9th Biennial International Conference
& Exposition on Petroleum Geophysics

"HYDERABAD 2012"

P-297

# Occupational Risk Management: A Case Study of Noise Survey and Mitigation Measures at Offshore Process Complexes of Mumbai High Asset, ONGC, India

***Sudhir Bartaria*, V. K. Achtani, A.K.Sapre,*** *ONGC*

***Summary***

*Noise is no less pollutant than the toxic chemicals in our environment. As a result of increased mechanization, the use of increasingly voluminous and complicated machinery and equipment and the stepping of the pace of production, noise is becoming an increasingly wide spread and serious sources of discomfort and danger.*

*Noise is one of the major environmental pollutants creating potential hazard to human health. Continued and longer exposure to high level of noise result in annoyance, fatigue and temporary shift of threshold limit of hearing and mind, which may ultimately lead to permanent loss of hearing.*

*In the fast growing industrial world, the human resource is the biggest asset for any organization. Safe and conducive work environment is essential to achieve high levels of performance and enhanced productivity. Besides having optimum utilization the building of an overall well being of the human resource is a long term deal. Healthy workers – on the job and in proper physical and mental condition – are more likely to contribute their best efforts.*

*Every job function contains hazards that can be minimized or eliminated if they are systematically identified and then controlled. Noise is considered to be a typical hazard as its damaging effect is not noticed by the exposed person but the damaged caused is irreparable & irreversible. Hence, in occupational health, prevention is the only cure.*

*This case study of offshore process platforms of Mumbai High Asset, ONGC, India reports the identification, evaluation and analysis of noise levels at various strategic locations of offshore complexes. Based on the level of Noise recorded the areas were segregated as Safe Zone, Alarming Zone & Dangerous Zone. The efforts were made to mitigate residual risk through administrative control measures like changes in the OCP (operation control procedures), trainings / awareness programms, use of personal protective equipments etc. The Medical Examination report along with audiograms of employees exposed to high noise areas are evaluated by occupational health expert for personal counseling. The feasibility to explore engineering controls for long term solutions of the problems were considered under management programs.*

***Keywords****: Noise, Decibel, Noise Dose, Safe Zone, Alarming Zone, Dangerous Zone*

## Introduction

Noise is typically defined as sound that is unwanted, as perceived by a listener, because sensitivities to certain types of noise may be related to ear physiology or psychology. Noise pollution is not new, but it has become more problematic with the developments associated with industrialization and urbanization. It is one of the most common occupational health hazards.

The present case study deals with the noise survey and mitigation measures at various offshore process complexes of Mumbai High Asset. With the ageing of the equipments and machinery more and more emphasis is required to be

*M H Asset, ONGC, India*
*E-mail : sudhirbartaria@gmail.com*

focused for their maintenance and up keeping of the systems in operation for optimum life cycle. As equipments are getting older the probability of generation of noise levels increases. Noise survey is therefore one of the important activities performed on regular basis for ascertaining the noise levels for planning and timely initiatives for their mitigation.

Noise induces a severe impact on humans. The hazardous effects of noise depend on its intensity (loudness in decibels), duration and frequency (high or low). Loud, abrupt sound can harm the eardrum, while sustained sounds at lower volume can damage the middle ear; both types of sounds can cause psychological damage. Noise disrupts sleep and communication. Stress, high blood pressure, anger and frustration and many other physiological and psychological problems have been linked directly to noise. Numerous studies have documented the heart related, respiratory, neurological and other physiological effects of noise.

Human resource is the biggest asset for any organization. In this fast developing world, particularly in petroleum industry where per barrel cost is constantly showing an upward trend, the demand for trained and skilled human resource is also increasing. Besides legal and other statutory requirements the employer is also required to demonstrate through appropriate and adequate measures taken for management of risk and efforts undertaken to provide a safe and healthy working environment for the employees. A safe and conducive work environment is essential to achieve high levels of performance and enhanced productivity.

