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INDIAN SAFETY ENGINEER

QUARTERLY JOURNAL OF SAFETY ENGINEERS ASSOCIATION

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38th Professional Development Programme

L-R: Mr S Ulaganathan, President; Mr Bevin Frederick Sequeria, Mr S Sri Ram, Secretary

The Thirty Eighth Professional Development Programme was held on August 17th 2014 at Chennai.

Mr Bevin Frederick Sequeria , B S & B Safety Systems (Asia Pacific) Pte Ltd delivered a technical talk on "Dust Explosions". Large number of SEA India members and invitees participated in the programme and enriched their knowledge.

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NEW EDITORIAL BOARD

The Editorial Board has been reconstituted with the following members on the Board.

1. **R Parameswaran**
2. **W A Balakumaran**
3. **P Manoharan**
4. **G S Swaminathan**
5. **K N Sen**

The SEA India members are requested to send articles/Case studies and any other E H S related matters if any to paramesh48@msn.com for publication in the journal and please ensure that the matter does not have copyright.

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NEBOSH Course Update

The next batch of NEBOSH course is scheduled to commence on Monday 8th December 2014 and the admission is in progress. As usual the contact classes will be conducted at Sri Ramachandra University, Porur, Chennai. We have proposed to have the examination I G C 1 on Monday 22nd December 2014 and I G C 2 on Tuesday 23rd December 2014. The examinations will be conducted by the British Council, Chennai.

SEA India encourages its members and other safety professionals to pursue this course to enhance their professional knowledge and career prospects. Those who are aspiring to join this course are requested to contact Mr Ramesh 044 24764101, SEA India or by mail,

info@seaindia.org or **paramesh48@msn.com** for getting admission.

FROM THE DESK OF PRESIDENT

Dear Members,

Seventy First Executive Committee meeting of SEA was held on 13-07-2014. Professional Development Programme on "Dust Explosion" was held on 17-08-2014. Our quarterly journal "Indian Safety Engineer" and the monthly 'Safety Alerts' (on important case studies) are brought out and distributed to Members periodically. After organsing a successful Factory visit programme to "Chennai Metro Rail - Underground Tunneling System" on 10th May 2014, we are trying to organize one more visit during October 2014 for the benefit of members who could not be accommodated during the previous visit.

Accreditation for conducting IGC (OSH) course has been renewed by Nebosh (UK) for 3 more years and is now valid till 26-09-2017. 15th Batch of NEBOSH IGC course is scheduled during 08th -19th December 2014 and Exams will be held on 22nd and 23rd December 2014. Members are advised to avail this value added programme and upgrade their qualifications.

Mumbai Chapter of SEA and Students Chapter at Anna University, Chennai are active. Safety Awareness programme was conducted to a group of about 200 students of Anna University (College of Engineering, Guindy)

Our efforts to relocate SEA office to a more spacious and convenient location continues.

Members are advised to fill up the Personal data update form in the event of any changes and submit to SEA office through email. Fresh forms may be obtained from SEA office.

Best Wishes!

S. Ulaganathan
President, SEA (India)

ILO Director-General: "Work claims more victims than war"

Guy Ryder announces ILO to renew efforts to get compliance for health and safety standards at work around the globe (ILO) news - Calling for "a culture of intolerance towards risks at work".

International Labour Organization (ILO) Director-General Guy Ryder told nearly 4,000 participants at the XX World Congress on Safety and Health at Work that safety and health will be an integral part of all the ILO's work.

Speaking in Frankfurt, Germany to occupational safety experts, politicians and scientists from 141 countries at the world's largest occupational safety event, Ryder said the ILO would focus on producing a greater impact on the global culture related to safety and health at work and on the ground in workplaces.

"Ebola and the tragedies it is causing are in the daily headlines - which is right. But work-related deaths are not. So, the task ahead is to establish a permanent culture of consciousness," said Ryder.

"The challenges we face is a daunting one. Work claims more victims around the globe than does war, an estimated 2.3 million workers die every year from occupational accident and diseases", Ryder added.

Ryder made clear the failure to ensure a safe and healthy workplace constitutes an unacceptable form of work: "This puts safety and health alongside forced labour, child labour, freedom of association and discrimination, which were recognized in the ILO Declaration of Fundamental Principles and Rights at Work."

BASICS ON DUST EXPLOSION

Mr Bevin Sequeira – *BS & B Safety Systems (Asia Pacific) Pte Ltd., Singapore delivered technical talk on* **"Dust Explosion".** *The gist of the talk is given in this article for the benefit of all SEA India members.*

Introduction to Dust Explosion:

A Dust Explosion is the fast combustion of dust particles suspended in the air in an enclosed location. Coal dust explosions are a frequent hazard in underground coal mines, but dust explosions can occur where any powdered combustible material is present in an enclosed atmosphere or, in general, in high enough concentrations of dispersed combustible particles in atmosphere.

Dust explosions can lead to loss of life, injuries, damage property and environmental damage as well as consequential damage such as business interruption losses.

Dust explosions involve most commonly "dust", i.e. fine material. This can be the product being handled or it can be produced as the result of the processing. However, in many cases fine dust is present in material that is otherwise too coarse to pose a dust explosion hazard, either as part of the product or generated by attrition during handling or transport. Therefore, while replacing a fine material by a granular one (such as pellets or flakes) will reduce the dust explosion hazards, this may not be sufficient to eliminate the hazards. Similarly, a user of a granular material may process it to a particle size that introduces dust explosion hazards.

Many dust explosions that occur in process plant are relatively small, leading to limited damage. However, under the right circumstances, even small explosions can escalate into major incidents. This is most commonly the case when secondary dust explosions happen. The typical scenario is that a small "primary" explosion raises a dust cloud, often from dust deposited over time on plant surfaces, and ignites the resulting dust cloud. This "secondary" explosion takes place in the workplace where often people are present, placing them in immediate danger. Secondary dust explosions can form a chain reaction that can run through a facility as long as fuel is present, leading to widespread devastation.

A fatal dust explosion at West Pharamaceutical Services, North Carolina, took the lives of 6 people in 2003

Conditions for dust explosion:

There are five necessary conditions for a dust explosion or deflagration:

1. Presence of Combustible Dust

2. Dust suspended in the air at a high concentration

3. There is an Oxidant (typically atmospheric oxygen)

4. There is an Ignition source (Either Flames & hot surfaces, Spontaneous Ignition, Friction sparks, Static Electricity, Electrical Equipment's, etc.)

