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INDIAN SAFETY ENGINEER

QUARTERLY JOURNAL OF SAFETY ENGINEERS ASSOCIATION
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VOL: 11 No. 4 **OCTOBER – DECEMBER 2012**

FROM THE DESK OF PRESIDENT

Dear Members,

A collaborative programme on 'H& S Risk Assessment' was jointly conducted with Regional Labour Institute, Chennai and Sri Ramachandra University at Chennai on 02nd & 3rd November 2012. Inspectorate of Factories, Govt. of Tamil Nadu supported the programme.

61st Executive Committee meeting of SEA was held on 08th December 2012. 32nd Professional Development Programme was held on 04th November 2012. Our journal "Indian Safety Engineer" for the third quarter 2012 was released in October 2012 and hopefully the next issue for the last quarter of 2012 will reach you soon. We are trying to schedule a factory visit during early 2013.

Mumbai Chapter of SEA is witnessing some hiccups due to few of their office bearers leaving Mumbai for taking up assignments in other places. They are planning to address these issues and elect new Coordinators for the Chapter in their next Committee meeting scheduled in January 2013.

There are no further updates from our Hazira Chapter at Gujarat. However, SEA (India)'s next Chapter is now taking shape at New Delhi. A meeting was held recently and the constitution is in progress. Let us wish them good luck.

Eleventh Batch of NEBOSH, IGC course by SEA India was conducted in October 2012, 20 members attended classes and wrote the examinations. Results have just come in and most of them have passed out with good marks. Admissions for March 2013 batch are in progress.

SEA (India) website, www.seaindia.org is now fully functional. Members may advise their Service providers / vendors to advertise their products/services in the exclusive web page available in the site towards bringing in awareness among members.

SEA Library is now set up and full list of these books are available at SEA Office. Suggestions are welcome from members towards making use of these wealth of knowledge.

Wish you and your family members a Safe, Healthy and Prosperous New Year, 2013

Best Wishes!

S. Ulaganathan
President, SEA (India)

SEA India wishes A HAPPY AND SAFE

Inside....

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NEBOSH Course Update

Mr Robert Stynes, International Business Executive, NEBOSH, UK visited SEA India office on Tuesday, December 4th 2012 and discussed about the conduct of International General Certificate Course by SEA India. He appreciated our mode of conduct of the Course in India.

The Fourteenth batch of International General Certificate Course of NEBOSH is scheduled during March 2013 at Sri Ramachandra University, Porur. The admission process for this course is in progress.

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.

Mr Robert Stynes with our office-bearers

Candidates of NEBOSH Course – October 2012 batch

Noise in Fettling and dressing of castings

Fettling and dressing (or trimming) are the terms traditionally given to the finishing of castings to remove excess or unwanted metal, eg flashings, risers etc. It can include processes such as grinding, chipping and shot blasting.

Hand-held tools such as grinders and chipping hammers, or fixed tools such as pedestal grinding machines, linishers and bandsaws are traditionally used to remove the unwanted metal. Automated fettling is becoming more common today in a variety of ways although until recently applications have been limited.

Very high noise levels are produced during fettling and may exceed 117 dB(A). Personal noise exposure levels of100-110 dB(A) have regularly been measured during routine fettling operations in both ferrous and nonferrous foundries. Exposure to dust (including free silica) and vibration are also significant in many cases.

The risk to hearing at a noise level of 110 dB(A) is high. Only five minutes' exposure is required at this level for the daily personal noise exposure of an unprotected operator to exceed the 90 dB(A) second action level of the Noise at Work Regulations 1989 of UK.

Hierarchy of noise reduction measures

The following hierarchy should be followed to prevent hearing damage: elimination of the noise producing part of the process; implementation of adequate engineering controls to reduce noise levels; provision and use of suitable personal hearing protection as an interim measure or to supplement the above.

In many cases measures used to reduce or control the risks to hearing from fettling noise will also improve product quality and productivity. Other health risks, such as those due to exposure to vibration and dust, may also be reduced.

Examples of measures

Elimination

A thorough reappraisal may enable noise exposure to be reduced by improved design and control of the casting process. For example, improved mould design can eliminate or at least significantly reduce the amount of excess metal required to be removed after casting, thus reducing the need for fettling.

Engineering controls

Purchasing policy

Companies should operate a positive purchasing policy for new machinery and ensure that noise levels are acceptable before introduction into the factory. For example, low-noise or noise-reduced grinding discs are now available and can reduce noise levels by around 5 dB(A). Exhaust silencers can be fitted to some pneumatic tools. Low-noise blow guns are also available.

Automation

The introduction of automatic or semi-automatic fettling, eg fettling robots, CNC grinding machines, cropping etc, will remove employees from risk. Where these techniques are used noise levels can often be further reduced by fitting acoustic guards or enclosures. Whether such engineering controls are reasonably practicable will depend on the volume of product, the nature of the process involved, and the types of castings produced. Automation or mechanisation of fettling is steadily becoming a more practicable and cheaper option although mechanical fettling is still likely to be required for intricate castings and where a variety of castings are produced in small numbers.

Process modification

In some cases it may be possible to substitute rough or even finish machining for hand fettling processes.

Example: Chipping hammers can be replaced by grinders or linishers to achieve significant noise reductions. One of the commonest noise sources is the air exhausts in pneumatic systems. Fitting suitable and low cost silencers can significantly reduce this noise. Metal on metal noise can be avoided by covering fettling bench worksurfaces with abrasion resistant rubber and by reducing impact noise from castings falling into stillages by means of lined chutes, or devices to break the castings' fall. The ringing of castings being fettled

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Hazards ....

