Multidisciplinary Project - 18

An Occupational Safety and Health (OSH) assessment of Limestone Mining Industies in Tamil Nadu

Gururanga Ramanujam B[1a], Suraj Choudhary[1a], Basith Shaik[1b], GuvvalaTharun[1b], Dr. Vignesh K.S*[b], Dr. S. Vishali*[a], Dr. Muthamil Selvi*[a]
Department of Chemical Engineering[a], Department of Mechanical Engineering[b], College of Engineering and Technology, SRM Institute of Science and Technology
Kattankulathur 603 203, Chengalpattu District, Tamil Nadu, India.

INTRODUCTION

Fig 1 Areal View of Mine-1

Fig 2 Areal View of Mine-2

1. India's infrastructure boom has driven a surge in demand for limestone, a key material for cement production.
2. As the result Limestone mining operations have intensified, relying on powerful machinery that expedites production but also generates significant: Dust, Noise and Vibrations.
3. Chronic exposure to these elements can severely impact the health and safety of limestone mine workers.
4. OSH studies and data in the limestone mining industry, particularly in India, might be limited or outdated. This lack of recent data creates a gap in understanding current risk factors and their prevalence.
5. This project aims to comprehensively evaluate occupational safety and health (OSH) risks faced by limestone mine workers in Tamil Nadu.

Fig. 3:Heavy Machineries

Fig. 4: Dust Produced while mining

METHODS

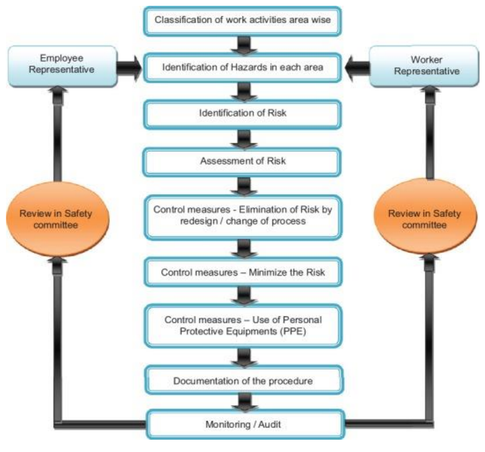
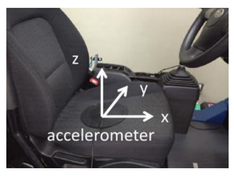


Fig 5: Risk Assessment Flow Chart

a)

b)

c)



d)

Fig. 6: (a) Noise Data Collection, (b) Dust Sample Collection, c)Vibration Exposure measurement
d) Volatile Organic Compounds detection

RESULTS

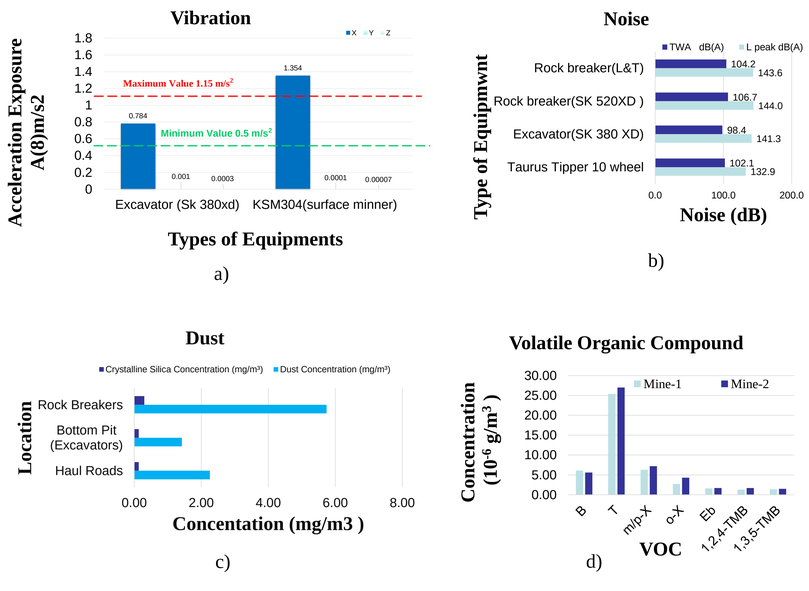


Fig. 7: (a) Vibration Vs Type of Equipment , (b) Noise Vs Type of Equipment, (c) Location Vs Respirable Dust and Silica Dust Concentration, (d) VOC Vs Concentration

