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SURVEY OF CRITICALITY OF RISK FROM LPG STORAGE TANKS AT USER-SITES IN NORTH INDIA

S.S. GAUTAM
P.K.SAXENA

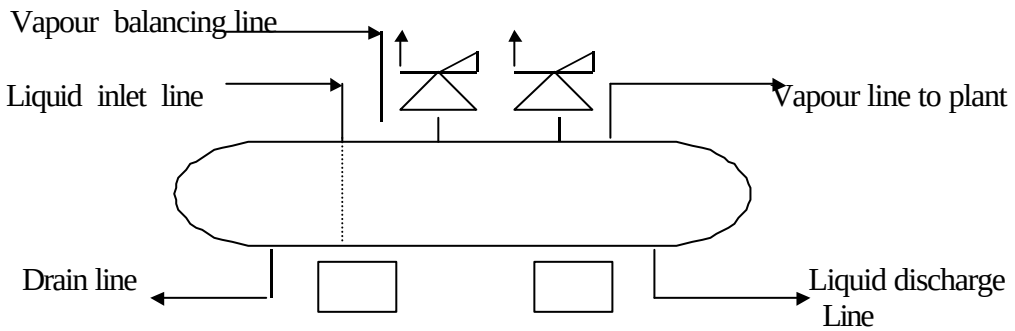
INTRODUCTION

LPG storages are spreading all over India at a very fast rate. Some of these storages belong to user industries and some are owned by petroleum companies for filling the gas in cylinders for supply as domestic and industrial fuel. These storages have given rise to transport hazards on road and rail. LPG is a gas stored and handled in liquefied form under pressure. Its large inventories in bottling plants and user industries have lead to anxiety among the industrial workers, surrounding public and the State & Central Governments. The authors surveyed the criticalities and maximum damage potentials of several such storage sites in the northern part of India during recent past. This article intends to present the findings of these surveys and to prefer recommendations to limit the risks involved in such storages based on the experiences acquired during the survey.

STORAGE OF LPG IN BULLETS

At user sites the LPG is commonly stored in horizontal dish-end cylindrical mild steel tanks (commonly know as bullets). These are mounted on two RCC saddles. Each tank is fitted with liquefied gas inlet line entering into the tank from top. The vapour outlet line for direct use of the gas in the plant is also taken out from the top of each tank. The bottom connections include liquid discharge line to vaporizer and drain line with two isolation valves and with its end outside the shadow of the tank. Each tank is provided with multiple pressure relief valves with discharge capacities enough to avoid undue pressure rise under fire in the vicinity of the tank. Each tank is also fitted with roto-gauge (a device to check the level of liquefied gas), pressure gauge and temperature gauge. (Figure 1 presents the schematic representation of a typical LPG storage tank).

Figure 1



LPG Storage in a bullet

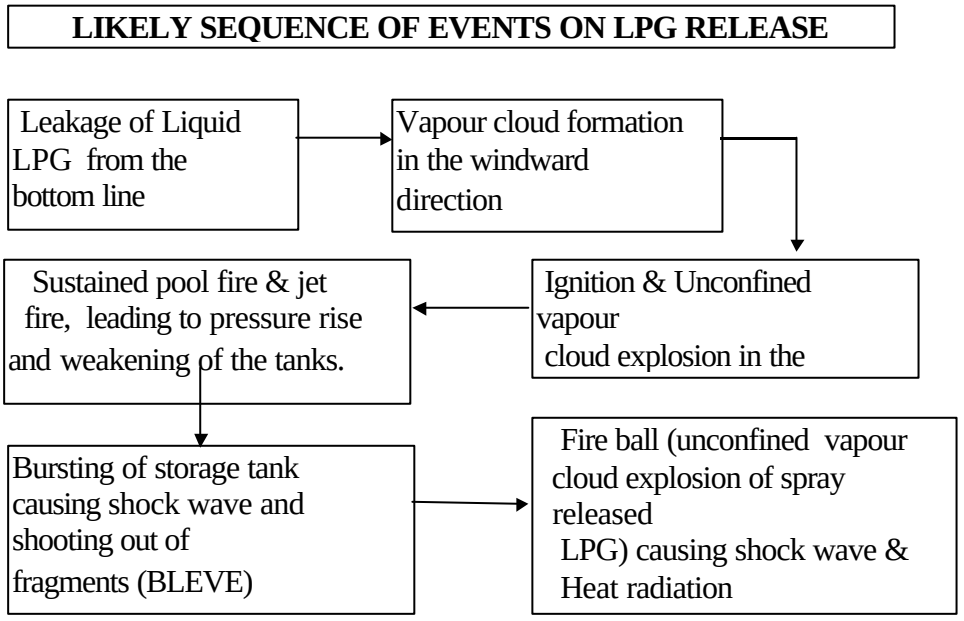
MAXIMUM CREDIBLE LOSS ACCIDENT SCENARIO

The accidents involving fire and explosion in LPG storage system is likely to start with the leakage or release of gas either from the storage tanks or from the distribution system. As revealed from the HAZOP analysis, the possibilities of release are:

1. Gas release from the top fittings or nozzles of a tank
2. Liquid release from the bottom fittings of a tank
3. Gas release from vapour line from the decanting platform to the tanks or from the tanks to the plant.
4. Liquid release from the pipeline from the pump to the tanks or from the tanks to the vaporizer or from the drain line.

Among the situations indicated above,the release of liquefied gas through one of the bottom nozzles of the tank either due to breaking of liquid discharge line or due to breaking of drain line or due to failure of valve is likely to be the worst case of release. This release is likely to last with almost uniform strength till the liquid level in the tank becomes zero. Hence this has been selected as the starting point of the worst case scenario incident. As indicated in figure 2 the sequence of events are - dispersion of gas in the windward direction forming flammable vapour cloud, explosion of this cloud leading to heat radiation and damages due to shock waves, formation of pool fire and jet fire, bursting of tank due to rise in internal pressure and weakening of tank wall due to rise in temperature, spray release of un-vaporized LPG and ignition of releasing gases leading to enlarging fire ball causing shock waves and heat radiation.

Figure No.2



OBSERVATIONS & DISCUSSIONS

RELEASE RATE:

The raw data on the basis of which the computations have been done for various considerations are presented in Table 1. As seen from the table, the installation A has LPG tanks as well as Propane tanks at the site whereas other installations had only LPG tanks.

The initial source strengths for release of liquefied gas on potential breaking of bottom line for LPG for four installations A,B,C & D, as presented in Table 2 are 29.7, 30.0, 6.6 and 26.7 Kg/Sec respectively. The installation D had propane storage tanks also, the discharge rate for which was found to be 41.0 Kg/Sec.The factors responsible for variations in release rate are - area of cross section of the aperture, coefficient of discharge, density of liquefied gas, pressure inside the tank and to some extent hydraulic pressure exerted by the liquefied gas.For any particular gas, the density and internal pressure at a particular temperature are constant. The only variable, that is different in different installations, is diameter of liquid discharge line. This is the most important factor that influences the rate of release. The comparison of diameters of pipelines and the release rates as presented in Table 3 shows the great impact of this factor i.e. discharge rate has increased to about four times on doubling the diameter of the aperature.

The finding gives a very interesting clue that by reducing the pipeline diameter to half, the release rate has reduced to more than four times. As the value of release rate is likely to control the scenario of vapour cloud size, the maximum distance of cloud and the damage on explosion of cloud, the most prudent way of controlling the risk is to reduce the diameter of liquid discharge line to the minimum practicable.