5. Confinement (enclosed location)

Many materials which are commonly known to oxidise can generate a dust explosion, such as coal, sawdust. The dust can arise from activities such as transporting grain and indeed grain silos do regularly have explosions. Mining of coal leads to coal dust and flour mills likewise have large amounts of flour dust as a result of milling. A gigantic explosion of flour dust destroyed a mill in Minnesota on May 2nd, 1878, killing 18 workers

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Basics on Dust...

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at the Washburn A Mill.

To support combustion, the dust must also consist of very small particles with a high surface area to volume ratio, thereby making the collective or combined surface area of all the particles very large in comparison to a dust of larger particles. Dust is defined as powders with particles less than about 500 microns in diameter, but finer dust will present a much greater hazard than coarse particles by virtue of the larger total surface area of all the particles.

Sources of ignition:

There are many sources of ignition and a naked flame need not be the only one: over one half of the dust explosions were from non-flame sources. Common sources of ignition include electrostatic discharge friction arcing from machinery or other equipment; hot surfaces, including e.g. overheated bearings fire. However it is often difficult to determine the exact source of ignition post-explosion. When a source cannot be found, it will often be cited as static electricity. Static charges can occur by friction at the surfaces of particles as they move against one another, and build up to levels leading to a sudden discharge to earth.

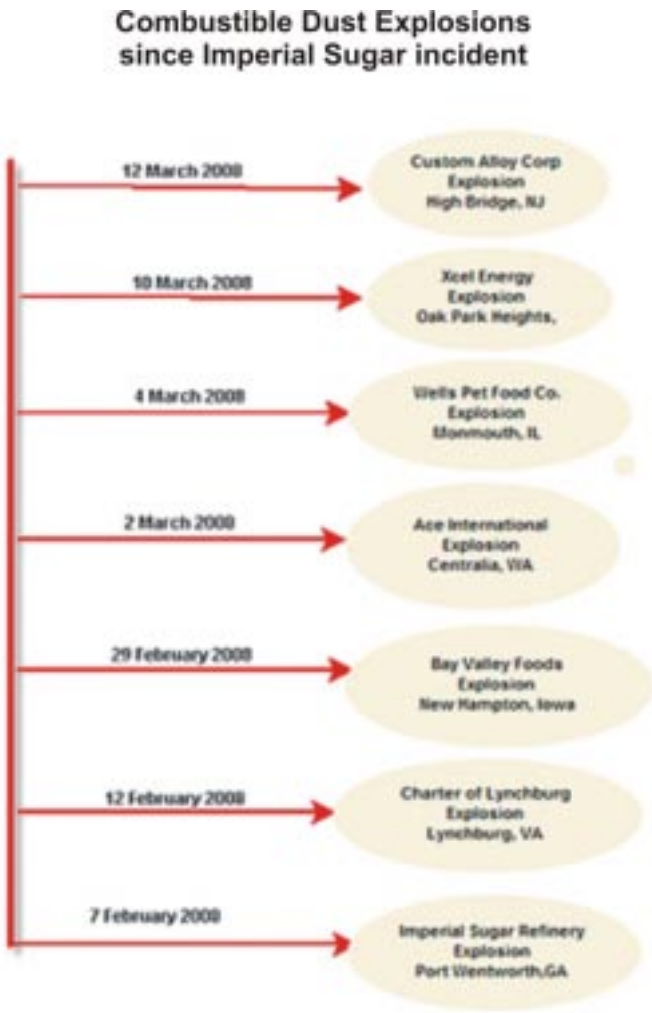
Combustible Dust Concentrations:

As with gases, dust is combustible with certain concentration parameters. These parameters vary widely across the spectrum. Highly combustible dust can form a flammable mixture with less than 15g/m^3.

Mechanism of dust explosions:

Dusts have a very large surface area compared to their mass. Since burning can only occur at the surface of a solid or liquid, where it

Imperial Sugar Explosion: Wentworth, GA (14 Fatalities)



can react with oxygen, this causes dusts to be much more flammable than bulk materials. For example, a 1 kg sphere of a material with a density of 1g/cm3 would be about 27 cm across and have a surface area of 0.3 m2. However, if it was broken up into spherical dust particles 50μm in diameter (about the size of flour particles) it would have a surface area of 60 m^2 This greatly increased surface area allows the material to burn much faster, and the extremely small mass of each particle allows it to catch on fire with much less energy than the bulk material, as there is no heat loss to conduction within the material. When this mixture of fuel and air is ignited, especially in a confined space such as a warehouse or silo, a significant increase in pressure is created, often more than sufficient to demolish the structure.

Even materials that are traditionally thought of as non-flammable, such as aluminium, or slow burning, such as wood, can produce a powerful explosion when finely divided, and

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Basics on Dust...

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can be ignited by even a small spark.

Terminology: Dust explosions may be classified as being either primary or secondary in nature.

Primary dust explosions: occur inside process plant or similar enclosures and are generally controlled by pressure relief through purpose-built ducting to atmosphere.

Secondary dust explosions: are the result of dust accumulation inside the factory being disturbed and ignited by the primary explosion, resulting in a much more dangerous uncontrolled explosion inside the workplace.

Historically, fatalities from dust explosions have largely been the result of secondary dust explosions.

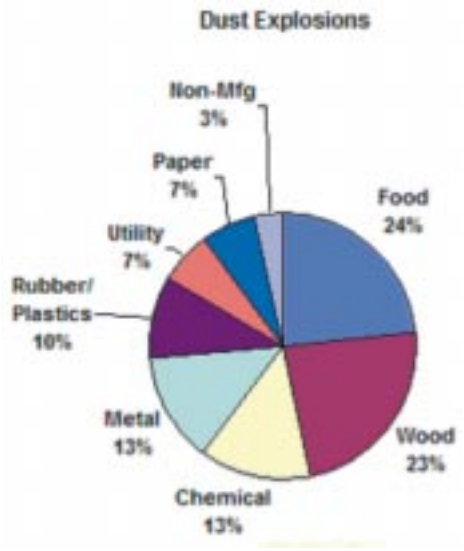
Best engineering control measures which can be found in the National Fire Protection Association (NFPA) Combustible Dust Standards include:

