ISSN 2229-5518

Analysis of Noise Level Reduction for Plant Machine Monitoring

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Abstract— In this project, study is done on Noise levels. Noise is simply the unwanted and displeasing sound that disrupts the activity or balance of human or animal life. The word noise comes from the Latin word nausea meaning seasickness. There are several sources of noise in the surrounding environment. The Automobile Industries are having several machinery which produces noise. Our study is based on to reduce the noise levels of machines. In this, Noise levels are identified and monitored for several machines and comparison done with its actual acceptable limits. The unacceptable noise limits are smoothened by certain techniques like change in design on equipment, providing silencers, sealing the leakages, preventive maintenance schedule and again noise level is measured for the machines to get the result of acceptable noise.

The ill effects of noise coming from machineries can lead to disease like NIHL. So there is a need to control the Noise Level. The study is revealed towards the approach to reduce and control the noise level of shop floor machineries.

Index Terms— Audiometry, NIHL, Noise, Noise Level, Occupational Disease, Silencers,

1 INTRODUCTION

In the 1990s it has become widely recognized that the economic and social cost of high levels of noise in the workplace require significant action to reduce the exposure of workers to noise [1]. Our scope is to concentrate on the Shop Floor Noise level which is generated mainly due to machineries and Equipments. The Plant is a Reconditioning Plant of Engine Business Unit which reconditioned the Exported Engine Components mainly Cylinder Head, Turbochargers, Lube Oil Pump, Cam Follower, Water Pump. There are approximately 50 machineries at shopfloor and several operations including disassembly, pre cleaning, primary cleaning, secondary cleaning, and polishing, salvaging, milling, air tool operation, shot blasting, polishing, crack detection, leak test, quality check, packaging, and despatch.

In India, occupational permissible exposure limit for 8 h time weighted average is 90 dBA [3]. There are several areas observed having noise level above accepted limit, they are mainly Polishing Operation, Air Tool operation, Crack Detection Test Machines, Chillers.

Our aim is to concentrate on high noise area and take measures to avoid it or reduce it by certain measure and techniques.

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2 PROCEDURE FOR NOISE REDUCTION

2.1 Methodology

1. To Check the Noise level of Shop Floor
2. Concentrate on High Noise Areas
3. Monitor the equipments, machine and processes of that area
4. To reduce the noise level by certain techniques
5. Implement the required techniques in desired areas
6. Monitor the feasibility of it
7. Check the noise level of Shop floor
8. Evaluate the difference in noise level

2.2 High Noise Area

The shopfloor noise level mapping is done and high noise areas are identified in the table given below.

Table 1: Noise Level Measurement of Shop Floor

S.No.	Area	Noise Level
1	Cylinder Head, Polishing Station	118.8 dB
2	Turbo Charger, Light part Salvage Station	102.6 dB
3	Turbo Charger, C-Case Salvage Station	102.6 dB
4	Turbo Charger, T-Case Salvage Station	104.1 dB
5	Lube Oil Pump, Body Salvage Station	104.1 dB

6	Lube Oil Pump, Cover Salvage Station	104.1 dB
7	Water Pump, Leak Test Machine	110 dB
8	Turbo Charger, Zyglo Machine	100 dB
9	Turbo Charger, Air Chamber	102 dB

2.3 Techniques for Noise Reduction

2.3.1 Change in Design of Polishing Tool

The Polishing tool wheel was rubbed at the surface of engine component, which is producing high noise at Cylinder Head, Turbo Charger and Lube Oil Pump Polishing Stations. There are 6 such stations.So the wheel design was changed and provided new tool with soft wheel, which is producing lesser noise and tool is provided with an controller nob, so the speed of the wheel rotation can be controlled as per requirement.

2.3.2 Providing Silncers on Machine

The leak test machine of Water Pump Area is producing high noise, so Silencer of Festo make is provided at exhaust to compensate the high noise.

2.3.3 Air Tool Standardisation

Four different models of Air Gun are used mainly:

a. Festo-LSP/1/4-D
b. SMC VMG1
c. Legris A
d. Legric C

Multi vary study carried out with Pressure and Blow Distance on three people with all types of gun. After study, it is observed that Blow distance plays an important role in producing noise and Festo-LSP/1/4-D model is producing minimum noise for the required blow distance. So at 14 stations, the Air gun tool is standardized to Festo Make.

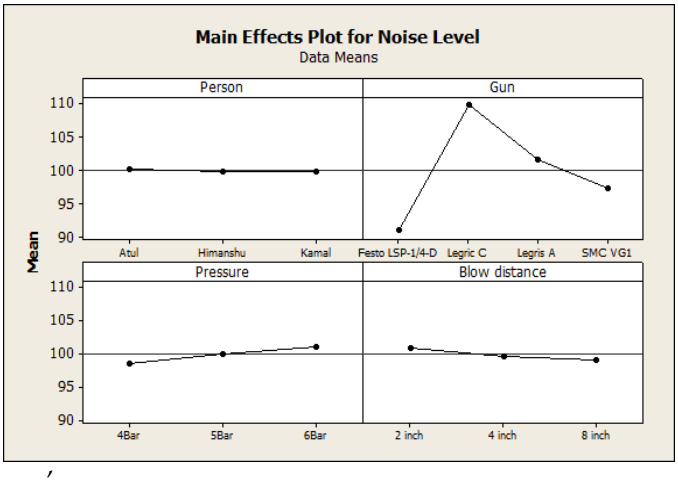

Fig 1: Multi Vary study of Air Tool

2.4 Providing Noise Absorbent Material

Shopfloor is having Ultrasonic Cleaning and Crack Detection

Zyglo make machine, which is producing high noise. The machine is having Piezo generators which are the reason for noise, so noise absorbent material is provided there.