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can be reduced by clamping workpieces, by using rests on pedestal grinders, or by the use of damping devices. Finally, noise-reduced grinding discs are available.

Process control and maintenance

Good process control is not only important for product quality and production efficiency but also as a means of controlling noise exposure. Careful attention to the maintenance of machinery and training of operators will make a significant difference to noise levels - for example: keeping cutting tools sharp; regularly dressing grinding wheels; replacing worn parts, damaged patterns, mould boxes etc; maintenance of enclosures; repair of air leaks; tightening of loosened machinery panels.

Enclosure and separation

Acoustic enclosures or acoustic guards can be fitted to some existing machinery to reduce noise levels.

Example: The use of separate fettling booths, acoustically lined with 75 mm mineral wool, will assist in reducing the personal noise exposure of individual operators and can give reductions of up to 5 dB(A) in the additive effects of noise from adjoining booths.

Other measures

Further measures are available such as the rotating of the fettling work among employees to keep personal noise exposures at a controlled and reasonably low level. For example, halving an operator's exposure time will reduce exposure by 3 dB(A) thus halving the risk to the operator's hearing.

Personal hearing protection

The selection and use of suitable hearing protection should be based on the results of the noise assessment required under the various regulations.

In practice most manual fettling operations will require suitable hearing protection in addition to the use of the other measures referred to above.

Control of Substances Hazardous to Health during Fettling Operation

Hazard

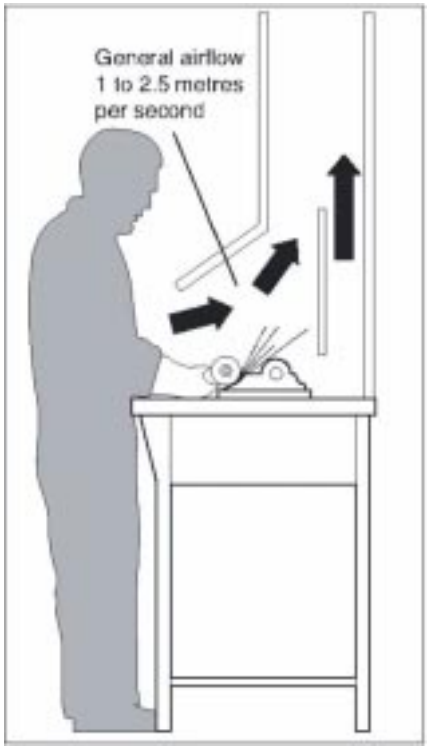
- Fettling can produce respirable crystalline silica (RCS).
- All RCS is hazardous, causing silicosis. This is a serious lung disease causing permanent disability and early death.
- Silicosis is made worse by smoking.
- 'Respirable' means that the dust can get to the deepest parts of the lung. Such fine dust is invisible under normal lighting.
- Keep inhalation of RCS as low as possible.
- When all controls are applied properly, less than 0.1 mg/m3 RCS is usually achievable (based on an 8-hour time-weighted average).
- Sand contains up to 100% crystalline silica.

Access and premises

Authorised persons alone can be permitted to do any operation.

Equipment

- Can you use a shotblast cabinet?
- Control fettlings and dust. Fettle small castings in an extracted booth.
- Fettle very small castings using an abrasive or wire wheel fitted with dust extraction.
- You need an air speed between 1 and 2.5 metres per second into the fettling booth, or between 2.5 and 10 metres per second into abrasive area
- Fit a manometer or pressure gauge near the extraction point, to show that the extraction is working properly.
- Always confirm that the extraction is turned on and working at the start of work. Check the gauge.
- Discharge cleaned, extracted air to a safe place outside the



Foundries: Silica – Engineering control

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Hazards ....

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building, away from doors, windows and air inlets.

- Have a supply of clean air coming into the workroom to replace extracted air.
- Consult a qualified ventilation engineer to design new control systems and to update current controls.
- Shake down air filters four times a day.
- Fit an indicator or alarm to show if filters have blocked or failed.

Procedures

- Position the workpiece so that it is as close as possible to the extraction point.
- Ensure that fettling dust is directed into the booth and that pneumatic tools do not blow dust out of the booth.

Maintenance, examination and testing

- Follow instructions in maintenance manuals - keep equipment in effective and efficient working order.
- Repair faulty extraction systems as soon as possible. Meanwhile wear respiratory protective equipment (RPE).
- Fettlings are very abrasive and plant wears out quickly. Fettlings can block extraction points. Plan regular maintenance.
- Every day, look for signs of damage. Noisy or vibrating fans can indicate a problem.
- At least once a week, check that the extraction system and gauge work properly.
- You need to know the manufacturer's specifications to check the extraction's performance.
- If this information isn't available, hire a competent ventilation engineer to determine the performance needed for effective control.
- The engineer's report must show the target extraction rates.
- Keep this information in your testing log-book.
- Get a competent ventilation engineer to examine the extraction thoroughly and test its performance at least once every six months.
- Keep records of all examinations and tests for at least five years.
- Carry out air sampling to check that the controls are working well

Personal protective equipment (PPE)

- Ask your supplier to help you get the right PPE.

Respiratory protective equipment (RPE)

- RPE is not normally needed for work done inside a fettling booth. RPE may be needed for maintenance. If so:
- Provide RPE with an assigned protection factor (APF) of at least 10.
- Disposable RPE is acceptable - throw this away at the end of the task.
- Otherwise replace RPE filters as recommended by the supplier.

