions in industry, especially of so-called "nontraditional" dusts (such as those made of nanomaterials), and a constant threat exists. That's why the researchers decided to probe the explosibility of three types of nontraditional dusts: nanomaterials; flocculent (fibrous or fuzzy) materials used in various products, such as floor coverings; and hybrid mixtures of a dust and a flammable gas or vapor.

After reviewing results of studies that exist on the topic, the researchers concluded that the energy needed to ignite nanomaterials made of metals, such as aluminum, is less than 1 mJ, which is less than 1/30th the energy required to ignite sugar dust or less than 1/60th the energy required to set wheat dust aflame. Flocking is often made with a process that generates static electricity, which could set off an explosion of flocculent dust, they point out. And the addition of a flammable gas or vapor to a dust as a hybrid mixture increases the chance that the dust will explode. The researchers warn that precautions should be taken to prevent these materials from exposure to sparks, collisions or friction, which could fuel an explosion.

Source: Washington, DC, February 15, 2012

Mega mock drill in Delhi to test quake preparedness

Delhi witnessed one of the biggest coordinated mock drills with disaster management agencies checking the alertness and preparedness of various other agencies in the event of an earthquake of 7.2 magnitude rocking the capital.

The drills were conducted in several places, including at six Metro stations, across the national Capital by the National Disaster Management Authority and Delhi Disaster Management Authority .

The drill's motive was to check the preparedness of the agencies in the event of an earthquake with a high intensity of 7.2 on magnitude.

Six metro stations were closed for over half-an-hour and road traffic in many areas in Central, South and North Delhi were diverted as part of the exercise, causing inconvenience.

Commuters in metro, buses as well as motorists also faced inconvenience because of the mega mockdrill.

They created a number of simulated situations like collapse of flyovers, crack in metro pillars, damage to hospitals and collapse of residential buildings.

Officials from all the important emergency support functionary departments like police, MCD, DMRC, Health department, Delhi Jal Board and Food and Civil Supplies coordinated the events with senior officials of all the nine districts to make the drill a success.

30^{TH} PROFESSIONAL DEVELOPMENT PROGRAM

30^{th} Professional Development programme was held on Sunday, 25^{th} March 2012 at Chennai. Mr S Ravishankar, Madras Atomic Power Station, Kalpakkam delivered a talk on "Safety in Nuclear Power Plant Operations". Large number of SEA members participated and enriched their knowledge.

The salient topics discussed in the programme is given below for the sake of SEA India members who could not attend the programme.

Power Generation Process in Nuclear Reactors

When a large fissile atomic nucleus such as uranium-235 or plutonium-239 is bombarded by a neutron, it undergoes nuclear fission. The heavy nucleus splits into two lighter nuclei (the fission products), releasing kinetic energy, gamma radiation and free neutrons. A portion of these neutrons may later be absorbed by other fissile atoms and trigger further fission events, which release more neutrons, and so on. This is known as a nuclear chain reaction.

In a nuclear power reactor, the energy released from continuous fission of the atoms in the fuel as heat is used to generate steam. The steam is used to drive the turbines which produce electricity (as in most fossil fuel plants, but without the combustion of fossil fuels and resultant greenhouse gas emissions).

Safety of Nuclear Power Stations: Safety has been given paramount importance in design, construction and operation of nuclear power stations. To ensure the safety of reactor, a defence-in-depth philosophy is followed, which leads to multiple barriers, diversity, redundancy, independence and fail-safe design of the safety-related systems. Safety of nuclear power stations is further ensured through sound design, using international standards and codes, stringent quality assurance, approved operating procedures, in-service inspection and maintenance of safety systems, etc.

Nuclear facilities are designed so that earthquakes and other external events will not affect the safety of the plant. Particular attention is paid to seismic issues in the siting, design and construction of nuclear power plants. The seismic design of such plants is based on criteria far more stringent than those applying to non-nuclear facilities. Power reactors are also built on hard rock foundations to minimize seismic shaking. The plants near the sea coast are also built at a higher elevation to avoid flooding during tsunamis.

Environmental Protection: Protection of the plant personnel, the environment and the public is an important consideration in the design, construction and operation of the nuclear power stations. Nuclear Power Corporation of India Limited (NPCIL) is the public sector enterprise entrusted with the task of nuclear power generation in India. All the nuclear power stations in India have been certified for ISO-14001 (Environment Management System) and ISO-18001 (Occupational Help and Safety Management System). The radiation source is adequately shielded, monitored and all operation and constantly maintenance works on the active systems are carried out strictly according to approved procedures.

The release of radioactivity to the environment from nuclear power stations is in very small quantities and it is a fraction of the limits stipulated by the Atomic Energy Regulatory Board (AERB). The radiation dose due to actual releases is insignificant compared to the dose received from the natural radiation background. A person living at the fence post of a nuclear power station receives a radiation dose in 10 years equivalent to the radiation dose of a single chest X-ray indicating the adequacy of radiation control in nuclear power plants.

It is interesting to compare the radiation exposures resulting from the operation of a nuclear power plant in India to the unavoidable natural background radiation exposure. Detailed surveys have shown that normal natural background radiation in different parts of the country varies from 2.01 millisievert/year (a unit for radiation measurement) at Tarapur in Maharashtra to 3.1 millisievert /year at Narora in Uttar Pradesh. It is estimated that annual average maximum individual exposure at a plant boundary of nuclear power stations is around 0.01-0.02 millisievert/year. These small additional exposures are indistinguishable in the large variations of natural background that are observed and have no impact whatsoever on the health of the population. ■