2.5 Sealing the Air chamber

Turbo Charger area is having air chamber which is producing high noise, it is found that there is air leakage from joints. So the joints are sealed to control the air leakage, thereby reducing the noise level.

2.6 Preventive Maintenance Scheduling

The Air Gun daily monitoring is incorporated in the daily checklist of Associates, so that air tool condition is being monitored and any deviation can be captured immediately and rectified.

The Fume Extractor of the machine is a major factor of producing noise in machine. If fume extractor is not working properly, then machine will produce noise. So In preventive Maintenance Schedule, the point of cheking the fume extractor pad condition is added and monitored.

2.7 New Machine Pass Off Checklist modification

While purchasing new machinery, the machine is released by Safety Department on the basis if Checklist. The point of acceptable noise level condition by the supplier is added in the checklist so that noise reducing measures will be provided at the Manufacturer's end.

3 EQUATIONS

The Time Weighted Average is calculated using these noise levels together with the amount of time that the worker is exposed to them.

First calculate the Noise Dose as Dose = 100 x (C1/T1 + C2/T2 + C3/T3 + ... + Cn/Tn)

$$Tn = \frac{8}{2^{(L-90)/5}}$$

Cn= Time spent at each noise level

L= measured sound level [2]

6 FIGURES AND TABLES

Table 2: Permissible Noise Limits

Permissible Sound Limits as per OSHA	
Exposure time in Hours	**Sound level in Decibel dBA**
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 hours or less	115

Table 3: Comparison of Noise Level

S.N.	Area/Cell	Machine Equipment	Noise Level (dBA) Before	Noise Level dBA (After)
1	Cylinder Head	Polishing Station	118.8	98.2
2	Turbo Charger	Light Part Salvage Station- Polishing Operation	102.6	94.2
3	Turbo Charger	C-Case Salvaging Station- Polishing Operation	102.6	91.6
4	Turbo Charger	T-Case Salvaging Station- Polishing Operation	104.1	91.6
5	Lube Oil Pump	Body Salvaging Station- Polishing Operation	104.1	87.7
6	Lube Oil Pump	Cover Salvaging Station- Polishing Operation	104.1	87.7
7	Water Pump	Leak Testing Machine	110	88
8	Turbo Charger	Ultra Sonic Cleaning and Crack Detection M/c	100	88.7
9	Turbo Charger	Air Chamber	100	87.5

7 Appendices

1. Noise: Unwanted and unpleasant sound
2. NIHL: Noise Induced Hearing Loss, occupational disease caused due to continuous noise exposure.
3. Audiometry: Standard test to detect and evaluate hearing loss.
4. Frequency Weightings: The *frequency weightings* used in sound level meters, related to the response of the human ear
5. A- Weighting: The most common weighting that is used in noise measurement is *A-Weighting*. This effectively cuts off the lower and higher frequencies that the average person cannot hear
6. C-Weighting: C Weighting is usually used for Peak measurements.
7. OSHA: Occupational Safety & Health Association

7.1 Acknowledgments

I wish to thanks Dr. Ashesh Tiwari for his valuable guidance at every step in accomplishing the work and keep the moral high to concentrate on work. I would like to thanks the company for giving me opportunity for doing this project and Maintenance team including Mr. Swapnil Khanapurkar and Mr.Arpit Tare for support in implementing the techniques. I wish to thanks Safety Officer Mr. Narendra Makwana for providing way to approach to problem solution

4 CONCLUSION

The average noise level measured earlier was 105.36 dBA. After implementing the noise reductiong techniques, the average noise level reduced to 80.57 dBA. This provides a significant improvement in Associates comfort level of working and productivity and compliance to legal requirement of Pollution Control Board (PCB) and OSHA.

REFERENCES

[1] Professor Samir N.Y.Nerges, Noise Sources, 5.1, http://www.who.int/occupational_health/publications/noise5.pdf

[2] Subroto S Nandi, Occupational noise-induced hearing loss in India, Year : 2008 | Volume : 12 | Issue : 2 | Page : 53-56

[3] Prof. Gabriel S.Timar, Effects of Noise, Page 1

[4] Technical Assessment of Upper Limits on Noise in the Workplace :- http://www.i-ince.org/data/iince971.pdf

[5] Henry ,Technical Assessment of Upper Limits On Noise In The Worplace.- Convener-Tony,F.W.Embleton;Link:-http://www.i-ince.org/data/iince971.pdf