- Oxidant Concentration Reduction
- Deflagration venting
- Deflagration pressure containment
- Deflagration suppression
- Deflagration venting through a dust retention and flame-arresting devices
- Spark Detection & Extinguishing Systems

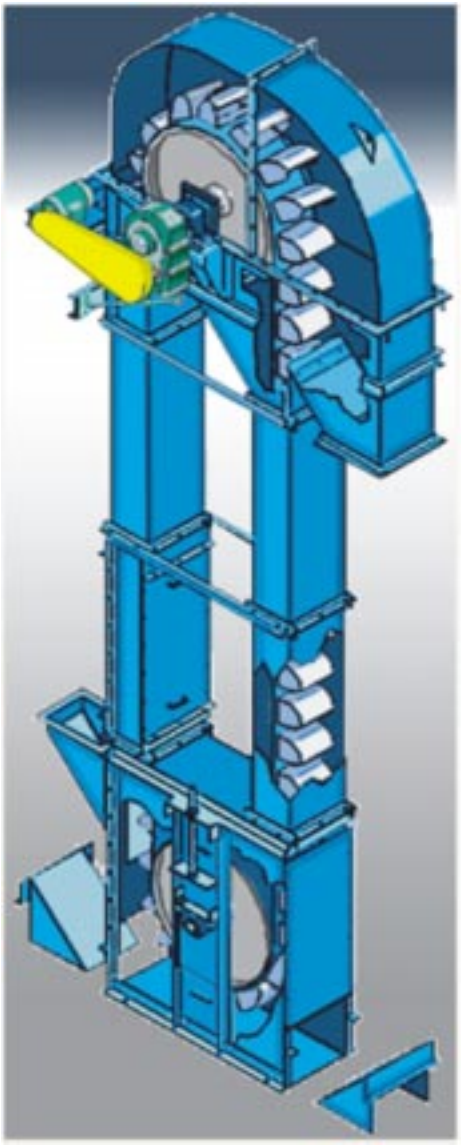
Explosive Materials:

The following materials are prone to dust explosions.

- Coal
- Fertilizer
- Cosmetics
- Pesticides
- Plastic & plastic resins
- Wood
- Charcoal



- Detergents
- Foodstuffs (sugar, flour, milk powder, etc.)
- Ore dusts



Protection of Bucket Elevators

- Metal dusts
- Graphite
- Dry industrial chemicals
- Pigments
- Cellulose

Industrial Equipment:

Typical industrial equipment's that require explosion protection.

- Dust Collectors
- Dryers
- Cyclones
- Crushers
- Grinders
- Silos
- Pulverisers
- Conveyors
- Conveyor ducts
- Screw conveyors
- Bucket Elevators
- Furnaces
- Hoppers
- Bins

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THEME WRITE-UP OF 47TH ENGINEERS DAY
SEPTEMBER 15, 2014

Theme: **"Making Indian Engineering World-class"**

"World-class" engineers denotes the engineers of tomorrow with a broad range of competencies and skills to synthesize new ideas; and develop new processes and technologies to address contemporary challenges to suit global needs anywhere in the world. The word "World-class" is a relative term and is very difficult to define as there is no datum or fixed standard to classify any engineering work as "World-class". The phrase has different connotations in countries from different categories, viz. Developed, Developing and Under-developed, based on their economic and social standards. However, the engineers, who are the harbinger of development of any country, always strive for enrichment of their knowledge and skill to upgrade the quality of life and their performance. The pursuit for betterment is a continuous process. There is no end to development and engineering progress. The process of upgradation from one standard to the other, from 'under-developed' to 'developing', or from 'developing' to 'developed', is a continuous process, which is led by the engineers after taking into account the prevailing sociopolitico-economic conditions of the particular country.

Engineers are key figures in the material progress of the world. A world-class engineer, regardless of the job he is engaged in, is always considered an asset to the nation and the society; as it is he who makes a reality of the potential value of science by translating scientific knowledge into tools, resources, energy, and labour to bring science into the service of the country.

It is a challenge to conclude about the class to which the engineers of India belong. In the diversified, heterogeneous nature of development in our country, the engineers have to work from construction of rural roads to manufacturing of spaceships to Mars. Both are equally important for accelerating the development of the country. There is no scope to undermine the contemporary skill and knowledge of the engineers of our country. It is a matter of pride that Indian engineers, whether working in the country or outside, are a force to reckon with globally.

The knowledge, skill, and wisdom of Indian engineers is no less than that of their counterparts from other so-called "advanced" countries. Due to the socio-politico-economic structure of our country, engineering is still very much labour-intensive. Unlike in other parts of the developed world, Indian engineers are quite capable of blending the modern mechanized systems with prevailing traditional human-oriented activities.

However, it does not mean that the pursuit for self-enrichment by Indian engineers will not be perceived. India requires large numbers of qualified and competent engineers to address the numerous challenges faced in the developmental journey. To produce large numbers of competent engineering and technical

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Basics on Dust...

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Dust Explosion by Equipment: 127 Incidents

Equipment type	% of incidents
Dust collector	52
Impact Equipment	17
Silos & Bins	13
Dryers & Ovens	9
Processing Equipment	6
Conveyor	3

Conclusions

Many reported dust explosions have originated in common powder and bulk solids processing equipment such as dust collectors, dryers, grinders/pulverisers, and blenders. Electrostatic discharges are frequently cited as the ignition source for dust collector and blender explosions, whereas particulate overheating is the most common ignition source in dryer explosions, and friction/impact heating associated with tramp metal or misaligned parts is probably the most frequent ignition source in grinder/pulveriser explosions.

Dust explosions are often exacerbated by propagation through ducting between process equipment, frequently via dust collector pickup and return ducting. More widespread use of effective deflagration isolation devices in such ducting would clearly be beneficial in mitigating the damage and injuries from these propagating dust explosions.

Secondary dust explosions in processing buildings probably cause the largest numbers of dust explosion fatalities and injuries. One crucial aspect of secondary dust explosion prevention and mitigation is greater awareness of good housekeeping and maintenance practices to prevent particulate leakage from equipment and subsequent accumulations of dust deposits in large areas of the buildings. ■

CRYSTALLINE SILICA

What is crystalline silica?

Crystalline silica is a basic component of soil, sand, granite, and many other minerals. Quartz is the most common form of crystalline silica. Cristobalite and tridymite are two other forms of crystalline silica. All three forms may become respirable size particles when workers chip, cut, drill, or grind objects that contain crystalline silica.