RESULTS

SL.NO	Equipment and Operator	Axis	A_{RMS} m/s^2	Adjustment A(8) m/s2	Exposure Duration (hour)	Maximum Vibration Exposure m/s2	Health Risk Exposure
1	Taurus Tipper 10 Wheel	X	0.002	0.002	8	0.002 in X Axis	Below the Exosure Action Value
		Y	0.0003	0.0004			
		Z	0.00003	0.00003			
2	Dozer(KCPL)D50	X	0.0005	0.0006	8	0.0007 in Y Axis	Below the Exosure Action Value
		Y	0.0005	0.0007			
		Z	0.0002	0.0002			
3	Rock Breaker (CK-300)	X	0.00005	0.00007	8	0.0002 in Y Axis	Below the Exosure Action Value
		Y	0.0001	0.0002			
		Z	0.00003	0.00003			
4	Front wheel loader	X	0.23	0.322	8	0.322 in X Axis	Below the Exosure Action Value
		Y	0.0007	0.0009			
		Z	0.0003	0.0003			
5	Excavator	X	0.56	0.784	8	0.784 in X Axis	Exposure Action Value
		Y	0.0008	0.001			
		Z	0.0003	0.0003			
6	KSM304(surface minner)	X	0.967	1.354	8	1.3 in X Axis	Above the Exposure Action Value
		Y	0.00008	0.0001			
		Z	0.00007	0.00007			

Table 1:Vibration Exposure of Machinery Operators

CONCLUSIONS

- This particular profile of VOCs is indicative of emissions from heavy machinery used in limestone mining operations and well below the exposure limits
- The (TWA) dust level ranged from 1.42-5.74 mg/m^3 with Silica concentration range of 0.13 - .03 mg/m^3. The highest dust and Silica concentration was found to be 5.74 mg/m^3 and 0.03 mg/m^3 respectively, near Drill Operator or Rock Breaker which is exceeds the permissible limit for dust (3 mg/m^3) and Silica (5% Weight of total Dust conc) given by Director General of Mines Safety (DGMS).
- Providing workers with appropriate respiratory protection such as N95 respirators or powered air-purifying respirators (PAPRs), along with other PPE such as goggles, gloves, and coveralls to prevent dust exposure.

REFERENCES

- Priyanka Mankar: Monitoring and Assessment of Airborne Respirable Dust and Free Silica Content in an Indian Mine Publication: J Health Pollution (June 13 2019) GOOGLE SCHOLAR
- Wang H L, Nie L, Li J, et al. Characterization and assessment of volatile organic compounds (VOCs) emissions from typical industries. Chin Sci Bull, 2013, 58: 724-730.
- Amit Kumar, Deepak Singh, Krishan Kumar, Braj Bihari Singh, Vinod Kumar Jain, Distribution of VOCs in urban and rural atmospheres of subtropical India: Temporal variation, source attribution, ratios, OFP and risk assessment, Science of The Total Environment.
- Dharas, Nandi S. Assessment of silica dust exposure profile in relation to prevalence of silicosis among Indian sandstone workers: Need for review of standards.
- Indian Minerals, Yearbook 2020 (Part-III: Mineral Reviews), Edition: 59, Limestone & Other Calcareous Materials (Advance Release). • Priyanka Mankar: Monitoring and Assessment of Airborne Respirable Dust and Free Silica Content in an Indian Mine Publication: J Health Pollution (June 13 2019) 7. Wang H L, Nie L, Li J, et al. Characterization and assessment of volatile organic compounds (VOCs) emissions from typical industries. Chin Sci Bull, 2013, 58: 724−730
- Amit Kumar, Deepak Singh, Krishan Kumar, Braj Bihari Singh, Vinod Kumar Jain, Distribution of VOCs in urban and rural atmospheres of subtropical India: Temporal variation, source attribution, ratios, OFP and risk assessment, Science of The Total Environment, Volumes 613–614,2018, Pages 492-501, ISSN 0048- 9697.