## Noise Level Monitoring

Keeping the importance of above in to consideration and realizing the contributing effect of safe and conducive environment towards achieving the high levels of performance and enhanced productivity, initiative was taken to evaluate the noise levels at various areas & strategic locations of the complexes / platforms of Mumbai High Asset so as to find out whether the measured noise levels are within the permissible limits as prescribed by Environmental Protection Act'1986 as well as OSHA (Occupation Safety and Health Administration, US Department of Labour),1995 and The International Organization for Standardization – ISO – R 1999-1971. The survey have been conducted by using "LUTRON' make direct reading noise level meter of standard ICE 651 – 1979, 804-1958, type-1L,1975. The noise level dB (A) has been measured in decibels on scale A, which is relatable to human hearing response.

The graph shows the limits set by International Organization for Standardization (ISO, R-1999, 1971 (Ref: 1) and occupational Safety and Health Administration (OSHA), US Department of Labour) (Ref.2). From the curve, we can also find out the exposure time (in hours) for a particular sound level.

Based on the guidelines by various national / international standards such as OSHA / ISO standards, the following classifications have been made for the identification of zones of noise levels. Areas / Zones where noise levels below 60 dB have been considered as Safe Zone, the noise

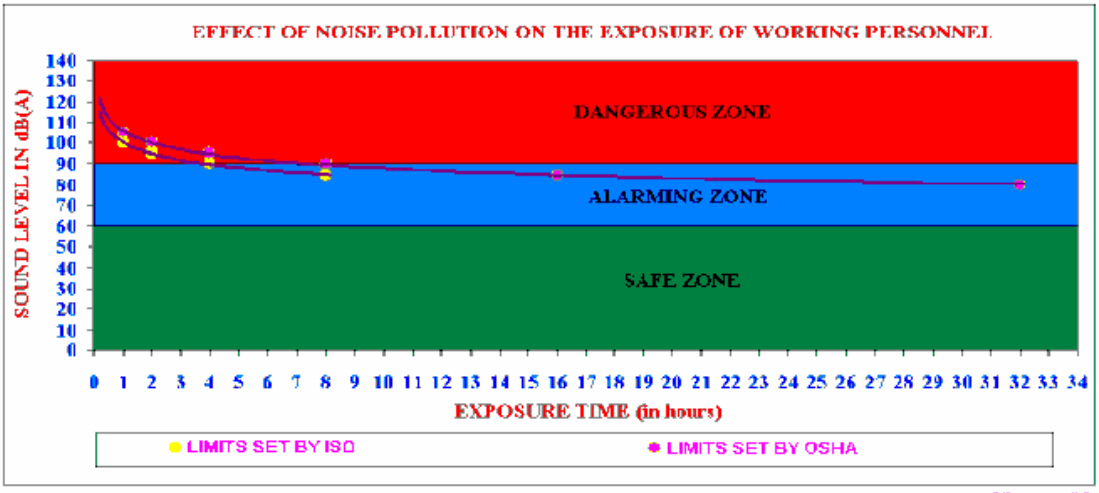



Figure: 01

| NOISE LEVEL dB(A) | ZONES |
|---|---|
| < 60 | Safe |
| 60 to 90 dB | Alarming |
| >90 | Dangerous |

Table - 1

levels in the range 60-90 dB have been considered as within the "Alarming Zone", while the values above 90 dB have been considered as "Dangerous Zone".

The factors which determine the hazardous nature of noise are – Intensity (loudness) measured in dBA and Time of exposure measured in hours and minutes. A "Noise Dose" combines both loudness and time. Taking in to consideration the 12 hour shift pattern at offshore, the Alarming zone window has been considered from 60 dB to 89 dB for better monitoring & control of the noise effects.

The above survey was conducted every year at all the sensitive locations in order to ascertain changes / variations in the noise levels so as to ensure that timely corrective action in this regard are put in place and also to create awareness about the harmful effects of noise pollution to the working personnel.

The case study of offshore process platforms of Mumbai High Asset, India reports the identification of work locations where noise levels may be hazardous to employees. These locations were marked as strategic locations and the personnel exposed to the high noise areas were identified. Total 650 locations (for all the seven complexes) were identified for measurement of noise levels for further categorization based on decibel levels. The measurements of noise level have been done with running conditions of the equipments for realistic estimates. The results of last four years have been considered in this paper for discussion.

The overall picture of Mumbai High Asset indicates that around 74 % of the locations covered for noise survey are in non hazardous zone (Safe zone 30 %, Alarming zone 44 %) where as dangerous zone constitutes around 26 %.