What are the hazards of crystalline silica?

Silica exposure remains a serious threat to nearly 2 million U.S. workers, including more than 100,000 workers in high risk jobs such as abrasive blasting, foundry work, stonecutting, rock drilling, quarry work and tunneling. The seriousness of the health hazards associated with silica exposure is demonstrated by the fatalities and disabling illnesses that continue to occur in sandblasters and rockdrillers. Crystalline silica has been classified as a human lung carcinogen. Additionally, breathing crystalline silica dust can cause silicosis, which in severe cases can be disabling, or even fatal. The respirable silica dust enters the lungs and causes the formation of scar tissue, thus reducing the lungs' ability to take in oxygen. There is no cure for silicosis. Since silicosis affects lung function, it makes one more susceptible to lung infections like tuberculosis. In addition, smoking causes lung damage and adds to the damage caused by breathing silica dust.

What are the symptoms of silicosis?

Silicosis is classified into three types: chronic/classic, accelerated, and acute.

Chronic/classic silicosis, the most common, occurs after 15-20 years of moderate to low exposures to respirable crystalline silica. Symptoms associated with chronic silicosis may or may not be obvious; therefore, workers need to have a chest x-ray to determine if there is lung damage. As the disease progresses, the worker may experience shortness of breath upon exercising and have clinical signs of poor oxygen/carbon dioxide exchange. In the later stages, the worker may experience fatigue, extreme shortness of breath, chest pain, or respiratory failure.

Accelerated silicosis can occur after 5-10 years of high exposures to respirable crystalline silica. Symptoms include severe shortness of breath, weakness, and weight loss. The onset of symptoms takes longer than in acute silicosis.

Acute silicosis occurs after a few months or as long as 2 years following exposures to extremely high concentrations of respirable crystalline silica. Symptoms of acute silicosis include severe disabling shortness of breath, weakness, and weight loss, which often leads to death.

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Theme Write-up ....

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personnel to take on the global challenges, India will need to complete the following activities to transform the curriculum for training and skill upgradation:

i) Generate awareness about the global nature of the profession,in-tune with growing challenges and opportunities

ii) Develop a comprehensive understanding in the respective engineering discipline to tackle complex, real-world problems

iii) Accept challenges and solve them with wisdom and shared knowledge

iv) Acquire knowledge and expertise through lifelong education and continuous learning

v) Build familiarity in other engineering and scientific disciplines so that interdisciplinary solution approaches can be evolved

vi) Pursue opportunities to apply skills in both traditional and non-traditional fields to address societal challenges

vii) Communicate and interact with other highly recognized international leaders in engineering, and

viii) Establish themselves as personalities with ethical and noble values. Achieving excellence is a journey that needs considerable effort. It requires a transition from a reactive, compliance-based approach to a proactive, contributory and value-add mindset to create an environment of sustained operational progress. Over the long-term, world-class engineers will create a set of approaches and best-practices that will improve tomorrow's world, create long-term value, and institutionalize business sustainability. ■

Crystalline....

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Where are construction workers exposed to crystalline silica?

Exposure occurs during many different construction activities. The most severe exposures generally occur during abrasive blasting with sand to remove paint and rust from bridges, tanks, concrete structures, and other surfaces. Other construction activities that may result in severe exposure include: jack hammering, rock/well drilling, concrete mixing, concrete drilling, brick and concrete block cutting and sawing, tuck pointing, tunneling operations.

Where are general industry employees exposed to crystalline silica dust?

The most severe exposures to crystalline silica result from abrasive blasting, which is done to clean and smooth irregularities from molds, jewelry, and foundry castings, finish tombstones, etch or frost glass, or remove paint, oils, rust, or dirt form objects needing to be repainted or treated. Other exposures to silica dust occur in cement and brick manufacturing, asphalt pavement manufacturing, china and ceramic manufacturing and the tool and die, steel and foundry industries. Crystalline silica is used in manufacturing, household abrasives, adhesives, paints, soaps, and glass. Additionally, crystalline silica exposures occur in the maintenance, repair and replacement of refractory brick furnace linings.

In the maritime industry, shipyard employees are exposed to silica primarily in abrasive blasting operations to remove paint and clean and prepare steel hulls, bulkheads, decks, and tanks for paints and coatings.

How is OSHA addressing exposure to crystalline silica?

OSHA has an established Permissible Exposure Limit, or PEL, which is the maximum amount of crystalline silica to which workers may be exposed during an 8-hour work shift (29 CFR 1926.55, 1910.1000). OSHA also requires hazard communication training for workers exposed to crystalline silica, and requires a repirator protection program until engineering controls are implemented. Additionally, OSHA has a National Emphasis Program (NEP) for Crystalline Silica exposure to identify, reduce, and eliminate health hazards associated with occupational exposures.

What can employers/employees do to protect against exposures to crystalline silica?

Replace crystalline silica materials with safer substitutes, whenever possible.

Provide engineering or administrative controls, where feasible, such as local exhaust ventilation, and blasting cabinets. Where necessary to reduce exposures below the PEL, use protective equipment or other protective measures.

Use all available work practices to control dust exposures, such as water sprays.

Wear only a certified respirator, if respirator protection is required. Do not alter the respirator. Do not wear a tight-fitting respirator with a beard or mustache that prevents a good seal between the respirator and the face.

Wear only a Standard abrasive-blast supplied-air respirator for abrasive blasting.

Wear disposable or washable work clothes and shower if facilities are available. Vacuum the dust from your clothes or change into clean clothing before leaving the work site.

Participate in training, exposure monitoring, and health screening and surveillance programs to monitor any adverse health effects caused by crystalline silica exposures.

Be aware of the operations and job tasks creating crystalline silica exposures in your workplace environment and know how to protect yourself.

Be aware of the health hazards related to exposures to crystalline silica. Smoking adds to the lung damage caused by silica exposures.

Do not eat, drink, smoke, or apply cosmetics in areas where crystalline silica dust is present. Wash your hands and face outside of dusty areas before performing any of these activities.

Remember: If it's silica, it's not just dust. ■

WORKING SAFELY WITH ACETYLENE

Introduction

This article provides guidance on the fire and explosion hazards of acetylene. It is for people who use acetylene for welding, cutting and similar processes.