This also indicates that the probability of the disaster can be reduced by bringing down the probability of breaking the line. Some installations are so designed that the liquid discharge lines have also been routed through the top of the tanks which reduces the probability of its breaking. The drain line, however, has still to be from the bottom, but the probability of the event will be considerably reduced in case of such tanks.

The temperature variations have some effect on the release rate because lower the temperature of the place lesser will be the vapour pressure inside the tank. The mass inside the tank has no direct effect except that the level of liquid in the tank is affected by it, which has minor impact on the release rate

Distance of Lower Explosive Limit Concentration in Axis of Wind:

Assuming that all the liquefied gas that will release from the liquefied gas outlet valve will become airborne, the dispersion computations were done to work out the maximum distance in windward direction up to which the concentration of lower explosive limit can reach. The results have been presented in Table 2. It is seen that these values are 160, 159.6, 67 and 133.4 Meters for wind speed 2 M/Sec in the plants A, B, C & D respectively. For the wind speed 5 M/Sec, these values are 93, 93.4, 39 and 77.0 respectively. The distance for the propane tank in plant 'A' is 215 M for 2 M/Sec wind speed and 125 M for 5 M/Sec wind speed, which are greater than corresponding values for LPG.

These distances vary for the same materials on the basis of gas released, weather condition, wind speed, roughness of surrounding surface, source dimensions etc. The source strength is the only factor which is contributed by the installation. So it can be seen that 2″ diameter pipeline gives rise to about 160 meter long cloud at 2 M/Sec wind speed and 1″ diameter pipe gives rise only to about 97 meters. Thus, a reduction of diameter of pipe is the most effective way to reduce these distances. These distances are significant not only for the damage distances but also for the possibility of ignition of the cloud. If any source of ignition falls in windward direction within this distance, the cloud will ignite and jet/pool fire will result.

Source Strength for Dispersion Calculation:

The liquefied LPG first partially evaporates into vapour taking latent heat of evaporations from itself. This is commonly referred to as adiabatic flash evaporation, which can be calculated with the available equations (1)& (2). The fraction, which falls on the ground evaporates subsequently taking heat from the ground and atmosphere. The risk of ignition of the vapour cloud is more when the cloud stays for longer periods. Hence, to minimise the period of live hazard, the evaporation area or evaporation pits are recommended for LPG. Keeping these considerations in view, it has been assumed in these surveys, that all the liquefied gas released instantly evaporates and the whole of it is taken as source strength for dispersion calculation. This will represent the worst condition.

Mass of Gas Within Explosive Range:

The ultimate damage to property and life due to an unconfined vapour cloud explosion depends upon the mass of gas within explosive range. It was found that under stability conditions for 2 M/Sec wind speed these values were 887 Kg, 892.2 Kg, 86 Kg and 833 Kg respectively for A, B, C & D installations. At higher wind speed (5 M/Sec) these values changed to 404, 209, 20 and 192 Kg respectively. It is interesting to note that at 2 M/Sec, mass of propane in explosive range was more than that of LPG but when the wind speed is raised to 5 M/Sec the value became less than the corresponding value for LPG. Thus, having the installation at a place which has more average wind speed, is advantageous in many ways.

It is envisaged that some liquid will flow towards the evaporation area. If the evaporation area is in opposite direction to wind direction, the cloud will surround the tank farm. In case of flash fire, the chances of damage of the tanks and fittings are more. Hence evaporation area should be made in the predominant wind direction.

Radius Of Damage to Shock Wave On Ignition of Cloud:

On the basis of the data on mass of gas in explosive range, the radii of damages of different kinds were worked out. The computation by available model is based on the assumption that the shape of the cloud is hemi- spherical. Results of this calculation as presented in item 5 of table 2 shows that the radius of heavy damage at 2 M/Sec wind speed in 48 meters. It is seen from the length of the clouds in item 3 of table 2, the diameter of damage circle is less than the length of the explosive cloud. It is certain that the damages within the complete cloud are likely to be more severe. Hence, this computation fails to show the correct results. This is because the shapes of the clouds are too oblong to be approximated with the assumption of hemispherical cloud. It has been reported that the computer based systems for drawing the damage contours around the concentration contours have been developed, yet, the equations are not found in the literature (3).

BLEVE:

The Boiling Liquid Evaporating Vapour Explosion which is commonly referred as BLEVE is the bursting of vessels containing superheated liquids due to over pressure. This situation is probable in case of ignition of vapour clouds formed by leakages. The first flash fire ends up into a jet fire and pool fire under the tank, which starts heating up the vessel leading to bursting. The bursting of vessels leads to shock waves with ejection of splinters and subsequent ignition of flammable vapours released from the tank. This explosion is known as fireball. The fireball causes shock waves leading to destruction of building and heat radiations leading to burns. In the present surveys, the shock wave and heat radiation from the fireball were computed. The results of these computations are presented in table 4.

Perusal of results indicates that the effects of shock wave and radiation effects vary directly with the quantity of material likely to be present when the vessel bursts. It has been suggested that 50% of the capacity of the vessel should be taken for computations if these are upto two tanks and

if the number of tanks are more, the maximum filling ratio i.e. 90% should be considered(4) . This criterion has been formed on the basis of the logic that in case there is only one tank, the contents may get reduced to about half by the time the cloud is formed and ignition takes place. In case there are more tanks in vicinity, there is probability of bursting of the tank filled upto maximum filling ratio due to heat radiation from the effected tank. In the present survey the proposition was adopted because this appears to be logical,yet, as the maximum filling ratio practiced in India is 85%, the figure of 90% was replaced by 85%.

The consideration about the difference in extent of damage for LPG and propane shows that radiant heat effect is going to be same in case of both the gases. The comparison of the observation from the criteria of physiological effects indicates that the risk of 1% fatality will be at a distance of about 240 meters for 25 MT tank and 280 meters for 30 MT tank. This finding indicates that as far as possible smaller vessel should be used. The shock wave effects, however, are slightly more for LPG than for propane. This difference is due to the difference in heat of combustion of the two gases.

CONCLUSIONS

The survey of criticality of risk carried out in four LPG installations at users' sites in northern part of India revealed that:

a) The release of the LPG on breaking of liquid discharge lines will lead to maximum loss associated accidents. The release rates observed for 2" diameter pipe line were about 26 Kg/Sec which is about 4 times to that of 1" diameter pipe line (6 Kg/Sec). Hence, minimizing the diameter of liquid discharge line is the best course of action to bring down the criticality of the potential worst accident.
b) It is envisaged that probability of breaking of liquefied gas discharge line will reduce if the line is taken through roof of the tanks.
c) The discharge time governs the period for which the hazard remains live. Lower capacity tanks, which take less time to get emptied are safer from this point of view.
d) Cloud dimensions will be larger with greater release rates. Lower wind velocities allow larger clouds than the higher wind velocities. Stable weathers and night times favor larger cloud dimensions.
e) The energy released on explosion of vapour clouds is more when the mass of gas within the explosive range is more. The mass of gas in explosive range is more when cloud dimensions are larger.
f) The release rate and subsequent effects or vapour cloud explosions will be larger for the propane gas as compared to LPG for the same dimensions of aperture.
g) The evaporation area tank covered with gravels (provided for quick evaporation) towards which slope is in windward direction to minimize the effect of the shock and heat exposure on the tanks and fittings.
h) In case of bursting of tank due to internal over pressure, the fire ball radius will be dependent on the contents in the tank. If a fully filled tank is available in the vicinity of effected tank, there is probability of bursting of that too, which will cover larger damage distances. Hence, it is safer to isolate the tanks with so much distance in betweeen that domino effect is avoided.
i) The fire ball of LPG as well as propane may cause 1% lethality among the exposed persons up to about 240 meters for 25 MT tanks and 280 meters for 30 MT tanks are safer.
j) The shock wave effect have shown that the heavy damage to buildings and process equipments will occur upto 67 meters for 20 MT tank, 72 meters for 25 MT tanks and 77 meters for 30 MT tanks. Minor glass damages will occur upto about 900,970 and 1030 meters respectively. This finding also favours the concept of smallest possible tanks.