Other protective equipment

- Provide coveralls that do not retain dust.
- Use a contract laundry or suitable equivalent to wash work clothing. Warn them that the dust contains silica. Caution: Never allow use of compressed air to remove dust from clothing.

Health surveillance

- You need health surveillance unless exposure to RCS is well below the limit.
- Consult an occupational health professional.

Cleaning and housekeeping

- Every day, clear up fettlings.
- Clean general workrooms once a week to stop dust being stirred up.
- Use a suitable vacuum cleaner fitted with a good filter to clear up dust.

Caution: Don't use a brush or compressed air.

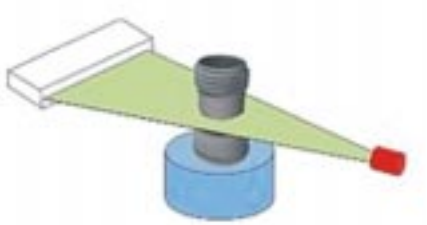
Training and supervision

- Tell workers that fettling dust can cause serious lung diseases.
- Working in the right way and using the controls correctly is important for exposure control. Train and supervise the workers. ■

MODERN MATERIAL INSPECTION TECHNIQUES TO DETECT VOIDS & CRACKS IN THE COMPONENTS

Industrial computed tomography (CT) scanning is a modern material inspection technique which uses X-ray equipment to produce three-dimensional representations of components both externally and internally. Industrial CT scanning has been used in many areas of industry for internal inspection of components. Some of the key uses for CT scanning have been flaw detection, failure analysis, metrology, assembly analysis and reverse engineering applications.

Types of scanners



Line beam scanner

Fan/line beam scanners-translate

Line scanners are the first generation of industrial CT Scanners. X-rays are produced and the beam is collimated to create a line. The X-ray line beam is then translated across the part and data is collected by the detector. The data is then reconstructed to create a 3-D Volume rendering of the part.

Cone beam scanners-rotate

During the CT scan the part is placed on a rotary table. As the part rotates the cone of X-rays produce about 1300 2D images which are collected by the detector. The 2D images are then processed to create a 3D volume rendering of the external and internal geometries of the part.

Cone beam scanner

Analysis/inspection techniques

Various inspection techniques include

Part to CAD comparisons, part to part comparisons, assembly / defect analysis, void analysis, wall thickness analysis, and generation of CAD data for reverse engineering requirements and GD&T (geometric dimensioning and tolerance) analysis to meet PPAP (production part approval process) requirements.

Assembly

One of the most recognized forms of analysis using CT is assembly or visual analysis. CT scanning has been largely used for medical purposes as an imaging tool to supplement medical ultrasonography and X-rays as well as for screening for disease and preventative medicine. For industrial CT scanning, the ability to see inside a component is beneficial since internal components can be seen in their functioning position. Also, devices can be analyzed without disassembly. Some software programs for industrial CT scanning allow for measurements to be taken from the CT dataset volume rendering. These measurements are useful for determining the clearances between assembled parts or simply a dimension of an individual feature.

Part comparisons (part to part or part to CAD)

In today's market parts can be manufactured around the world: designed in one country, machined in another and assembled in a third. Verification of the part to the original CAD design is critical, especially if the part is to be used in an assembly. Industrial computed tomography allows for a comparison of parts to one another or parts to CAD data. The deviations for both external and internal geometries can be shown on the surface colour map chromatically on the 3D representation or by whisker plots in the 2D windows. This process is beneficial when comparing the same part from various suppliers, studying the differences in parts from one cavity to another cavity from the same mould, or verifying the design to the part.

Void Analysis

Traditionally, determining an object's porosity would require destructive testing. CT scanning can detect internal features and flaws without destroying the part. Industrial CT scanning (3D X-ray) is used to detect flaws inside a part such as porosity, an inclusion, or a crack before a failure can occur. In some software programs the porosity within a part is categorized by colour based on their respective sizes.

Metal casting and moulded plastic components are typically prone to

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CASE STUDY

The involved unit: Incineration unit

Waste materials are received either in bulk or pre-packed and then moved to storage in designated zones: aboveground vats for liquids, ditches for solids and pastes.

For certain types of waste, it may be decided to treat them by direct injection as an incineration process from the tanker truck parked adjacent to the unit.

Waste is conveyed to the combustion furnace intake and then to a rotary furnace. A pre-treatment step (drying) is applied to the sludge according to its level of dryness, prior to introduction into the furnace.

The incineration process takes place over several stages: combustion, cooling of gasses, and gas treatment.