The article does not cover fixed installations where acetylene is used.

(Note that cylinder valves will be operated either by a 'cylinder key' or a 'handwheel').

What does the law say?

There are specific legal duties relating to acetylene under the Health and Safety at Work Act and Regulations. This article will help people who use acetylene to comply with their legal duties.

Explosion hazard of acetylene cylinders

An acetylene cylinder has a different design from most other gas cylinders. It consists of a steel shell containing a porous mass. The acetylene gas in the cylinder is dissolved in acetone which is absorbed by the porous mass. Decomposition of the acetylene is triggered by heat, eg when it is:

- involved in a fire;
- scorched by flames from a blowtorch; or
- involved in a flashback.

The porous mass slows down any decomposition of the gas. From the start of decomposition to the cylinder exploding could take several hours. This should provide time for emergency action.

Decomposition can be triggered more easily and proceed more rapidly if:

- the porous mass has been damaged by repeated flashbacks;
- the cylinder has been mishandled or dropped;
- the cylinder valve is leaking; or
- the acetylene in the hoses is above the pressure recommended by the supplier.

There are a number of incidents each year where a flashback into an acetylene cylinder triggers decomposition, leaving the cylinder in a dangerous, unstable condition, which can lead to an explosion.

A flashback occurs if there is a flammable mixture of fuel gas and oxygen in the hoses when the torch is lit. This can ignite the mixture and will travel backwards into the cylinder. A flashback can cause decomposition of the acetylene.

An explosion of the cylinder immediately after a flashback is rare. If decomposition is identified early, there is time to evacuate, call the fire and rescue services and take emergency action.

The fire and rescue services cool cylinders for at least an hour, then monitor them for another hour. They then decide whether it is safe to enter the exclusion zone or move the cylinder.

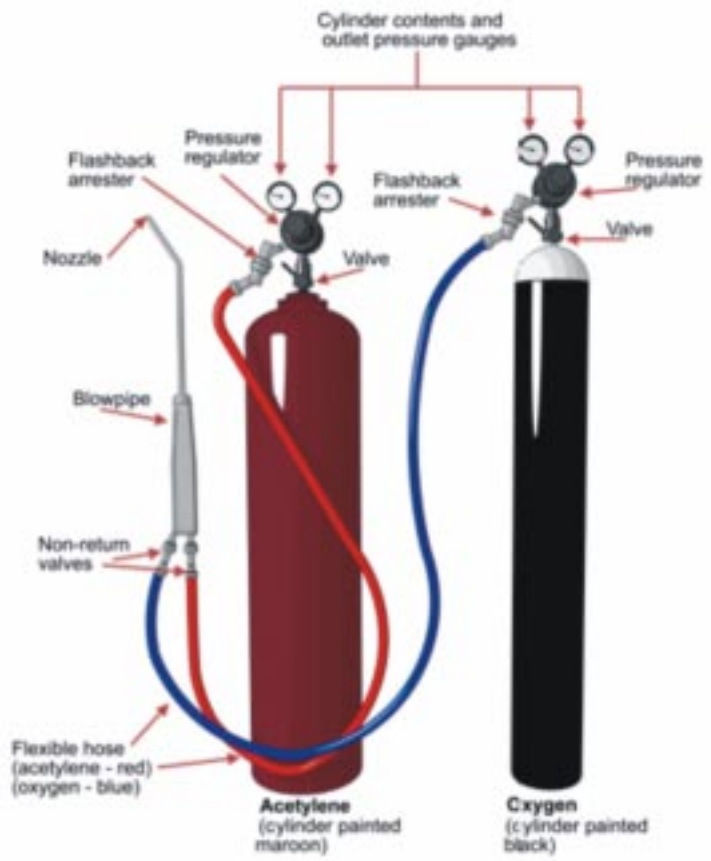

Figure 1 Typical equipment used in oxy/acetylene gas welding and similar processes

Other hazards

If acetylene gas is drawn off from cylinders too quickly, acetone can

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Working....

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be mixed with the gas. This can cause the equipment to malfunction. Acetylene gas can also condense and drip off the torch, causing a fire risk. To avoid this, the rate of withdrawal of gas should be restricted to the values given in the British Compressed Gases Association (BCGA) Code of Practice The design and construction of manifolds using acetylene gas from 1.5 bar to a maximum working pressure of 17 bar (246.5/bf/in^2).

The working pressure of acetylene equipment is critical: Acetylene pressure must not exceed 0.62 bar (9psi) unless equipment has been specifically designed for it.

How to prevent flashback

Only use regulators, flashback arrestors, hoses and blowpipes designed for acetylene and oxygen, respectively, and marked and manufactured to the correct ISO Standards.

For most welding and cutting processes, the acetylene pressure should not exceed 0.62 bar (9psi).

Before use

Check:

- the identification on the cylinder;
- that it looks safe for use;
- that it is clean with no obvious damage.

After use

- Check there is no obvious damage.
- Turn off all valves (at cylinder, blowpipes etc).
- Vent excess gas from the hoses.

Training

- Do not use oxy/acetylene equipment unless you have been trained.

Use the correct lighting-up procedures

- Before lighting the blowpipe, purge the hoses by opening the gas supply to each hose for a few seconds. This will flush out any flammable mixtures of gases in the hose.
- Purge one hose at a time and close the blowpipe valve after purging.
- Use a well-ventilated area.
- Use a spark ignitor to light the gas.
- Use the correct gas pressures and nozzle sizes for the job.

Handle acetylene cylinders with care

- Do not drop or jar them.
- Do not roll them across the floor.
- Keep them in an upright position, and if returned to an upright position, leave for an hour to settle.

Fit flashback arresters (or equivalent)

- Fit flashback arresters onto the pressure regulators on both the acetylene cylinder and the oxygen cylinder. These, or equivalent devices, prevent any decomposition travelling back into the cylinder.
- For long lengths of hose, fit arresters on both the blowpipe and the regulator, and shorten the hose as soon as the long length is no longer required.

Note: The fitting of flashback arresters is not a substitute for safe working practices.

Maintain non-return valves

- Fit non-return valves (often called check valves) on the torch, to prevent backfeeding of gas into the hoses.
- Inspect regularly and replace damaged non-return valves.

Note: Non-return valves will not stop a flashback once it has occurred.