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Table -1
Basic Information about the Selected Installations

Sl.No.	Description/Installation	A		B	C	D
	Material	LPG	Propane	LPG	LPG	LPG
1.	Largest tank capacity	20 Te	20 Te	20 Te	20 Te	30 Te
2.	No.of tanks installed	2	2	3	4	3
3.	Tank length(meters)	11.4	7.422	12.362	1.7	-
4.	Initial level of liquid(meters)	1.95	1.984	2.04	2.2	1.7
5.	Inner diameter at the liquid discharge pipe line(cm)	5.08	5.08	5.08	2.54	5.08
6.	Maximum temperature at the place (^{0}C)	50	50	45	50	50
7.	Pressure of the tank at Max.temperature(Kg/cm^2)	7	15	6	7	7
8.	Maxmum filling ratio at the tank (%)	85	85	85	85	85

Table 2
Result of computations for unconfined vapour cloud explosion

Sl.No.	Description/Installation	A		B	C	D
	Material	LPG	Propane	LPG	LPG	LPG
1.	Initial Source Strength (Kg/Sec.)	29.7	41.0	30.0	6.6	26.7
2.	Discharge Time (Min)	11.7	7.5	14.5	43	18.7
3.	Distance (meters)of lower explosive limit in axis of wind for neutral weather for wind speeds:					
	(i) 2 M/Sec	160	215	159.6	67	133.4
	(ii) 5 M/Sec	93	125	93.4	39	77.0
4.	Mass of gas(Kg) within explosive range for neutral weather at wind speed:					
	(i) 2 M/Sec)	887	1638	892.5	86	833
	(ii) 5 M/Sec	404	381	209	20	192
5.	Radius of circle for shock wave ffects on ignition of vapour clouds (for neutral weather):					
5.1	Heavy damage to buildings and process equipment for wind speed:					
	(a) 2 M/Sec	48	58	47.9	22	47
	(b) 5 M/Sec	37	36	29.6	14	29
5.2	Repairable damage to buildings & Process equipment for wind speed:					
	(a) 2 M/Sec	96	117.15	95.9	44	94
	(b) 5 M/Sec	73	72.08	59.17	27	58
5.3	Glass damage circle causing injuries for wind speed:					
	(a) 2 M/Sec	238	292.88	239.7	110	234
	(b) 5 M/Sec	182	180.00	147.9	68	144
5.4	10% glass damage for wind speed:					
	(a) 2 M/Sec	633	781	639.3	293	622
	(b) 5 M/Sec	486	480	394.5	180	382

Table 3
Comparison of effects of pipeline diameter on the release rates

Installations (codes)	Inner diameter of the pipelines assumed to have broken (cm)	Release rate (Kg/Sec)
A	**5.08**	**29.7**
B	**5.08**	**30.0**
C	**2.54**	**6.6**
D	**5.08**	**26.7**

Note: The minor differences for A,B and D are attributable to size of tank and maximum termperatures of the places.

Table 4
Effects of BLEVE

Sl.No.	Description/Installation	A		B	C	D
	Material	LPG	Propane	LPG	LPG	LPG
1.	Largest tank capacity	20 Te	20 Te	20 Te	20 Te	30 Te
2.	No.of tanks installed	2	2	3	4	3
3.	Fire ball radius on BLEVE (Meter)	62	62	81.02	72	85
4.	Fire ball duration on BLEVE (Seconds)	10	10	12.5	12	13
5.	Radiant heat load due to fire ball at a distance (from the tank): (Kw/M^2)					
	1. 100 Meters	56	56	60.4	56	63
	2. 150 M	33.9	33.9	37.6	33.9	40.7
	3. 200 M	21.3	21.3	24.1	21.3	25
	4. 300 M	10.2	10.2	11.6	10.2	13
	5. 400 M	5.8	5.8	6.7	5.8	7
	6. 500 M	2.7	2.7	4.3	2.7	4.8
6	Radius of damage circle (Meter) due to shock wave of categories:					
6.1	Heavy damage to buildings and process equipment:	67	68	72	67	77
6.2	Repairable damage to build-ings and process equipment	135	136	146	135	155
6.3	Glass damage with injuries	338	339	364	338	387
6.4	10% glass damage	902	905	971	902	1032

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AN ERGONOMIC EVALUATION OF JOB STRESS IN A TYPICAL HOT INDUSTRY

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Twenty-four workers, randomly selected from a forging plant, were studied to ascertain the impact of occupational work-load on the physiological functions during some typical jobs comprising I) LOADING II) UNLOADING III) HELPING and IV) FORGING, routinely performed in a Forge Shop.

Environmental heat load was assessed through measurements of 'Ambient Air Temperature', 'Humidity', 'Wind Velocity', and 'Radiant heat' ; the physiological demand was evaluated in terms of 'Energy Cost', 'Heart Rate' and 'Oral Temperature'.

Findings reveal that the environmental heat load, expressed as CET, was quite severe (around 32.0^0C) with intense thermal radiation. Extreme condition was observed at 38.9^0C which is well above the permissible limit (i.e 29.5^0C) for day to day industrial work. From the consideration of the energetic workload ranged from 3.5 to 6.0 koal min^{-1} , the jobs could be graded 'Moderate' to 'Heavy' which could, however , be categorized 'Heavy' to 'Very Heavy', based on the circulatory stress.

Discrepancies in the job-severity are due to superimposed effect of climatic stress coupled with physical workload. The oral temperature records also indicate alarming physiological response. It could, thus, be concluded that the workers on the forging tasks have to experience a considerable degree of occupational stress arising out of environmental heat load and physical activities, and hence the consequent undue strain in their day to day occupational work. Appropriate recommendations are suggested.

Details are discussed in the article.

Key words: 'Ergonomics', 'Occupational Work Load', 'Environment Heat Load', 'Energy Cost', 'Heart Rate' and 'Oral Temperature'.

INTRODUCTION :

Since biblical times heat is considered as an occupational hazard to human-being. Extensive studies on the impact of environmental heat stress and resultant physiological strain among the workers have been carried out by many from abroad (Mc Ardle et al, 1947; Mackworth, 1950; Christensen, 1953; Wyndham , 1965; Lind, 1960, 1963, 1964 and 1970). Situation in tropical countries like India may be much more acute when strenuous manual activities couple with adverse hot working in day to day occupational work. Considerable studies are also carried out in our country, in many hot industries (Chief Adviser of Factories 1957, Sen et al 1964, Chakraborty et al 1969, and Sensarma 1973, 1977, 1982, 1991). All these have indicated that physiological reactions of the workers are greatly influenced due to working in heat. However, barring a pilot study in a forging Plant (Sensarma 1977), no systematic information is available in this sector employing over 5 lakhs population who are exposed to hot working environment and get involved in a variety of manual activities.