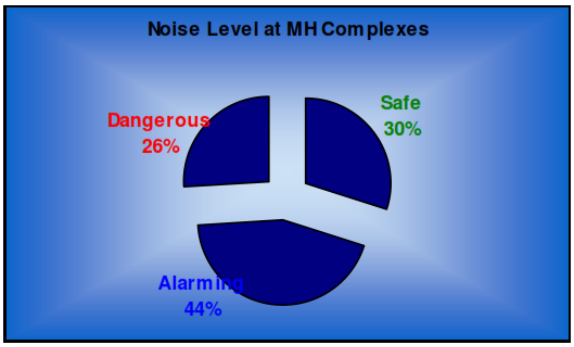



Fig. 2

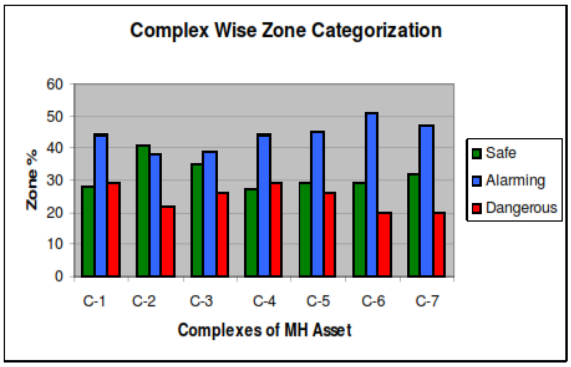



Fig.3

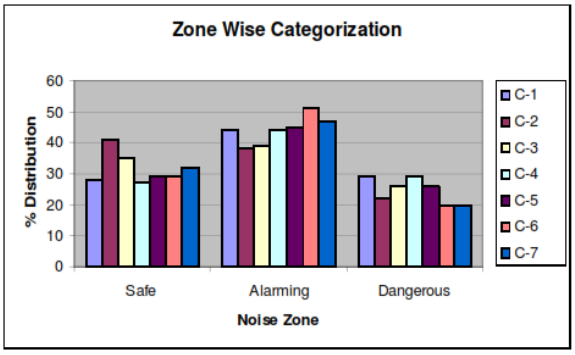



Fig.4

| Complex | C-1 | | C-2 | | C-3 | | C-4 | | C-5 | | C-6 | | C-7 | | | Avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone | Nos | % | Nos | % | Nos | % | Nos | % | Nos | % | Nos | % | Nos | % | Total | |
| **Safe** | **39** | **28** | **13** | **41** | **37** | **35** | **31** | **27** | **32** | **29** | **26** | **29** | **19** | **33** | **197** | **30** |
| **Alarming** | **61** | **44** | **12** | **37** | **41** | **39** | **51** | **44** | **49** | **45** | **45** | **51** | **28** | **47** | **287** | **44** |
| **Dangerous** | **40** | **28** | **7** | **22** | **27** | **26** | **33** | **29** | **29** | **26** | **18** | **20** | **12** | **20** | **166** | **26** |
| **Total** | **140** | | **32** | | **105** | | **115** | | **110** | | **89** | | **59** | | **650** | |

Table 2

## C-1 to C-7: Process Complexes of MH Asset

All the complexes are involved in similar functioning of receiving, processing and dispatching of oil & gas. They are also equipped with almost similar set up except the size of the complex. Larger the complex, greater the handling facilities for hydrocarbons and other associated jobs, which in turn involves placement of more equipments and other infrastructure commensurate to that. Minor variation in above graph is due to size of the complex and equipment numbers.

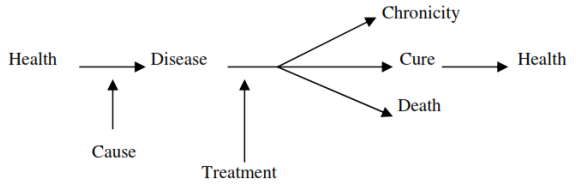
In all the complexes, the noise level recorded at Living Quarter (Galley, Rooms, Radio Room, Dining Room, Control Rooms, Chemistry Lab and Switch Gear Room have been found to be in the range of 50 dB to 60 dB which is well within the safe limits. These areas are the most sensitive areas, from noise point of view, as these are always occupied by persons and required to be maintained in the safe limits.