Keep nozzles in good condition

Poorly maintained nozzles cause turbulent gas flow, which increases the risk of flashback.

- Inspect nozzles regularly. Make sure they are not blocked by dirt or spatter.

Replace damaged nozzles.

- Do not hold the nozzle too close to the workpiece. The nozzle can overheat and cause a flashback.

What to do if there is a flashback

If a flashback does occur:

- immediately close both the blowpipe/nozzle valves, oxygen first, then acetylene.

(Note: this is opposite to the normal closing-down procedures);

- close both cylinder valves;
- if the flame cannot be put out at once, evacuate the area and call the fire and rescue services;
- find the cause of the incident and examine all equipment for damage;
- do not move or vent cylinder, monitor for any heat over the next hour;

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ENERGY SAVING BULBS

Energy Saving Bulbs have been in existence for a long time now. As the name indicates, these bulbs are more effective as compared to an ordinary bulb in terms of power consumption. Most of us are currently using these bulbs in order to save on electricity consumption and ultimately the electricity bill.

Energy saving Bulbs will come in different shapes on the market with different ratings in terms of Voltage or Watts and they will definitely save our pockets especially that, we are buying electricity in our respective houses.

Some Health and Safety issues on these low-energy light bulbs:

However, these types of bulbs, if broken, cause serious danger.

- If one breaks, everybody will have to leave the room for at least 15 minutes, because it contains Mercury (poisonous) which causes migraine, disorientation, imbalances and different other health problems, when inhaled.
- It causes many people with allergies, severe skin conditions and other diseases just by touching this substance or inhaling it.
- Do NOT clean the debris of the broken bulb with vacuum cleaner, because it wouuld spread contamination to other rooms in the house when using the vacuum cleaner again. It must be cleaned up with a normal broom or brush be kept in a sealed bag and disposed of right away from the house in a bin for hazardous materials.

WARNING: Mercury is poisonous than lead or arsenic!

Below is the advice on what to do if a low-energy light bulb breaks be it at home or where these bulbs can be found:

1. Evacuate the room, taking care not to step on the shards of glass littering on the floor.
2. Do not use a vacuum cleaner to clear up the mess as the machines sucking action could spread toxic mercury droplets around the house.
3. Put rubber gloves to sweep the debris onto the dustpan.

Infected foot of a person stepped on to a broken mercury bulb

4. Place the remains in a plastic bag and seal it.
5. Do not put the plastic in a normal household bin.
6. Instead, place it in Municipal recycling bin for batteries which also contains mercury to take it to a council dump where it can be disposed of safely.
7. Try not to inhale dust from the broken bulb. ■

Working safely....

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- if a hotspot is detected, or the cylinder begins to vibrate, immediately evacuate the area and call the fire and rescue service;
- before using again, make sure all equipment is working effectively, especially anything that might have been affected by heat. If in doubt, consult your supplier.

General maintenance

Regulators and other equipment should be maintained in line with the manufacturer's recommendations. If uncertain, refer to your supplier or the BGCA guidance.

Carrying acetylene in vehicles

Acetylene has an unusually wide explosive limit which means that even a small leak in an enclosed space can cause an explosive atmosphere to build up. Acetylene cylinders should therefore be transported in open vehicles where it is reasonably practicable.

If this is not reasonably practicable and acetylene cylinders or an oxy/acetylene set has to be carried in the rear of a closed van, you must ensure that there is ventilation fitted to the load space of the vehicle. In most vans, this can be two low level ventilation grills and rotary roof vents which will increase the air changeover rate in the load space when the vehicle is parked or moving.

Note: A large release, such as when valves are not closed or do not close properly, will cause an explosive atmosphere to develop quickly even with ventilation (although the gas may dissipate once the cylinder is empty). Following industry guidance on removing the hoses from the cylinders reduces the risk of this not being noticed. ■

CASE STUDY

BURSTING OF HEAT EXCHANGER DURING PNEUMATIC TESTING

A fatal accident had occurred, while carrying out pneumatic test on the core assembly of the plate type heat exchanger in the factory.

HISTORY:

The factory was involved in the manufacturing of welded Plate type heat exchangers. The heat exchanger had main parts like core assembly, shell, end covers. The manufacturing process for plate type heat exchanger was as follows. The s.s. plate were cut to a circular shape with holes in it for inlet/ outlet on the automated press machine. These chevron type plates welded to form a cassette. Depending upon the capacity of the heat exchanger, number of cassettes stacked to obtain a plate pack and perimeter welded together to form a cylindrical shape core. A circular plate with hole was welded at upper end of the core, on which a flange (top cover) was welded. The top cover was provided with two nozzles welded with a flanges-one for inlet and other for outlet. The cylindrical shell was welded with a bottom cover. The core assembly was fitted in the shell.

During the manufacturing process, the core assembly was being tested for leakage at welded joints. The testing was being carried out in three stages. Initially the core assembly was pneumatically tested to locate and the leakages were rectified. Then the assembly was immersed into water and pressurized air was passed through the assembly to find further leakages if any and these leakages were rectified. Finally, hydro test was carried out.

The pneumatic test was being carried out as follows. The core assembly was being clamped between the top and bottom flanges. Out of the two nozzles provided to the top flange, one was closed by fitting a blank flange and other was fitted with a flange having nipple. Then pressurized air from a compressor was being passed into the core assembly by a hose connected to the nipple through a valve. With this the core assembly got pressurized and air came out from the portion where, welding was not proper. Then air was being released and leakage was being rectified by welding and again procedure was being repeated for finding further leakage if any.