In view of the wide magnitude of the health problems as well as accident potentiality, as reported from different forging units, this investigation has been initiated.

The paper deals with the study in a few forging plants with a view to highlighting the severity of thermal environment encountered in different work-sites and consequent physiological strain and fatigue among the workmen.

MATERIALS AND METHODS:

Work-sites:

The study was undertaken in the forgeshops of few Ferrous-forging plants. Forging work involves heating up of raw materials, weighing in the range of 5to 38 Kg in the hot furnaces

(700 - 900^{O}C) and their subsequent processing on the hammer for desired product.

Workers :

Twenty four healthy and acclimatised workers were selected from various activities routinely performed in the forgeshop comprising (a) 'Loading' (b) 'Unloading' (c) 'Helping' and (d) Forging. They are referred to respectively as (i) Loader (ii) Unloader (iii) Helper and (iv) Hammer Man. Their Physical characteristics are given in Table 1.

Workers get involved in variety of activities in close vicinity of hot furnaces (700 - 900 ^{0}c).

Working Environment

Following thermal measurements were made at periodic intervals at various worksites using conventional methods to assess the magnitude of heat problem: (i) Dry Bulb Temperature (DBT) (ii) Wet Bulb Temperature (WBT) (iii) Air Movement (AM) and (iv) Black Globe Temperature (BGT). Severity of working environment was expressed as Corrected Effective Temperature (CET).

Physiological Strain

Job stress on different forging tasks was evaluated in terms of following physiological parameters: (a) Energy cost (b) Heart rate and (c) Oral temperature. Whereas 'Energy cost' estimates the quantum of physical tasks, 'Heart rate' and 'Oral temperature' responses highlight the combined effects of physical activity and environmental heat load. Parameters were recorded periodically by use of conventional techniques during rest / pre-work as well as during various work-spells and recovery periods.

RESULTS AND DISCUSSION :

Job-stress refers to load on the individuals due to stress in the occupation arising out of work-stress and environmental heat-stress. The scope of present study was to ascertain the extent of stress imposed among the workmen by applying the principles of ergonomics.

While the assessment of environmental heat-load highlights the extent of stress due to working environment, study on physiological functions ascertain degree of stress in occupational workload in terms of physiological strain and fatigue among the workers. Findings of the study are summarized in various Tables and discussed in seriatim.

Evaluation of Environmental Heat Load :

Environmental heat load is summarized in Table-2 alongwith maximum values recorded during the present investigation. Findings on environmental records as presented in table, indicate that level of heat stress in the forge shop was quite high exceeding the recommended limit (i.e. 29.5^{O}C) for safe work (CAF, 1957). Environmental severity was even found as high as 38.9^{O}C which indicates that workers in the forge shop were exposed to high degree of environmental stress posing threat to individuals exposed in their day to day occupation.

Evaluation of Occupational Work Load :

An Attempt was made to ascertain the impact of occupational stress in day-to-day work objectively in terms of physiological parameters such as i) Energy cost, ii) Heart rate, and iii) Oral temperature. Findings are summarized in Table-3.

Physiological Responses :

Findings presented in Table indicate the physiological responses in different forging tasks. Energy cost due to various tasks ranged from 3.6 to 6.0 kcal min^{-1}. Circulatory stress in terms of heart rate during actual operations was in the order of 146 to 160 beats min^{-1}, while the Oral temperature responses were 37.4 to 38.1^{O}C. Circulatory stress and Oral temperature response were indicative of undue physiological strain and fatigue. Findings also indicate poor recovery, as evident from 3rd minute recovery heart rate 90 - 101 beats min^{-1} (Brouha 1967). Peak values recorded both in circulatory and thermo regulatory responses as well as poor recovery pattern show alarming responses (Christensen, 1953).

Work Classification :

Based on the Energetic workload, as mentioned above, it is apparent that jobs were graded 'moderate to heavy' which could be, however, categorized from 'heavy to very heavy' in the light of circulatory stress, (Ramanthan et al 1967) as illustrated in Table 4.

The discrepancy in work classification could, therefore, be attributed to super-imposed effect of manual activities coupled with environmental heat load (Christensen, loc-sit). Thus, it is observed that in forging industry the tasks demanding high degree of physiological cost are undertaken in adverse working environment. All the physiological reactions were not only beyond the permissible limits indicating undue physiological strain and fatigue, health and well being of the workers in this sector are likely to be at stake as evident from the alarming physiological responses due to occupational work.

CONCLUSION

In the light of findings and discussion, following conclusion could be drawn :

a) The environmental heat load in the workplace was extremely severe exceeding the thermal environmental limit in day to day industrial task.

b) The physiological strain during work as evaluated from various parameters was quite severe. The occupational workload appears to be quite alarming at times in view of the magnitude of the problems arising out of workload and environmental heat-load.

RECOMMENDATIONS

The most important recommendations which are considered worthwhile to make work more humane, are as follows :

1) Introduction of mechanization in forging industry, whenever possible, to reduce extent of ardoucity of manual work, such as loading, unloading etc., routinely performed, in forging work.

2) Improvement of ventilation for removal of hot air to the outside.

3) Shielding of furnace-walls with materials having low emissivity like Aluminum, Calcium silicate etc.

4) Use of thermal barriers between the heat source and workers to minimize degree of heat exposure.

5) Use of Personal Protective Garments with reflective surface and internal cooling arrangement.

6) Selection of workers with high degree of physical fitness as well as thorough medical screening.

7) Arrangement of cold drinking water in the vicinity of shopfloor to avoid ill-effects of dehydration.

8) Provision of Air conditioned/Well ventilated rest-room for recovery.

9) Re-organisation of work-team and also re-scheduling of work-rest regimen.

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T A B L E - 1 PHYSICAL STANDARDS OF WORKERS

(Mean Values)

No. of Workers	**Age (Yr.)**	**Length of Service (Yr.)**	**Body Height (cm.)**	**Body Weight (kg.)**	**$VO_{2\ max}$ ($Ml\ min^{-1}\ kg^{-1}$)**
24	30.9	7.3	164	58.4	31.1

T A B L E - 2 ENVIRONMENTAL HEAT LOAD IN WORK-SITES

(Mean and maximum Values recorded)

No. of Observations	**DBT (^{O}C)**	**WBT (^{O}C)**	**R.H. (%)**	**BGT (^{O}C)**	**AM ($cm.sec.^{-1}$)**	**C.E.T (^{O}C)**
134	36.3 (41.7)	25.8 (29.4)	44 (69)	51.2 (78.9)	140 (281)	31.7 (38.9)

T A B L E - 3 PHYSIOLOGICAL REACTIONS

(Range of Values)

No. of Workers	**Energy Cost ($Kcal\ min^{-1}$)**	**Heart Rate (Beats Min -1)**			**Oral Temperature (^{O}C)**	
	Work	Pre-work	Work	3rd Min. recovery	Pre-work	Work
24	3.5 - 6.0	72 - 82	146 - 160	90 - 101	36.7 - 37.1	37.4 - 38.1

T A B L E - 4 WORK CLASSIFICATION

Operation	**Energy cost During Actual work (Kcal min^{-1})**	**Work Classification**	**Working Heart Rate (Beats min^{-1})**	**Work Classification**
Forging Tasks	3.5 - 6.0	Moderate - Heavy	146 - 160	Heavy - Very Heavy

Dr.S.K.Sensarma
Director(Physiology) & Incharge of Ergonomics Division,
Central Labour Institute, DGFASLI, Sion, Mumbai.400022

WORK ENVIRONMENT STUDY IN A PESTICIDE PLANT

The Directorate General Factory Advice Service & Labour Institutes, Mumbai undertook a National Project on 'Safety,Health and Working Environment in Pesticide Industry'. Under this project, a Work Environment Study on pesticide exposure to workers was carried in a pesticide plant by Regional Labour Institute, Kolkata.