The common areas falling under Alarming zone are Test Separator, Water Maker, Riser Area, Sewage Treatment Plant, Dehydration Units, Glycol Filter and Well Head areas with a noise range between 71 to 89 dB.

The common locations categorized under Dangerous zone involves Helicopter Take Off and Landing (106 dB to 112 dB), Fire Water Pumps and Utility Generators (100 dB to 106 dB in running condition).

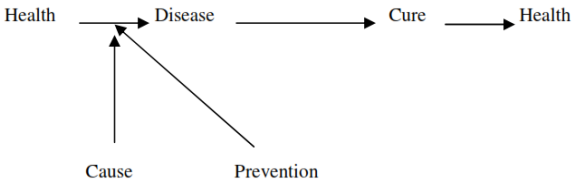
## Importance of Noise

Noise is considered to be a typical hazard as its damaging effect is not noticed by the exposed person but the damaged caused is irreparable & irreversible, hence, prevention is the only cure.




In Normal Disease Pattern

Fig. 5




In Occupational Diseases

Fig. 6

## Noise Management Strategy

To prevent adverse impact of noise exposure, noise levels is required to be reduced to acceptable levels. The best method of noise reduction is to use engineering modifications to the source itself, or to the work place environment. But, if it is not feasible, then the technique or the combination of techniques is to be employed for noise control depending upon the extent of the noise reduction required, nature of the equipment used and the economy aspects of the available techniques.

For mitigating the noise problem, noise management strategy is planned for evaluating and assessing the best possible solution required for minimizing the impact.

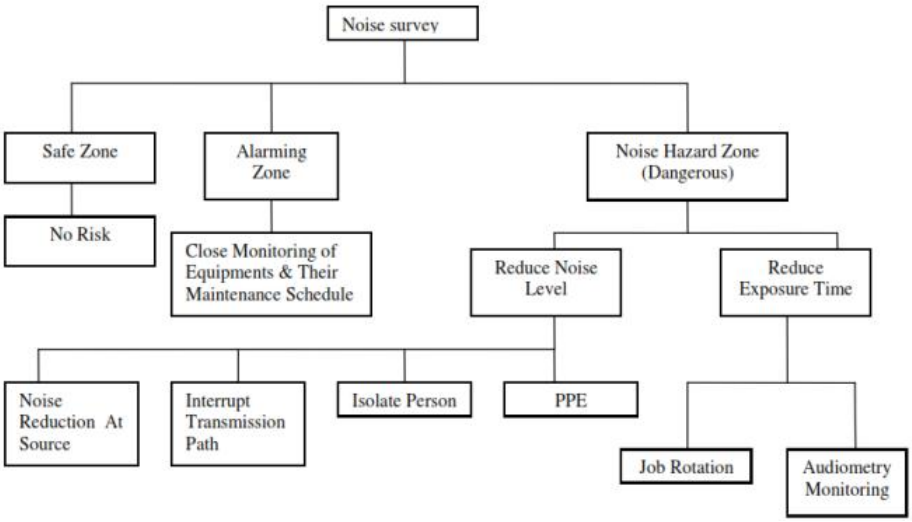



Table – 3 Noise Management Strategy

## Noise Protection Measures

Safe zone locations are well within the acceptable limits and therefore do not need any protective measures.

Areas particularly under Alarming zone are closely monitored as they are the potential areas to be converted in to Dangerous zone, if not dealt properly.

Noise hazard zone (Dangerous) is the main area of concern. The first effort is always to look in to the possibility of reducing the noise level at source. As engineering controls is capital intensive and may have impact on the existing old structures, every option is evaluated for its economic viability considering the residual life and structural integrity of the complex. In addition to this, engineering controls can be taken up only during planned shut down for major revamping / repair jobs; any option in this regard is therefore evaluated along with feasibility study to ascertain the practical utility.

The common areas of high noise levels are Helicopter Take off / landing, Fire Water Pump (FWP) and Utility Generators.

### *a) Helicopter Noise*

Each complex is provided with a facility of helideck for inter platform personnel transfer and crew change through helicopters. Very high noise levels are recorded during helicopter take off and landing (106 to 112 dB). Allowable Noise exposure is based on Noise Dose. Noise Dose is expressed as a percentage of the allowable limit. How high it goes depends on both noise intensity and time of exposure to noise.