ABOUT ACCIDENT:

The deceased was working as a helper. On the day of incidence, the deceased and other two workers were entrusted with the work of testing of the core assembly required for the Heat Exchanger. Accordingly, for carrying out the said work, they kept the circular shape bottom flange on a cylindrical shell. The bottom flange was already provided with 8 no. of clits at its

periphery. The clits were in the form of pieces of m.s. pipe of size 35 mm I.D. x 45 mm O.D. x 40 mm height. They provided 5 no. of clits to the top flange at its periphery. For that purpose they used pieces of m.s. pipe each of size about 35 mm I.D. x 50 mm O.D. x 40 mm height and welded it to the periphery of the top flange. The core assembly with the top flange was placed vertically on the bottom flange kept on the shell. They inserted 5 no. of studs, each of size M 27 X 1000 mm length through the clits provided to the top and bottom flanges and put washer, nuts from both ends. The core assembly was clamped by tightening the nuts from both ends of the studs. One of the nozzles provided on the top flange was closed by providing a blank flange fitted with nuts and bolts. The other nozzle was fitted with a flange having a ½ "nipple by using nuts and bolts. A rubber hose of ½" dia was attached to the pressurized air pipe line and its other end was connected to the nipple on the flange fitted on the top end

cover (flange) through a ball valve. One worker opened the ball valve and passed pressurized air into the core assembly. The deceased and the other worker observed the core assembly and checked for the leakages. They rectified two leakages. Then, the ball valve was opened again and pressurized air was passed into the core assembly for checking further leakage, if any. The deceased reported about the leakage in the core assembly. It was necessary to stop the air supply and release the air from the core assembly for rectifying the leakage. So, one worker went at the valve for closing it, while the deceased along with the other worker were observing the leakage spot at the core assembly from opposite side. When he was about to close the valve, 3 no. of the clits of the bottom flange and 3 no. of studs gave a way and the core assembly burst open. The top flange along with few cassettes turned rapidly in vertical plane. With this the projecting portion of the bolt, fitted to the blank flange on the nozzle at the top flange hit and pierced in the head of the deceased worker. He was seriously

(A schematic sketch is available, next page)

Case Study....

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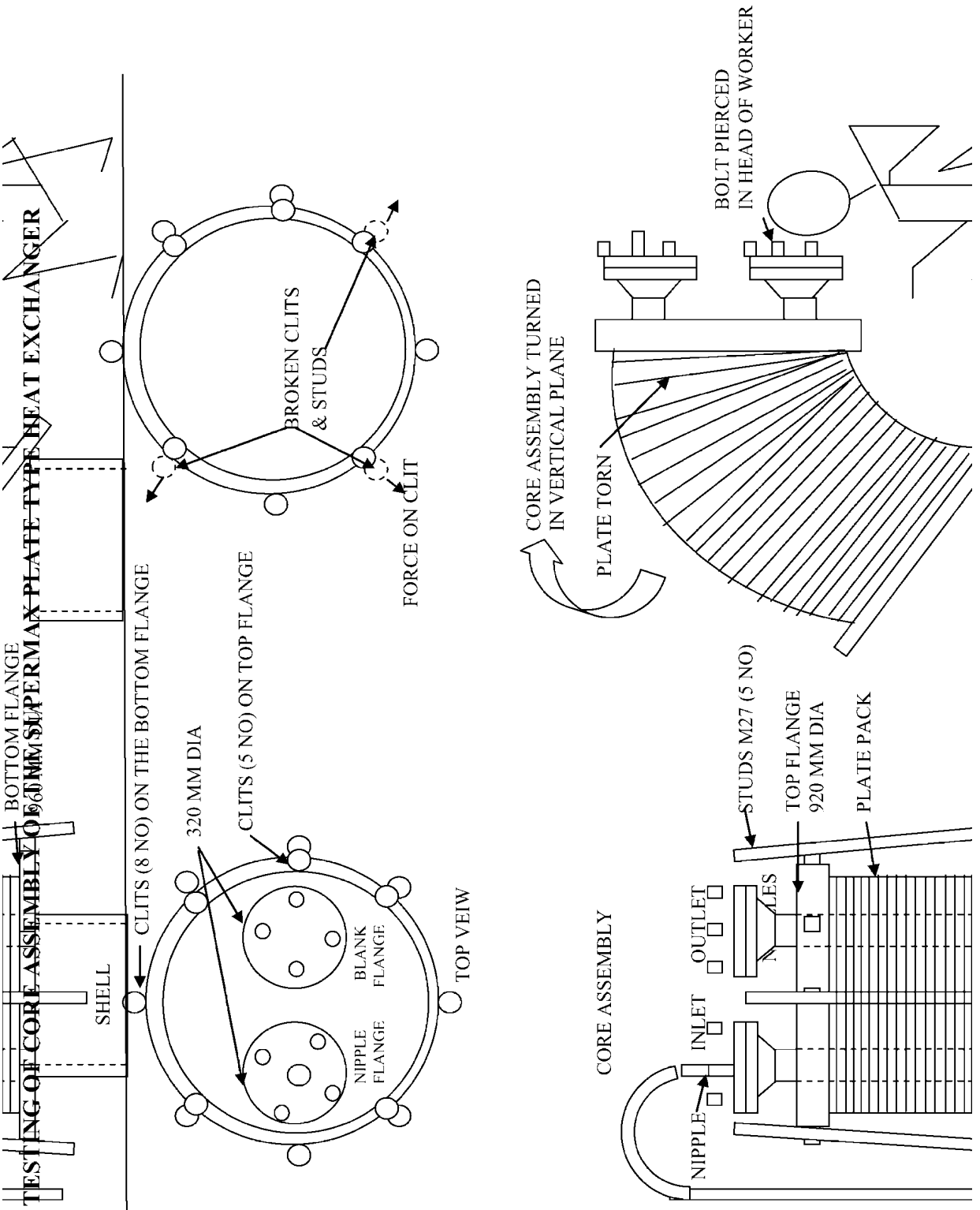

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Case Study....

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injured and died on the spot. The other worker fell unconscious due to impact of bursting of the core assembly. He received minor injury.

OBSERVATIONS:

The core assembly of the Heat Exchanger included the parts like- Plate pack, top flange (end cover) and bottom flange. The plate pack was of cylindrical shape formed by 132 no. of s.s. circular plates welded together, each of size about 800 mm dia x 0.8 mm thick. There were two circular openings each of size 150 mm dia in each plate provided for inlet /outlet. The plate pack was found burst open and found expanded. The bottom flange was of m.s. and of circular shape having size of about 960 mm dia x 40 mm thick. It was found provided with 8 no. of clits welded equidistance at periphery of the bottom flange. The clit is prepared from m.s. pipe and was of size about 45 mm

O.D. x 35 mm I.D. x 40 mm height. The distance between the consecutive clits was about 380 mm. Out of these 8 number of clits, 3 number of clits were found gave a way. The top flange was of m.s. and of circular shape having size of about 920 mm dia x 90 mm thick. It was found provided with 5 no. of clits welded at periphery of the top flange. The clit was prepared from m.s. pipe and was of size about 50 mm O.D. x 35 mm I.D. x 40 mm height. The distance between the consecutive clits was not equal and it was about 700 mm, 420 mm, 420 mm, 720 mm, 800 mm. Total 5 number of studs each of size M 27 x 1000 mm length were used for clamping the plate pack between the top and bottom flanges. Out of these 3 numbers of studs were found broken. The weight of then core assembly was about 1200 Kg. Air at pressure 6 Kg/cm2 was supplied to the core assembly by using ½ " rubber hose x 12 metre length through a ball valve. There was no pressure reducing valve provided in the air pipe line.