The factory manufactures three technical products viz. Dimethoate, Ethion and Acephate and formulates three products from the technicals viz. Dimethoate 30% EC, Ethion 50% EC and Acephate 75% SP. During this study, the company was producing ethion as a technical product and its 50% EC formulation.

OBJECTIVE

The study was carried out with the objective to determine the airborne levels of pesticide present in the shop-floor to which the workers engaged in the process were exposed and also to assess the existing control measures already installed in the process. During the study, critical observations on their actual work practices was also one of the main objectives. The above activities were framed to eliminate their shortcomings in the area of work practices and exposure to air-borne pollutants.

METHODOLOGY

The manufacturing of ethion technical was carried out in a three-storeyed building and barrelling of ethion was carried out under a separate asbestos-shed, adjacent to the process building. The manufacturing area was in the floors well ventilated and the workers were found wearing a spectacle and dust-masks as protective equipment.

The formulation of ethion was carried out in a separate building. The building was used for four purposes viz. storing empty as well as filled containers of formulation product, the preparation of acephate formulation, storing small packing machines and for the preparation of ethion formulation. The shed was conjested and ventilation was inadequate. Workers in this are were found to use gloves and dust-masks as personal protective equipment.

Representative air samples were collected from different locations of the manufacturing as well as formulation units using ethylene glycol and activated charcoal. Both personal and static samplings were carried out to assess the level of exposure to the pesticide of the workers engaged in the process and also to measure the prevailing level of pesticide in the work environment. General work area samplings were also carried out to determine the level of exposure of other personals.

The collected samples of ethion were analysed using Gas Liquid Chromatograph (GC) with Flame-ionisation detector.

FINDINGS

The result of the analysis revealed that the air-brone levels of ethion were within the threshold limit value of 0.4 mg/m^3 of ethion in the entire process area. However, the air-borne levels of pesticide near the packing zone of ethion formulation have shown a higher value than 0.4 mg/m^3. The air-borne levels of pesticide in other locations in the formulation unit have been found lower than 0.4 mg/m^3.

RECOMMENDATIONS

On the basis of results and work practice, a number of recommendations were given for the improvement of their working conditions. Improvement in the area of ventilation near packing of ethion formulation, house-keeping of the formulation section, use of suitable and specific personal protective quipment, regular and periodic environmental monitoring, etc. were among the recommendations given to the factory management for further improvement.

TRAINING PROGRAMME ON EVALUATION AND CONTROL OF HAZARDS IN PESTICIDE INDUSTRY

In India the pesticide production started in 1952 when a plant was set up near Kolkata for BHC, and today India is the second largest manufacturer of pesticides in Asia and the twelfth in the world. Pesticides cover 35,000 different preparations approximately, where more than 1000 active chemical substances have been incorporated. A large Indian population is exposed occupationally and/or environmentally to some or the other type of pesticides.

Pesticide industry is one of the industries involving hazardous processes as per the First Schedule, Section 2(cb) of the Factories Act, 1948. The manufacture, formulation and application of pesticides give birth not only to industrial environmental pollution but also to the general environmental (air, water and soil) pollution.

In view of the major hazard posed by the pesticides during their manufacture, formulation, handling and use, the Industrial Hygiene Division of this Institute, has designed a 5-days training programme on Evaluation and Control of Hazards in Pesticides Industry, to give practical guidance and enlighten the participants on various health and safety precautions to be followed in the pesticide industry.

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OBJECTIVES

- To disseminate information and create awareness amolng participants regarding hazards of pesticides at workplace.
- To illustrate the techniques of identification, evaluation and control of chemical hazards.
- To train participants on the practices and procedures to be followed for safe use of pesticides.

CONTENTS

- Health & Safety provisions in the Factories Act and Insecticides Act.
- Physical, Chemical & Toxicological Hazards of Pesticides.
- Safety in Transportation, Storage and Handling of Pesticides.
- Monitoring of workplace environment.
- Safety management of pesticides at workplace.
- Process Safety.
- Emergency Preparedness
- Medical Surveillance
- Environmental Management System- ISO-14000
- Training Techniques
- Personal Protective Equipment
- Case Studies

PARTICIPANTS

This programme is designed for the target group of Managers (HSE), Executives, Industrial Hygienists, Chemists, Supervisors and other Technical Officers concerned with health, safety & environment. the number of participants to be enrolled for this course will be limited to 25 on first-come-first served basis.

DURATION- 5 Days

Conducted by:

Industrial Hygiene Division
Central Labour Institute, DGFASLI
Mumbai.

- On 26th June,2000, loading of billet bundles on to trailers was in progress in a Port using Mobile cranes. During the course of hoisting a sling load ,the jib of the mobile crane collapsed and winch driver sustained serious injuries. He later succumbed to the injuries.Two other mazdoors also received minor injuries and were given treatment.

Investigations into the cause of the accident revealed that the accident had taken place due to slinging of the crane in an unsafe manner breaching the provision of the regulation 51(1) read with regulation 7(5) of the Dock Workers (Safety, Health & Welfare) Regulations, 1990. Further employer of dock worker breached the provision of regulation 65(10), 66(6) and 111 of the said regulations. Also the crane was not maintained and tested breaching regulations 40(1) and 41(1) of the said regulations. A prosecution case has been contemplated against the employer of dock worker for breach of the provision of regulations 65(10), 66(6), 73(1), 91(6) and 111 and also against the owner of the crane for breach of regulation 40(1) of the Dock Workers (Safety, Health & Welfare) , Regulations, 1990. Further the crane driver was warned for breach of regulation 53(1) read with regulation 7(5).

- On 13th July, 2000 a mazdoor while going to his work spot at a Port was hit by a lorry on the road and succumbed to his injuries.

Investigations revealed that the accident had taken place due to the negligent driving of the lorry driver and the unsafe act of the deceased who was riding the bicycle without keeping to his left. The driver of the trailer was warned through his employer for his unsafe driving.

- Amidst hosting a sling of bundles of steel billets with the help of a dock crane, the load struck a stationary fork lift truck in the hold of a ship at a Port . The fork lift truck in turn moved backward and hit two workers who were trapped between the fork lift truck and the latch wall and received fatal injuries.

Investigations into the accident revealed that the fork lift truck which was kept in the line of travel of the sling consisting of bundles of steel billets was hit by the load amidst its travel effected by deck crane. Two victims failed to ensure that the fork lift truck was not kept in the line of travel of sling. The prosecution for breach of regulation 116(2) and 117 is proposed to be launched against the employer and in addition the concerned Dock Labour Board will be instructed to strengthen routine supervision to eliminate the joker system which is an unsafe practice.

INTERNATIONAL OCCUPATIONAL SAFETY AND HEALTH INFORMATION CENTRE (CIS)

CIS (from the French name, Centre international d'Information de securite et d'hygiene du travail) i.e. International Occupational Safety and Health Information Centre, is a part of the International Labour Office, Geneva, Switzerland. The mission of CIS is to collect world literature that can contribute to the prevention of occupational hazards and to disseminate this information at an international level. CIS imparts to its users the most comprehensive and up-to-date information in the field of Occupational safety and health. The work of CIS is supported by a worldwide Safety and Health information exchange network which includes over 91 affiliated National Centres and 38 CIS collaborating Centres. Central Labour Institute, Mumbai has been designated as the CIS National Centre of India.