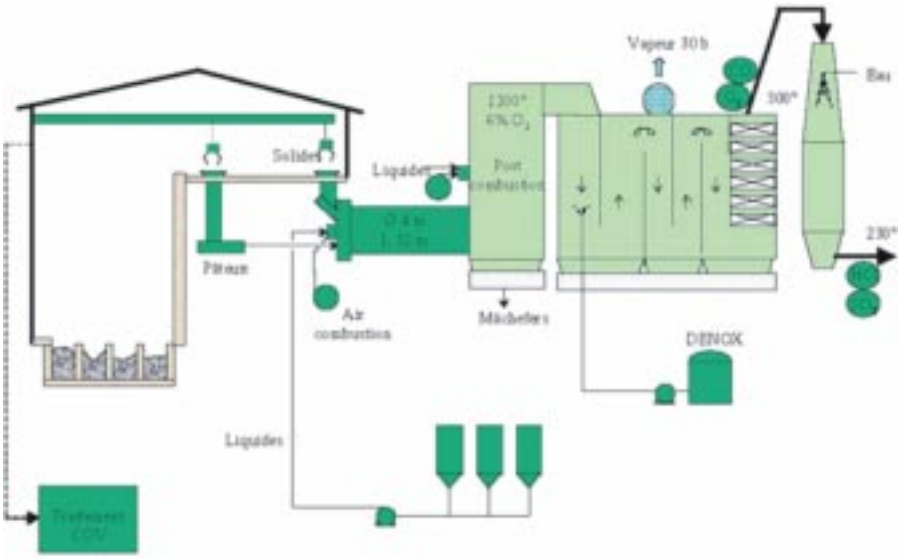

Diagram of the incineration process

Fume purification residues are then conveyed to the site's stabilisation-solidification unit.

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Modern material....

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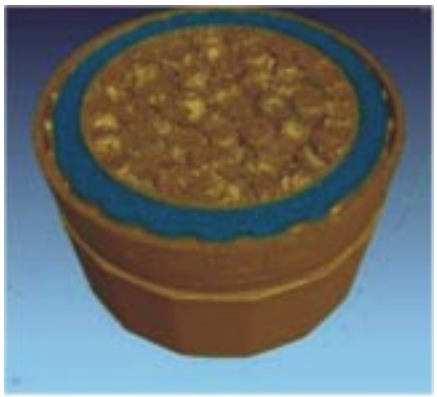
porosity because of cooling processes, transitions between thick and thin walls, and material



Flight through a 3D reconstruction of a disposable pepper grinder. Glass in blue.

properties. Void analysis can be used to locate, measure, and analyze voids inside plastic or metal components.

Generation of CAD data for reverse engineering requirements

A CAD file can be generated from the CT data set, which is particularly useful in reverse engineering applications and product development. Exported CAD file formats are recognized by many software such as CAD, FEA, Fluid Dynamics and Mold Flow software. The CAD file created by CT scanning not only shows the external components, but the internal as well. This allows for first-time rapid prototyping of internal components without the daunting task of creating an entirely new CAD file.

Geometric dimensioning and tolerancing analysis.

Traditionally, without destructive testing, full metrology has only been performed on the exterior dimensions of components. If a highly detailed component requires inspection, the conventional method of inspection would be to fixture the part to create specified datum reference plane and go through a timely CMM (Capability Maturity Model) touch-probe inspection process or use a vision system to map exterior surfaces. Past internal inspection methods would require using a 2D X-ray of the component or the use of destructive testing. Industrial CT scanning allows for full metrology of the CT datasets allowing for an analysis of GD&T (Geometric Dimensioning & Toleraneing) points to meet the PPAP (Production Part Approval Process) requirements.

Courtesy: **Wikipedia** ■

Case Study....

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Waste acceptance protocol:

The onsite acceptance protocol for hazardous wastes is as follows:

- The first step consists of identifying and characterising the specific type of waste before its arrival onsite, by means of a representative sample furnished by the waste producer, and offering judgment on waste suitability depending on both its characteristics and the site's capacity to provide treatment. A preliminary acceptance certificate is then sent to the client and an appointment set to receive the waste.
- Upon its arrival onsite, the shipment of waste must be accompanied by a waste tracking slip. Compliance of this slip along with the acceptance certificate is verified and a sample extracted for analysis in order to ensure a match between the waste received and the certificate and tracking slip details, ultimately with the aim of conducting specific analyses to refine treatment. The package of waste is then transferred to the appropriate installation.

Feeding the furnace with liquid waste: The liquid waste is conveyed to the point of furnace injection by means of a set of pumps and racked pipes. The distribution array, laid out adjacent to injection points, feeds the injection tubes where the liquid is pulverised by compressed air. For each line of waste, the array recomposes the flow measurement and safety sectioning instruments. Each flow rate is automatically adjusted on the basis of furnace operating parameters.

The Accident, its chronology, Effects and Consequences

The accident:

Waste acceptance: The waste at the origin of this accident was a mix of 30% hydrogen peroxide and 5% acid resins; it was the by-product of an unloading error that occurred within the paper mill complex .. This error caused an exothermic reaction of the mix and necessitated the onsite presence of local fire and emergency personnel along with evacuation of the entire plant.

The waste processing centre was asked to undertake the immediate removal of 40 tonnes of waste involved in this incident; due to a lack of detailed information, the centre initially refused the request. After analysing a waste sample and stabilising the waste at room temperature, the centre agreed to an incineration-based treatment by direct injection into the furnace. A preliminary acceptance certificate was issued .

In an e-mail message , the paper mill requested the processing centre to suspend the outlined waste removal procedure since the mill was studying the feasibility of an in-house neutralisation solution as a means of limiting reprocessing costs. Following investigation, it was clear that neutralisation tests conducted on several samples of these wastes, at the production site, were not conclusive.