Since these operations are for a very short duration, the exposure time is very limited, and therefore emphasis is focused on wearing PPE. However, personnel deputed as helicopter landing officer / assistant (HLO / HLA) to assist Helicopter landing / take off operations are more susceptible to its hazard due to long exposure time and therefore advised to strictly adhere to operation control procedures and PPE.

### *b) Fire Water Pump (FWP)*

FWP have been found to generate high noise during running conditions (100 to 106 dB). It starts only when there is any fire related signal which is subsequently followed by activation of Emergency Response Plan (ERP) for immediate measures for escape and evacuation of personnel on board. The exposure time of personnel to high noise (noise dose) during its running condition is very less. However, signages are placed at appropriate locations for wearing PPE.

The possibility of their repairs / overhauls during shut down

periods is the preferred option. As a prudent corporate, after conducting detailed technical study and economic viability assessment, Asset has taken an initiative for replacement of 8 units which is in advance stage and expected to be completed within six months time.

***c) Utility Generators***

Utility Generators have also been noticed to produce high noise (101 to 110 dB) at all the complexes. Since it is operational during power shut down which is generally for a limited time period, the probable exposure time for a person to high noise is quite limited. Since availability requirement of the equipment is for 24 hours, thrust is given on the maintenance schedule only as it can not be spared for other engineering works for reducing noise levels.

## Preventive Measures

Measures taken through management programmes to reduce the noise levels at source during major revamping jobs involving repair / replacement of various facility equipments and systems has been successfully carried out at C-4 where noise levels have been noticed to be reduced from dangerous to acceptable levels at TG Air Intake and PGS Train areas. Similarly, in complex C-5 the revamping projects have resulted in reduction of high noise levels at Cooling Fan and Utility Air Compressor areas.

To bring change in the people's perception and behaviour is not so easy. It requires constant realization, motivation and monitoring. Mumbai High Asset has taken following initiatives in this direction for mitigating noise hazard:

a) All the sensitive locations are surveyed every year for noise level assessment for taking suitable preventive actions.
b) All the locations identified as dangerous (dB > 90) have been earmarked and properly labeled with recorded noise levels. c) The areas with high noise levels have been provided with adequate Ear Muffs for persons working in the vicinity.
d) Every person on board has been provided with ear plugs as a protective measure for safe movement on the platform.
e) Periodic awareness programmes have been conducted on complexes for generating consciousness about individual's health and significance of preventive measures for averting the possible damaging effect of the hazards.
f) Special programmes have been conducted for contractor personnel for inculcating awareness and habit of using protective measures to prevent from adverse impact of occupational hazards.
g) Pre Medical Examination (PME) as per company policy is being followed and the results of the examination are studied and monitored and, if required, personal counseling and additional test are also conducted for maintaining the health and well being of the employees.

In addition to above, in order to evaluate the effect of noise on persons working on board, a comprehensive survey has been conducted at Process Complexes C-1 and C-4 by Occupational Health Expert. The audiometric test along with other physical parameters has been carried out for all the personnel on board. The study indicated good health profile of offshore personnel in general and recommended for repeat audiometric test for around 2% of personnel for further evaluation and counseling.

## Conclusion

The case study of noise survey at offshore process complexes of Mumbai High Asset has revealed the following:

1. 74 % of the locations covered for noise survey is under non hazardous zone (Safe zone 30 %, Alarming zone 44 %) where as Dangerous zone constitutes around 26 %.

2. Helicopter landing / take off, Fire Water Pump and Utility Generators are the common locations with very high noise levels (>100 dB). The initiative towards replacement of 8 units of Fire Water Pumps indicates positive corporate concern and commitment towards maintenance of health of the employees.

3. The common areas under Alarming zone are Test Separator, Water Maker, Riser, Sewage Treatment Plant, Dehydration units, Glycol Filter and Well Head areas.

4. Measures taken to reduce the noise levels at source

during major revamping jobs involving repair / replacement of various facility equipments and systems has been successfully carried out at Process Complex C-4 and C-5 where noise levels have been noticed to be reduced from dangerous to acceptable levels.

5. Comprehensive health survey conducted at two of the complexes by occupational health expert indicated good health profile of offshore personnel in general and recommended repeat audiometric test for around 2 % of personnel for further evaluation and counseling.

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