CIS can offer you rapid access to comprehensive information on occupational safety and health through:

- Microfiches on original documents abstracted in CIS DOC (CISILO)
- ILO CIS Bulletin "Safety and Health at Work"
- Annual and 5-year indexes
- The CIS Thesaurus
- The list of periodicals abstracted by CIS

EXCERPT FROM CIS DOC

Title:Influence of material handling devices on the physical load during the end assembly of cars.

CIS ACCESSION NUMBER :
CIS 00- 1181

ABSTRACT :

The effect of using a mechanical device on physical load was anlysed during the end assembly of cars. Five tasks, further sub-divided into lifting and positioning, were performed by someone experienced in working with and without the mechanical tool. A practical methodology was used: the subjective walk and talk through method, the NIOSH equation (1991), a three-dimensional goniometer (Back Tracker) and surface eletromyography (EMG) of the relevant muscle groups. According to the NIOSH equation, 8 out of 10 of the tasks should only be performed by trained workers and preferably with tools. The Back Tracker revealed that the mechanical tools reduced posture angles significantly ($p \leq 0.05$) for installing the windows, but not for left lateroflexion during pre-assembly of windows. It was clear from the EMG analysis that using tools did not always decrase muscular activity significantoy. In general, the appropriateness of each tool needs to be evaluated separately taking subjective criteria into account. (75248).

Note: For details write to CIS National Centre for India, Central Labour Institute, Sion, Mumbai 400 022.

The Library & Information Centre of Central Labour Institute has unique collection of Material Safety Data Sheet of about 1,20,000 chemicals/materials taken from Canadian Centre for Occupational Health & Safety. MSDS provides extensive coverage over safety perspective with detailed evaluation of health, fire and reactivity hazards. It also provides precaution as well as recommendation on handling, storage, personal protective equipment, accidental release etc.

IDENTIFICATION

PRODUCT NAME(S) : Sodium Sulphide

Hazardous ingredients of materials

Ingredients -Sodium Sulphide ,% - 98% , TLV Units 10 ppm (as H2S) CAS No. 1313-84-4

PHYSICAL DATA

Physical State: Solid.
Odour and Appearance: White to slightly yellow deliquescent crystals or granules or amorphous, yellow-pink solid. Odour of hydrogen sulphide.
Odour Threshold (ppm): 0.13 ppm (hydrogen sulphide); at or above 100 ppm paralyses sense of smell. Vapour Pressure (mm Hg): Not applicable Vapour Density (Air=1): Not applicable Evaporation Rate: Not applicable. Boiling Point (degrees C): Decomposes at 920 deg C.
Melting Point (degrees C): ~50 deg C (loses water at 120 deg C) pH: Strongly alkaline in aqueous solution.
Specific Gravity: 1.427 at 16 deg C Coefficient of Water/Oil distribution: Not applicable.

REACTIVITY DATA

Chemical Stability: Moderately stable. Extremely hygroscopic. Discolours on exposure to light and air. Releases hydrogen sulphide producing rotten egg smell. Incompatibility with other substances: Reacts with acids to release toxic and flammablehydrogen sulphide. Reacts violently with, oxidizers, forming sulphur dioxide. Reacts explosively with diazonium salts, N,N-dichloromethylamine. Reaction with carbon releases heat. Corrosive to zinc, aluminum and copper.
Reactivity: Avoid exposure to heat, light, air. Becomes unstable at elevated temperatures and pressures. Reacts non-violently with water.
Hazardous Decomposition Products: H2S, SOx.

FIRE AND EXPLOSION DATA

Flammability: Sodium sulphide can burn but is not readily ignited. Finely dispersed particles can explode. Releases HIGHLY FLAMMABLE hydrogen sulphide gas and therefore is a dangerous fire and explosion risk.
Extinguishing Media: Water, CO2, foam, dry chemical. Firefighters must wear protective equipment and clothing sufficient to prevent inhalation of dust or vapours, and contact with skin and eyes. Use water spray to cool containers, disperse vapours, and flush material away from ignition source.
Flash Point (Method Used): Not applicable.
Autoignition Temperature: 260 dec C (H2S)
Upper Flammable Limit (% by volume): 44.0% (H2S)
Lower Flammable Limit (% by volume): 4% (H2S) .
Hazardous Combustion Products: SOx, hydrogen sulphide gas, finely divided sodium sulphide explosive mixtures and Na2O Sensitivity to Impact: None identified
Sensitivity to Static discharge: As dust, under certain conditions, may be ignited by static discharge. Gases released during reactions or decomposition may be ignited by static discharge.

Toxicological properties and health data

Toxicological Data:
LD50: (ipr, mouse) 53 mg/kg
LC50: Not available

Effects of Acute Exposure to Product:

Inhaled: Toxic. Causes sore throat, coughing, shortness of breath. Higher concentrations or prolonged exposures may cause nausea, vomiting, dizziness, pulmonary edema and death.

In contact with skin: Causes irritation or burns to the skin.
In contact with eyes: Corrosive. Causes severe irritation, pain, intense tearing, blurred vision, slow-healing burns, and possible blindness.
Ingested: Corrosive. Ingestion can cause burns to the mouth, throat and stomach, nausea, vomiting, diarrhea, in severe cases, intestinal perforation and death.

Effects of Chronic Exposure to Product:

Carcinogenicity: No evidence of carcinogenicity
Teratogenicity: No information available
Reproductive Effects: No information available
Mutagenicity: No information available
Synergistic Products: None known.

PREVENTIVE MEASURES

Engineering Controls: Local exhaust required. Respiratory Protection: Dust mask. Use only in fumehood. NIOSH/MSHA approved respirator for concentrations above TLV. For higher or unknown concentrations, as in fire or spill conditions, positive-pressure, full face-piece self-contained breathing apparatus.
Eye Protection: Chemical safety goggles or face shield.
Skin Protection: Wear protective neoprene or PVC gloves. Other body-covering clothing, sleeves, coveralls, boots, sufficient to prevent contact.
Other Personal Protective Equipment: Safety shower and eye-wash fountain in work area. Leak and Spill Procedure: Evacuate area. Shut off all sources of ignition. Cleanup personnel must be trained in the handling of hazardous materials, and must wear protective equipment and clothing sufficient to prevent inhalation of dust or fumes, and contact with skin and eyes. Stop leak if safe to do so. Absorb on inert absorbent, transfer to container and transport to safe area.Tip into a large volume of water and leave until decomposed. Arrange removal by disposal company. Wash site of spillage thoroughly with water and detergent.
Waste Disposal: Dispose of in compliance with local, provincial and federal regulations. Handling Procedures and Equipment: Workers using this material must be thoroughly trained in its hazards and its safe use. Keep away from heat, sparks, flame, hot surfaces, and all sources of ignition. Use the smallest amount possible for the purpose, in an area with adequate ventilation. Avoid generating dust. Avoid inhalation of dust or vapours. Avoid all contact.
Storage Requirements: Store in suitable, labelled containers, in a cool, dry, well-ventilated area, out of direct sunlight. Keep containers tightly closed when not in use and when empty. Protect from damage. Store away from incompatible materials and all sources of ignition. Inspect periodically for damage or leaks.