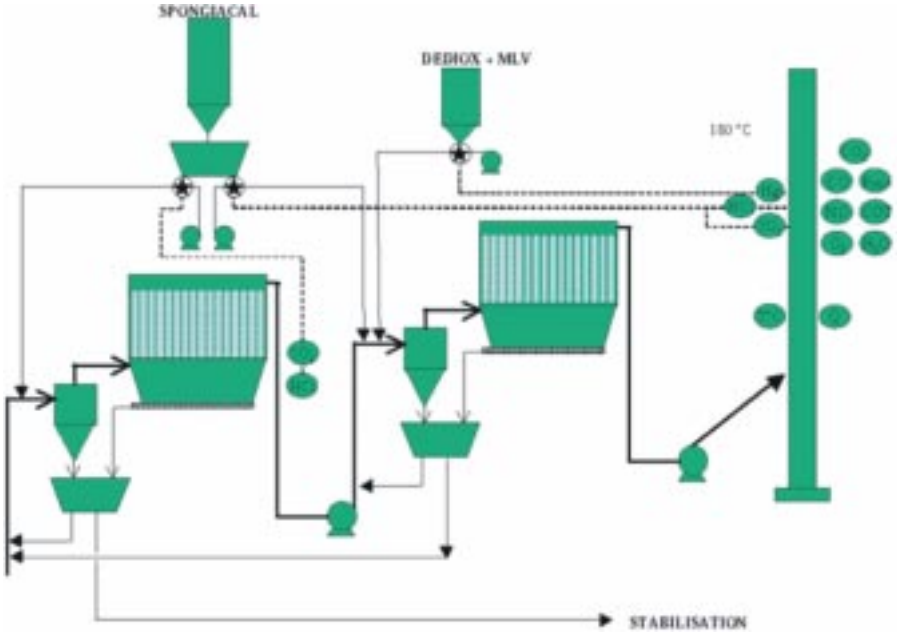

Diagram of the fume treatment process

The mix contained in two of the vats was pumped on into a stainless steel, single-compartment tanker truck. The first vat could be completely emptied and the second to a partial extent.

The waste was delivered to the processing centre . A sample was extracted and, following acceptance, the tanker truck was routed to the site's direct injection zone for unloading into furnace no. 1.

Chronology of events:

At 3:52 pm, the tanker truck arrived at the site.

At 5:45 pm, the direct injection line was rinsed with water before being connected to the tanker truck.

At 6:15 pm, incineration operations began.

At 9:00 pm, the direct injection line was obstructed. It was unplugged and nitrogen was injected via a vent on the truck, in an effort to "push" the waste through. The truck's valve was left open.

The next day, at 3:00 am, leaks on the truck's second manhole were still ongoing. The incineration operation was halted. The underflow gate was

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Case Study....

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closed and the nitrogen injection circuit isolated, yet the hose connecting the tanker truck to the direct injection pump was still hooked up to the truck.

At 4:00 am, the hose connecting the truck to the injection pump burst. The truck at this point was "very hot".

At 5:30 am, the truck was still "hot".

At 8:30 am, the temperature of the tanker truck sidewall was estimated at between 30°and 60°C. The ve nts were open and the truck was sprinkled by the spraying ramps located in the zone dedicated to direct processing operations.

By 12:00 noon, both the truck temperature and pressure were rising. The truck was moved outside the direct processing zone to install a "peacock fan"-shaped spraying device on each side of the truck. The valve on the site's industrial effluent and stormwater containment pond was then closed.

Around 1:30 pm, teams on the site's second shift arrived as a backup to continue spraying the tanker truck with fire hoses. In order to lower pressure, the truck was emptied of a few containers loaded with the mix, and these containers were placed adjacent to the truck. A safety perimeter was established.

The onsite teams chose to set up a water cannon in order to protect personnel from exposure. It was then decided to move the personnel to safety and call the emergency services unit.

At the same time, 2:30 pm, the internal tanker truck pressure rose and the manhole located on the back face of the truck broke open. The truck degassed all at once; then, both the truck and tractor were propelled some fifteen metres due to the effect of this pressure burst and came to rest when reaching the edge of the track.

Photographs of the tanker truck and the various spraying set-ups (reconstitution - Source: site operator)

Consequences of the accident: Just after the accident, a local evacuation notice for the zone was broadcast. Staff members at the nearby laboratory were evacuated to another zone on the same site, whereas office employees were told to remain indoors and not allowed to leave. Vehicle entrance bays were shut. A safety perimeter was marked off around the tanker truck. Truck cooling was facilitated using a fire hose. A message announcing the end of this alert was broadcast .

Three employees were slightly hurt: facial irritations, and a partial foot burn; they were all taken to hospital.

Nine other people showed up at the site infirmary with benign injuries.

No major property damage was declared (deformation of some metal cladding), except for the tanker truck itself, whose braces and hood were bent.

The quantity of mix released into the atmosphere, in the form of droplets and O2 remaining from peroxide decomposition, was estimated at less than a tonne (approx. 600 litres).

The Origin, Causes and Circumstances surrounding the Accident

Waste pumping at the production site: The paper mill indicated that it had not modified the waste during neutralisation testing conducted solely on samples and moreover had not noticed any heating during waste loading into the tanker truck. The pumping stage using new hoses was carried out onsite.

Inspection of tanker truck contents upon arrival: The sample taken from the truck, for the purpose of declaring acceptance or not at the processing site, was similar in composition to the one received for preliminary acceptance determination, yet showed slight instability (a few bubbles that were not mentioned on the material transfer form). Truck temperature was not verified by the sampling technician. The material transfer form listed the results of analyses performed and confirmed routing to the direct incineration unit. The tractor then towed the tanker truck to the required spot (direct treatment zone) and left it there.

Preparation for the incineration step: Racking of this tanker truck could not begin immediately since the injection line was already in use for another vat. The incineration unit had been forewarned of the need to use a clean set of bleeding lines and buckets. The direct injection lines were rinsed with water prior to initiating tanker truck pumping.