WHAT WENT WRONG?

i)The centres of clits were not aligned due to unequal diameters of the top and bottom flanges and also due to location of clits at unequal distances. Hence studs did not remain in vertical position, causing unbalanced force on the clits exerted by pressurized air in the core assembly and bending stress on studs. Out of 8 numbers of clits 3 no. of clits of bottom flange gave a way and 3 no. of studs broke.

ii)Total 5 numbers of studs were used for clamping the plate pack between the flanges. Out of these, 4 numbers of studs were fitted diagonally opposite and no stud was provided opposite to the 5th stud. The unequal tightening of the nuts caused bending stress to act on the studs, which led to failure of 3 numbers of clits and studs.

Thus equidistant holes in the flanges or clits of adequate strength ought to have been provided for fitting studs. Also diagonally opposite studs i.e. even numbers of studs ought to have been used for clamping. Thus the clamping arrangement for the plate pack of the heat exchanger was not of sound engineering design and construction.

iii) The core assembly was kept on a cylindrical shell having size about 585 mm dia x 360 mm height x 12 mm wall thickness. The bottom flange was of 960 mm diameter. Thus the core assembly was projecting outside the shell and was not well supported. A stand of sound construction ought to have been provided for mounting the core assembly. The pneumatic test of the core assembly of the heat exchanger ought to have been carried out with the core assembly properly mounted and fitted on the stand, so as to prevent random movement of the core assembly, in case it burst open. Thus the mounting arrangement for the core assembly of the heat exchanger was not safe.

iv)For carrying out pneumatic test air at pressure of about 6 Kg/cm2 was supplied from the air compressor through a ball valve. There was no pressure reducing valve provided in the air pipe line for reducing the pressure to safe value for preventing the bursting of the core assembly of the heat exchanger. The safety valve, pressure gauge, pressure switch ought to have been provided in pressurized air supply system. Thus the arrangement for the pneumatic testing of the core assembly of the heat exchanger was not safe.

v) The Safe Operating Procedure (SOP) for pneumatic testing of the core assembly of the Heat exchanger was not found displayed near the test area.

REMEDIAL MEASURES SUGGESTED:

i)The clamping arrangement for the plate pack of the heat exchanger shall be of sound engineering design and construction.

ii) The pneumatic test of the core assembly of the heat exchanger shall be carried out with the core assembly properly mounted and fitted on the stand / fixture, so as to prevent random movement of the core assembly, in case it burst open.

iii) The pressurized air supply system consisting a safety valve, pressure gauge, pressure switch shall be provided close to the core assembly subjected to the pneumatic testing. A pressure reducing valve shall be provided in the air supply line before the system. The air pressure for testing shall be maintained to the minimum required safe value for preventing the bursting of the core assembly of the heat exchanger.

iv) A Safe Operating Procedure (SOP) for pneumatic testing of the core assembly of the Heat exchanger shall be displayed and followed invariably.

■

IN THE NEWS

World Heart Day 2014: salt reduction saves lives

On World Heart Day, held on 29 September 2014, WHO is calling on countries to take action on the overuse of salt by implementing WHO's sodium reduction recommendations to cut the number of people experiencing heart disease and stroke, and, in turn, save lives.

Target: 30% salt reduction by 2025

Noncommunicable diseases, including heart disease and stroke, are the leading causes of premature death in the 21st century. WHO is supporting governments to implement the "Global action plan to reduce noncommunicable diseases" that comprises nine global targets, including one to reduce global salt intake by a relative 30% by 2025.

"If the target to reduce salt by 30% globally by 2025 is achieved, millions of lives can be saved from heart disease, stroke and related conditions," says Dr Oleg Chestnov, WHO Assistant Director-General for Noncommunicable Diseases and Mental Health.

The main source of sodium in our diet is salt. It can come from sodium glutamate and sodium chloride, and is used as a condiment in many parts of the world. In many countries, 80% of salt intake comes from processed foods such as bread, cheese, bottled sauces, cured meats and ready-made meals.

Increased risk of hypertension/high blood pressure, heart disease and stroke risks

Consuming too much salt can lead (or contribute) to hypertension, or high blood pressure, and greatly increase the risk of heart disease and stroke.

On average, people consume around 10 grams of salt per day. This is around double WHO's recommended level from all sources, including processed foods, ready-made meals and food prepared at home (less than 5 grams or under one teaspoon per day). WHO recommends that children aged 2 to 15 years consume even less salt than this, adjusted to their energy requirements for growth.

"Salt is in almost everything we eat, either because high levels of salt are found in most processed and prepared foods, or because we are adding salt when we prepare food at home," adds Dr Chestnov.

Dr Chestnov said that reducing salt intake is one of the most effective ways for countries to improve population health, and urged the food industry to work closely with WHO and national governments to incrementally reduce the level of salt in food products.

Strategies to reduce salt consumption

WHO's evidence-based strategies to reduce salt consumption include:

- regulations and policies to ensure that food manufacturers and retailers reduce the levels of salt in food and beverage products;
- agreements with the industry to ensure that manufacturers and retailers make healthy food (with low salt) available and affordable;
- fostering healthy eating environments (that promote salt reduction) in public places such as schools, hospitals, workplaces and public institutions;
- ensuring clear food labelling so consumers can easily understand the level of salt in products;
- " implementing WHO's recommendations on the marketing of foods and non-alcoholic beverages to children.

Strategies for individuals and families to reduce salt intake include:

- reading food labels when buying processed food to check salt levels;
- asking for products with less salt when buying prepared food;
- removing salt dispensers and bottled sauces from dining tables;
- limiting the amount of salt added in cooking to a total maximum amount a fifth of a teaspoon over the course of a day;
- limiting frequent consumption of high salt products;
- guiding children's taste buds through a diet of mostly unprocessed foods without adding salt.