FIRST AID MEASURES

Specific measures:
Eyes: Flush thoroughly with running water for at least twenty minutes,holding eyelids open while flushing. Avoid contaminating unaffected eye while rinsing. Get medical attention immediately.
Skin: Remove contaminated clothing, including watches, belts, rings and shoes. To avoid contact during first aid, wear protective gloves. Wash affected skin with plenty of running water for at least twenty minutes. Get medical attention. Inhalation: Immediately remove to fresh air (caution must be used by rescuers to avoid exposure to contaminating fumes). Give oxygen and get medical attention for any breathing difficulty. If breathing has stopped, give artificial respiration.
Ingestion: Do not induce vomiting. If victim is alert and NOT convulsing, rinse mouth thoroughly with water, and give 2 to 4 glasses of water to drink to dilute. Get medical attention immediately. If spontaneous vomiting occurs, rinse mouth and repeat administration of water.

<u>NOTE</u>: The above details constitute part information of MSDS taken from Canadian Centre for Occupational Health and Safety. For complete MSDS write to MIS division, Central Labour Institute, Sion, Mumbai.400022. MSDS on about 1,00,000 chemicals/materials are available with Central Labour Institute. Computer printout will be supplied on nominal charge basis.

LIBRARY AND INFORMATION CENTRE

The Library and Information Centre of Central Labour Institute has unique and rare collection of different kinds of publications in the field of Occupational Safety, Health, Management and allied subjects. It also has a good collection of different standards, codes, regulations on these matters. In the current year, the centre is subscribing to 30 Indian & foreign journals, besides receiving complimentary copies of different periodicals from all over the world. The centre provides facilities for study and research and at the same time supplies authentic and up-to-date information on Occupational Safety, Health and Management. It also extends reading facilities to students & scholars attending different training programmes & courses conducted by CLI. From December 2000 till date a number of publications in the field of OS&H have been added to Library. Some of them are :

YEAR BOOK OF LABOUR STATISTICS - 2000
Published by International Labour Office, Geneva.

The Yearbook of Labour Statistics is an annual publication of the International Labour Office, prepared by the Bureau of Statistics. The 2000 issue presents the principal labour statistics for over 190 countries, areas or territories. Most of the tables cover the ten years from 1990 to 1999. However, not all countries are in a position to provide the ILO with series covering the whole period; for some, figures may not be available until several years after the reference year. The data published in this edition of the Yearbook are those available in the ILO at 30 September 2000.

The annual data on consumer price indices, which also appear in the Bulletin of Labour Statistics with monthly, quarterly or half-yearly frequency are identified in the corresponding tables of the present Yearbook by the symbol “B”.

The editor contains thirtyone tables corresponding to nine major substantive chapter on the following:

- Economically active population
- Employment
- Unemployment
- Hours of work
- Wages
- Labour Cost
- Consumer prices
- Occupational injuries
- Strikes and lockouts.

Chapter 8 has been extensively revised to take account of the recommendations contained in the Resolution concerning statistics of occupational injuries (resulting from occupational accidents) adopted by the Sixteenth International Conference of Labour Statisticians in 1998. New series are now presented on cases of injury with temporary incapacity for work and on rates of non-fatal occupational injuries, and each table now contains separate data for men and women, where available.

The subjects are grouped in nine chapters, each with an explanatory note briefly indicating the main characteristics of the different types of data published.

The type of source for the series is shown as a code in parenthesis following the name of the country. The explanations of the codes are provided on page XVI.

The coverage of the series in terms of groups of workers or types of data is shown on the first line of the table, where relevant. Additional information concerning the coverage may be shown as footnotes.

The countries appear by continent in accordance with the table “Order of arrangement of countries, areas and territories” given in the Appendix.

This yearbook is a very useful reference source for Industry officials, research scholars and Government officials who are engaged in labour related fields.

DRAFT BILL TO LIFT BAN ON CONTRACT LABOUR

A new draft bill which lifts the prohibition on use of contract labour and envisages payment of both gratuity and retrenchment compensation to workers on contract is being given finishing touches by the labour ministry. The law allows outsourcing of services by implication.The draft is yet to be okayed by the Cabinet and could be referred to the Standing Committee on Labour given the sensitive nature of the amendments.

As per the draft bill, registration of the principal employer and the contractor will be made mandatory. Currently, the government issues licences to contractors. Registration will be subject to the condition that provisions on wages, health, safety and welfare etc. are complied with.

There is a debate about who will be the regulatory authority. The government would like to reserve this right, but employers say that can lead to extortion and harassment. Sharad Patil, Secretary General of the Employer' Federation of India, said that they would like a self regulatory authority to review this industry-wise and the Institute of Cost and Works Accountants could become the regulatory authority for wages. He also said that an industry body in the construction industry could consider issues of workers' safety.

Source: Business Standard

INSURANCE COVER FOR LABOURS, FARMERS AND POOR CHILDREN

The Government of India has announced in the Union Budget for 2001-2002 a number of insurance schemes which would cover farmers, labourers who would lose their jobs in the process of liberalisation, landless agricultural labourers and children of parents living below the poverty line.

According to the budget proposals, banks have been asked to provide a personal insurance package to the Kisan Credit Card holders. The scheme would be in accordance with the insurance scheme extended to the other credit card holders. It would cover KCC holders against accidental death or permanent disability, upto a maximum amount of Rs.50,000 (in case of death) and Rs.25,000 (in case of permanent disability).

The budget has also proposed an insurance cover for labourers who would be retrenched in the process of liberalisation. The new group insurance scheme, christened "Ashraya Bima Yojana" would provide compensation of upto 30 percent of last drawn annual pay for a period of one year to workers who would lose their jobs.

Source :Indian Express

Vishwakarma Rashtriya Puraskar" & "National Safety Awards" for the year 1997 and 1998 were distributed in a function held on 18th January, 2001 at Malwankar Hall, New Delhi.

During the Awards presentation function Shri Vinod Vaish, Secretary, Ministry of Labour welcomed the Awardees, Guest and invitees and gave an introduction about the differentVishwakarma Rashtriya Puraskar and National Safety Awards Schemes.

Awards were given away by Hon'ble Union Minister of Labour Dr.Satyanarayan Jatiya. The Hon'ble Minister of State for Labour and Employment Shri Muni Lall, presided over the function.

While appreciating the improvements being made in the field of Safety and Health and Environment in the Industrial sector, Dr.Satyanarayan Jatiya, laid emphasis on the requirements of much more efforts for achieving complete satisfaction and confidence. He also declared that the Cash Awards for the Winners of the different categories have been increased.

PRODUCTIVITY WEEK

Productivity Week was celebrated on 9th February, 2001 at CLI, Mumbai. The Director General inaugurated the function. Theme of the programme was "Vision Statements of the different divisions of the Institute, for next 10-15 years". The various divisions of the DGFASLI and Central Labour Institute made a presentation according to their visions during the programme.

Productivity week was also observed at RLI, Chennai from the 14-16th February, 2001. Shri M.Shankar Rao, Sr.Dy.Director, HRD National Productivity Council, Chennai delivered a talk on "Safety & Productivity" during the programme on 16.2.2001. The officers of the institute and diploma students expressed their views about Safety & Productivity. The programme was attended by about 40 participants.

SEMINAR

The Institute conducted a seminar on Fire & Explosion Prevention and Loss Control in Industries on 23rd February, 2001. The objective of this Seminar was to create an awareness and give importance to fire and loss prevention amongst the Safety Professionals. Twenty technical papers were presented by the post diploma students and ex-students of the Institute. The seminar was inaugurated by General Manager, Field Gun Factory & Valedictory address was delivered by Regional Controller of Safety D.G.O.E.F group Headquarters, Kanpur. One hundred delegates from 70 organisations participated in the seminar.