Origin of degassing: The decomposition of hydrogen peroxide led to a sudden degassing of the tanker truck. The H2O2 decomposition reaction is an exponential speed reaction. Defining with certainty the exact time when the product starts to react proves to

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Case Study....

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be a difficult step, since inertia runs high in a tanker truck carrying 25 tonnes. This reaction was in fact able to begin prior to waste acceptance: before/during loading, at the same time as the transport?

A number of questions still remain:

-The waste was able to undergo modifications during treatment tests conducted by the producer, between the date of sample transmission and the date of waste acceptance;

-The mixing of both vats at the time of pumping also served to trigger the reaction. This information relative to the two-vat mix was only received after the accident at the processing centre.

On the following day, an additional sample was extracted from the truck as the temperature inside the truck was starting to climb. This sample revealed a lower H2O2 rate than that recorded the day before, which confirms a progression in the reaction, yet the analysis was undertaken following the accident. The incineration unit had been advised to use clean bleeding lines and buckets but had not been formally notified by the laboratory of an eventual risk of pressure rise.

The unloading method employed did not enable coping with the risk of waste degassing:

-The selected unloading line was operated by either suction or nitrogen thrust; it lacks a specific relief valve system that could have allowed releasing the gas formed during the reaction;

-Only the tanker truck valves could have ensured proper aeration and the requisite evacuation of gas bubbles; these valves however proved inadequate for this particular waste within this particular volume.

Internal Emergency Plan

The Internal Emergency Plan had not been activated since the various scenarios did not feature either hydrogen peroxide degradation or a tanker truck rupture as the consequence of an uncontrolled chemical reaction; the situation did not present any fire or explosion risk and the toxic risk was controlled by water curtains. Nonetheless, the set of actions actually initiated in response to the event did correspond to the measures indicated in this emergency plan.

ACTIONS TAKEN

Immediate measures adopted:

In order to avoid and limit the consequences of a similar accident, the operator decided to:

- introduce the systematic verification of tanker truck temperature at the time of material acceptance (with all pertinent information recorded on the material transfer form);
- refuse the acceptance of wastes containing hydrogen peroxide in bulk packaging exclusively for concentrations below 5%, and require wastes containing higher concentrations to be shipped in barrels or containers.

Prescriptions issued, request for remedial actions:

Inspection authorities stated that the set of measures specific to the internal emergency plan established by the Prefectural order approving the site were not respected.

Non-activation of the emergency plan meant that the fire and rescue unit was not informed and moreover that the unit's technical resources were not mobilised to prevent the exacerbation of an accidental situation. More specifically, air quality measurements in the vicinity of the tanker truck, in the case where the truck had been degassing for several hours, were not completed.

Subsequent to this accident, a number of site safety management system improvements were anticipated: re-evaluation of waste acceptability controls (including the physical magnitudes that enable tracking a potential evolution in loading behaviour), assessment of risks relative to tanker truck parking near industrial installations and high-risk zones, and reexamination of the decision-making process that leads to activation of the internal emergency plan.

LESSONS LEARNT

The primary cause of the sudden tanker truck degassing was the decomposition reaction initiated within the waste contained in the truck. The accident analysis has shown however that not only were the waste material acceptability controls insufficient, but the safety measures in place at the time were inappropriate.

The treatment of hazardous waste requires a safety management system that includes the following:

- characterisation of the targeted materials (pH, temperature, colour, viscosity, odour, etc.), controls and testing for chemical compatibility between substances, verification of the absence of phases within the mix, and any immediate undesirable chemical reaction or deviation in material characteristics over time;
- assignment of responsibilities to be more clearly specified and adapted to all operations planned by personnel or contractors involved at the processing site;
- technician training in hazard prevention, specifically for the steps of material unloading and transfer (with the possible presence of residual toxic or inflammable gas, etc.);
- indications of measures to be adopted in the event of an incident or deviation in operating procedure;
- introduction of measurement, detection and monitoring devices. ■

DETONATION FLAME ARRESTER

A detonation flame arrester is a device fitted to the opening of an enclosure or to the connecting pipe work of a system of enclosures and whose intended function is to allow flow but prevent the transmission of flame propagating at supersonic velocity and characterized by a shock wave. (designed to prevent the transmission of a detonation).

Detonation Flame Arrester products were created in response to environmental regulations (such as The Clean Air Act) which required liquid product storage terminals and hydrocarbon processing plants to control evaporative hydrocarbon emissions from loading and storage operations. This process is called vapor control. Two types of recognized vapor control technologies are commonly used; carbon adsorption vapor recovery and vapor destruction or combustion. Vapor destruction systems include elevated flare systems, enclosed flare systems, burner and catalytic incineration systems, and waste gas boilers. Both systems require flame or detonation flame arresters to maximize safety. Detonation flame arresters are used in many industries, including refining, pharmaceutical, chemical, and petrochemical, pulp and paper, oil exploration and production, sewage treatment, landfills, mining,power generation, and bulk liquids transportation.

How Detonation Flame Arresters Work?

Flame arresters are passive devices with no moving parts. They prevent the propagation of flame from the exposed side of the unit to the protected side by the use of metal matrix creating a torturous path called a flame cell or element. All detonation flame arresters operate on the same principle: removing heat from the flame as it attempts to travel

Detonation Flame Arrester is being tested for an 8 inch piping system

Detonation Flame Arresters for various pipe sizes

through narrow passages with walls of metal or other heat-conductive material, but unlike flame arresters, detonation flame arresters must be built to withstand extreme pressures that travel at supersonic velocities, 1,500 psia @ 2500 m/sec is not uncommon with a group D Gas.