TRAINING PROGRAMMES
APRIL-JUNE 2001
CENTRAL LABOUR INSTITUTE , SION, MUMBAI - 400 022

Programme Title	Contact Person
Associate Fellowship of Industrial Health	Director (Medical) & Incharge Indl.Medicine Division
Training programme on Industrial Safety & Health for Trade Union Leaders	Director (Safety) & Incharge Indl. Safety Division
Industrial Fatigue - its Evaluation & Control for Safety,Health & Productivity at Work	Director (Physiology) & Incharge Indl.Physiology Division
Training programme on Hazards & operability studies	Director (Indl.Hygiene) & Incharge MAHCA Division
Industrial Ergonomics	Director (Phsiology) & Incharge Ergonomics Division
Wage & Salary Administration	Director (Productivity) & Incharge Productivity Division
Workshop on Safety Audit	Director(Safety)& Incharge Indl. Safety Division
Workshop on the Job Counselling Skill	Director (Psychology) & Incharge Indl. Psychology Division
Effective Supervision for Results	Director (Staff Trg.) & Incharge Staff Training Division
Improving Quality of work & working life for Safety Committee members	Director (Safety) & Incharge Indl.Safety Division

Programme Title	Contact Person
Industrial Heat -Evaluation & Control for Higher Productivity.	Director (Physiology) & Incharge Ergonomics Division
Selection & Quality Assurance for effective use of PPE	Director (Indl.Hygiene) & Incharge Indl.Hygiene Division
Fitness in Industry - its application for promotion of safety,health & productivity	Director (Physiology) & Incharge Indl Physiology Division
Training for Council of Industrial Safety Members	Director (Safety) & Incharge Indl.Safety Division
Productivity Improvement through Effective Employee Participation	Director (Productivity) & Incharge Productivity Division
Management of Occupational Stress & Fatigue	Director (Physiology) & Incharge Ergonomics Division
Refresher Course for Inspectors of Factories	Director (Safety) & Incharge Indl.Safety Division
Industrial Fatigue- its Evaluation & Control for safety, health & productivity at work	Director (Physiology) & Incharge Indl.Physiology Division

TRAINING PROGRAMMES
APRIL 2001 TO JUNE 2001
REGIONAL LABOUR INSTITUTE, LAKE TOWN, KOLKATA – 700 089

Programme Title	Contact Person
Prevention and control of Fire in Industry for worker Members of Safety Committee	Director Incharge
Application of HAZOP Techniques in Industry	Director Incharge
Safety Engineering and Management	Director Incharge

TRAINING PROGRAMMES
APRIL TO JUNE 2001
REGIONAL LABOUR INSTITUTE, SARVODAYA NAGAR, KANPUR

Programme Title	Contact Person
Prevention & Control of Fire in Industry	Director Incharge
Industrial Safety & Health	Director Incharge
Safety Audit	Director Incharge
Testing & Examination Of Lifting Machines, Tackles & Pressure Vessels	Director Incharge

INDOSHNET

Ministry of Labour, Government of India, is developing a National Network on Occupational Safety and Health information system known as INDOSHNET. Directorate General Factory Advice Service & Labour Institutes (DGFASLI), an attached office of the Ministry of Labour will act as a facilitator of the network system. The objective of the network is reinforcement and sharing of national occupational safety and health (OS &H) information on no-profit no-loss basis with a view to pooling our information resources for mutual benefit. The sharing of information will not only confine to the national level but also includes international sources. The communication of information will be through E-mail as well as postal/courier service. DGFASLI invites industrial organisations, institutions, industry associations, trade unions, professional bodies and non-governmental organisations having information on OS&H and willing to share the same with others at the national and international level to participate as members in the network. Interested agencies may please write for proforma of organisational profile to Director General, DGFASLI, Central Labour Institute Bldg., N.S. Mankikar Marg, Sion, Mumbai 400 022.

Note: Those who have responded to our earlier communication and sent organisation profile in the prescribed format need not write again.

NATIONAL REFERRAL DIAGNOSTIC CENTRE

Early detection and diagnosis of occupational health disorders and occupational diseases is one of the most important factors in the prevention and control of adverse health effects on workers due to various factors - physical, chemical, biological and psycho-social. The Industrial Medicine Division of Central Labour Institute, Mumbai runs a National Referral Diagnostic Centre (N.R.D.C.) for early detection and diagnosis of occupational diseases and recommends necessary measures for prevention/control of occupational health problems/occupational diseases. The diagnostic centre is well equipped for medical examination of the exposed workers and facilities are available for carrying out special investigation, e.g. Pulmonary function tests, Audiometry, ECG, Titmus vision test, Biological monitoring, etc. Medical professionals including Factory Medical Officers, ESI Doctors, Medical Inspectors of Factories and Certifying Surgeons, Doctors from Medical Colleges and Hospitals can refer suspected cases of occupational diseases to N.R.D.C. for diagnosis and advice. The communication should be addressed to the Director General, DGFASLI, Central Labour Institute Bldg., N.S. Mankikar Marg, Sion, Mumbai 400 022 for further details.

GOVERNMENT OF INDIA, MINISTRY OF LABOUR
DIRECTORATE GENERAL FACTORY ADVICE SERVICE & LABOUR INSTITUTES

The Directorate General Factory Advice Service & Labour Institutes (DGFASLI) is an attached office of the Ministry of Labour, Government of India. DGFASLI organisation was set up in 1945 under the Ministry of Labour, Government of India to serve as a technical arm to assist the Ministry in formulating national policies on occupational safety and health in factories and docks and to advise State Governments and factories on matters concerning safety, health, efficiency and well-being of the persons at workplace. It also enforces safety and health statutes in major ports of the country.

The Directorate General Factory Advice Service & Labour Institutes (DGFASLI) comprises:

* Headquarters situated in Mumbai
* Central Labour Institute in Mumbai
* Regional Labour Institutes in Kolkata, Chennai, Faridabad and Kanpur

The Central Labour Institute in Mumbai functions as a socio-economic laboratory and is a national institute dealing with the scientific study of all aspects of industrial development relating to the human factors.

Over the past 33 years the Central Labour Institute has constantly grown not only in size but also in stature and has earned national and international recognition. It has been recognised by the International Labour Organisation as a Centre of Excellence in training on Occupational Safety and Health in the Asian and Pacific Region. It also functions as a National Centre for CIS (International Occupational Safety and Health Information Centre) and the Centre for National Safety and Health Hazard Alert System. At the national level, apart from providing research and training support to the Government and functioning as a technical arm of the Ministry of Labour, the institute provides comprehensive and multi-disciplinary services to the Industrial Port sector through studies, technical advice, training and dissemination of information. It also runs National Referral Diagnostic Centre for early detection of occupational disorders and thereby controls and prevents them. It has a modern Audio Visual Studio fully equipped with sophisticated video production equipment to produce quality U-matic video films on Safety and Health. The Regional Labour Institutes are a scaled-down version of the Central Labour Institute and cater to the needs of their respective regions.

The organisation is poised to grow further, and meet the increased demands on it. In a developing country with a large number of industries having diverse and complex nature, the task of protecting safety and health of workers is an uphill task. Armed with the technology, good-will of the industrial society and the strength of the dedicated staff, the organisation is well prepared to meet the challenges of tomorrow. It is committed to the goal of making the workplace safer.

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