Detonation flame arresters made by most manufacturers employ layers of metal ribbons with crimped corrugations. The internal narrow passages of the crimped corrugations make up the element matrix. These passages are measured as the hydraulic diameter and are made smaller for gases having smaller maximum experimental safe gaps (MESG).

Under normal operating conditions the flame arrester permits a relatively free flow of gas or vapor through the piping system. If the mixture is ignited and the flame begins to travel back through the piping, the arrester will prohibit the flame from moving back to the gas source.

Most detonation flame arrester applications are in systems which collect gases emitted by liquids and solids. These systems, commonly used in many industries, may be called vapor control systems. The gases which are vented to atmosphere or controlled via vapor control systems are typically flammable. If the conditions are such that ignition occurs, a flame inside or outside of the system could result, with the potential to do catastrophic damage.

A flame arrester or flame trap is a device that stops fuel combustion by extinguishing the flame.

Usage and applications

Flame arresters are used:

- to stop the spread of an open fire
- to limit the spread of an explosive event that has occurred
- to protect potentially explosive mixtures from igniting
- to confine fire within an enclosed, controlled, or regulated location

They are commonly used on:

- fuel storage tank vents
- fuel gas pipelines
- safety storage cabinets for paint, aerosol cans, and other flammable mixtures
- the exhaust system of internal combustion engines
- Davy lamps in coal mines
- overproof rum and other flammable liquors.

Principles

A flame arrester functions by forcing a flame front through channels too narrow to permit the continuance of a flame. These passages can be regular, like wire mesh or a sheet metal plate with punched holes, or irregular, such as those in random packing.

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32ND PROFESSIONAL DEVELOPMENT PROGRAMME

Thirty Second Professional Development Programme Was held on Sunday, 4th November 2012 at Chennai.

Mr. C.N. Rathinam, Project Construction Manager and Mr. Shyam Thanigachalam, Safety Manager, M/s Tata Consulting Engineers Ltd, Chennai delivered the talk on, "Project Safety Management."

The meet was followed by lunch and presentation of certificates to the participants and a gift to the lucky winner among the participants.

Large number of SEA India members participated and enriched their knowledge on safety management. The salient features discussed during the programme is given in this article for the benefit of the members who could not participate in the programme.

Introduction:

Safety of men and material is of vital importance for unhindered execution of activities at site and timely completion of project. Everyone associated with the work regardless of his/her position or status, has the responsibility of his/her own safety and safety of people working around him/her.

Accident and injury cause pain, misery, loss of earning and hardship not only to the injured person, but also to his / her family. No one, therefore wants to get injured, instead wants to return home in the same condition in which he/she came every day. This is however possible only if everyone followed the safety requirements all the time.

While it is the responsibility of management to provide safe working conditions at work place it is the duty of all associated with the work to earnestly follow the safety rules, norms, standards and procedure and not to indulge in any unsafe act or practice and be cause for creation of unsafe condition.

To Achieve "Zero Accident "at work place an effective project safety management must be followed in the project.

Stage of Project Safety Management

1. Design Phase.
2. Procurement Phase.
3. Construction and Commissioning phase.

Design

Safety in design stage can contribute to the elimination of health and safety hazards in construction, from the earliest stage of the project. Safety consideration in design stages increases the productivity (early completion of project in time) and reduces delay in time due to accident.

- Design options.(usuage of safe material/equipment)
- Incorporation of safety requirements as per statutory regulations.

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Detonation....

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The required size of the channels needed to stop the flame front can vary significantly, depending on the flammability of the fuel mixture. The large openings on a chain link fence are capable of stopping the spread of a small, slow-burning grass fire, but fast-burning grass fires will penetrate the fence unless the holes are very small. In a coal mine containing highly explosive coal dust or methane, the wire mesh of a Davy lamp must be very tightly spaced.

For flame arresters used as a safety device, the mesh must be protected from damage due to being dropped or struck by another object, and the mesh must be capable of rigidly retaining its shape during a forceful explosive event. Any shifting of the individual wires that make up the mesh can create an opening large enough to allow the flame to penetrate and spread beyond the barrier.

On a fuel storage vent, flame arresters also serve a secondary purpose of allowing air pressure to equalize inside the tank when fuel is added or removed, while also preventing insects from flying or crawling into the vent piping and fouling the fuel in the tanks and pipes.

Safety

Flame arresters should be used only in the conditions they have been designed and tested for. Since the depth on an arrester is specified for certain conditions, changes in the temperature, pressure, or composition of the gases entering the arrester can cause the flame spatial velocity to increase, making the depth of the arrester insufficient to stop the flame front ("flow"). The deflagration may continue downstream of the arrester.

Flame arresters should be periodically inspected to make sure they are free of dirt, insects using it as a nest, or corrosion. ■

32nd Professional....

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- Layout review (various locations and configurations).
- Construability review.
- Fire Fighting System, Emergency Response Plan etc.

Procurement Phase:

As work execution at site is generally carried out by contractor in due care shall be exercised for their proper selection, duly considering their past performance (safety record) resource with regard to trained manpower, safety appliance, their understanding of clients requirement and inclusion of safety clause in the contract and effective contract management.

- Prequalification of vendors on safety ability.
- Site Visit to conduct safety evaluation of vendors.
- Tender documents included with safety requirements.
- Pre-bid meeting with vendors on safety requirements.
- Issuance of purchase order.

Construction and Commissioning Phase:

The construction and commissioning stage site specific safety plan sets out the arrangements for securing the health and safety of everyone carrying out the work and achieving "Zero accident " and It deals with

- Safety Kick of Meeting.
- Work methodology and Job safety analysis.
- Training requirements for the project.
- Monitoring of Safety Induction and Tool box talks.
- Permit to work.
- Safety communication.
- Inspection system.
- Emergency response procedure.
- Accident/Incident Investigation.
- Safety Audit.
- Safety reward program.

Conclusion:

With project safety management being followed from design till commissioning stage to achieve "Zero accident" it has been very useful in estimating:

- Budget requirement for Plant and Machinery (material handling and Logistics).
- Safe process operation system.
- Skill requirements for the job activity (Included in selection of contractors).
- Co ordination requirements for the job activity.(Sequencing of work activity for multiple contractors).
- Reduction of project schedule (by using latest engineering techniques).

IN THE NEWS

Safety takes back seat

It is very disheartening that in spite of several laws, codes and stipulations by the government, we are witnessing so many accidents.

The need of the hour is to spread safety awareness so as to instil confidence in people that the government is very clear about enforcing all laws and regulations to avoid accidents.

The main focus areas are homes, where gadgets like LPG stoves, induction heaters and microwave ovens, if not used safely, could lead to serious accidents. The international precautionary indication is that LPG is strongly blended with smelling agents so that leaks are detected, but due to a lack of knowledge and awareness, timely action is not taken, resulting in nasty accidents and loss of lives.

Use of substandard electrical wires and switches, inserting wires into sockets without plugs and improper earthing are the main reasons for accidents due to electricity. It is advisable to use appliances of standard makes and which are BIS marked. The placing of air conditioners in the correct positions and using non-flammable switch boxes would avoid mishaps. The use of ELCBS and flame-proof wiring will assure us of safety from electric shocks at homes.

Courtesy: **The Hindu**

IN THE NEWS

New rules on e-waste to boost resource efficiency in E U.

Improved rules on the collection and treatment of e-waste enter into force in European Union. E-waste (i.e. waste electrical and electronic equipment, or WEEE) is one the fastest growing waste streams, and it offers substantial opportunities in terms of making secondary raw materials available on the market. Systematic collection and proper treatment is a precondition for recycling materials like gold, silver, copper and rare metals in used TVs, laptops and mobile phones. The new Directive is a clear step forward in terms of environmental protection and a major boost to resource efficiency in Europe.

Environment Commissioner Janez Potocnik said: “In these times of economic turmoil and rising prices for raw materials, resource efficiency is where environmental benefits and innovative growth opportunities come together. We now need to open new collection channels for electronic waste and improve the effectiveness of existing ones. I encourage the Member States to meet these new targets before the formal deadline.”

The Directive entering into force introduces a collection target of 45 % of electronic equipment sold that will apply from 2016 and, as a second step from 2019, a target of 65 % of equipment sold, or 85 % of electronic waste generated. Member States will be able to choose which one of these two equivalent ways to measure the target they wish to report. From 2018, the Directive will be extended from its current restricted scope to all categories of electronic waste, subject to an impact assessment beforehand.

The Directive gives Member States the tools to fight the illegal export of waste more effectively. Illegal shipments of WEEE are a serious problem, especially when they are disguised as legal shipments of used equipment to circumvent EU waste treatment rules. The new Directive will oblige exporters to test whether equipment works or not, and provide documents on the nature of shipments that could be thought illegal.

Make road safety a social movement

Union Minister for Road Transport and Highways, has urged state Chief Ministers to take Road Safety a social movement in partnership with schools and universities.

In letters sent to Chief Ministers , the Union Minister has sought their cooperation in this endeavour by organizing road safety related activities in their state on a large scale especially in school/colleges so that the youth get sensitized on the issue.

Keeping in view the theme for Road Safety Week this time "Stay Alive, Don't Drink and Drive" the Minister has asked for spreading awareness against drunken driving.

He has also promised his Ministry's financial assistance, up to Rs. five lakh per state for organizing road safety related activities in schools. These activities may include debates/painting and essay competitions/rallies and other such events with token prizes/ certificates.

In order to spread road safety awareness "Road Safety Week" is observed all over the country in the month of January every year.

The ensuing 24th road safety week will be celebrated from January 1 to January 7 2013. The theme for Road Safety Week this time is "Stay Alive, don't drink and drive". The emphasis will be on spreading awareness against drunken driving.

During Road Safety Week, States/UTs/NGOs and other stake-holders/agencies involved in road safety undertake various activities aimed at inculcating/promoting road safety.

Mr S Ulaganathan, President, **Mr N Kumar,** Secretary, **Mr C N Rathinam,** Project Construction Manager, and **Mr Shyam Thanigachalam,** Safety Manager during the 32nd Professional Development Programme held on 04-11-2012 at Chennai

Mr S Ulaganathan, President, SEA India, **Dr R K Elangovan,** Director In-charge, Regional Labour Institute, Chennai, **Dr K V Somasundaram,** Dean of Faculties, S R U, **Dr Kannan Krishnan,** University of Montreal, Canada and visiting Professor to S R U, and **Dr S Sankar,** Head of Environmental Health Engineering Dept, S R U in the National Workshop conducted jointly by S R U, R L I and SEA India at SRI Ramachandra University, Porur on the topic "Current Concepts& Tools in Occupational Health & Safety Risk Assessment" on November 2 & 3, 2012