



A CASE STUDY ON QUALITY EVALUATION OF SOIL AND WATER IN A QUARRY AND IN ITS VICINITY

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Abstract: Quarry is an indispensable part of a developing country. Quarry and its related activities lead to structural development through dams, tunnels, bridges, roads, buildings etc., thus improving the living conditions of the society. On the other hand, it is one of the reasons for environmental degradation and pollution. The purpose of the analysis is to identify and assess the direct and indirect impacts of quarrying in the society. The quarry selected for the study is in the Varapetty Village of Kothamangalam Taluk, Kerala. This area has 3 actively working quarries within two km radius. These studies were performed in both soil and water samples within the quarry premises. This paper mainly aims to identify, evaluate and report the environmental and socio-economic effects of the proposed quarry.

Index Terms - Quarrying, Environment, Pollution, Soil, Water.

I. INTRODUCTION

The environment is being disturbed, all over the world due to various human activities. Quarrying is a major human activity which is leading to environmental degradation. As a coin has two sides, everything has its own benefits and drawbacks. In the case of quarrying, it is an important activity for the infrastructure development of a country since it is the largest industry where limestone, granite, chalk etc. are obtained for construction works. On the other hand, it leads to the socio-economic instability of the environment. Mining has various horrible effects on the environment. It contributes to the depletion of biodiversity thus the life of flora and fauna are disturbed. The chemicals used in the mining process reduce the quality of soil and water in that area and its influence can be seen over a large radius. Mining also has a direct impact on the countryside by leaving pits and heaps of waste materials. Based on the study conducted by Kerala Forest Research Institute (KFRI) in 2015 it was reported that a total of 5924 stone quarries are functioning in the state whereas the Department of Mining and Geology had granted permission only to 750 stone quarries. Majority of quarries are built by removing the soil from the surface level. As a result of it, natural absorption of water into the soil will be affected and leads to mudslide and earthquake. Quarrying activity is a complex activity which also contributes to air and noise pollution leading to various health-related problems to the people near the quarry. Thus, the work is to examine the influence or impact of a particular quarry on that area and to check the quality of water and soil within that quarry premise.

II. RESEARCH METHODOLOGY

2.1 SITE STUDY AND PRELIMINARY INVESTIGATION

Quarry site selected for the case study was from southern part of Kerala in the Varapetty Village of Kothamangalam Taluk. It is functioning in around 8 hectares of land with more than 60 workers. Schools, colleges, malls and other public properties are not found around 2.5 km radius of the quarry. But around the quarry, more than 30 houses are observed. Transportation facilities are rarely available in that region. Similarly, the roads are observed to be damaged due to the continuous passage of heavy trucks from the quarry. The quarry waste, blasted products, chemicals and dust produced from the operations are dispersed and settled in the quarry's surrounding areas.



Fig. 1 Selected Quarry Site



Fig. 2 Survey Map of Quarry

2.2 QUESTIONNAIRE SURVEY

For better analysis, a questionnaire survey was conducted around the quarry site within a radius of 3 km and the details were collected from 30 houses near the quarry site. This survey was conducted to investigate whether the residents are facing any kind of disturbance or problems related to quarry operation. The questionnaire sample includes:

- What is the resident's perception towards quarry activity?
- Do the residents face any kind of health-related problems?
- Do you face any kind of air or noise pollution due to quarry activity?

From the collected information the following points are noted:

Air quality plays a vital role in evaluating the quality of nature and its influence on human well-being. It is observed that majority of the residents claimed the air is dry within 5 km radius moreover within 3km radius, it was rated as extremely dry.

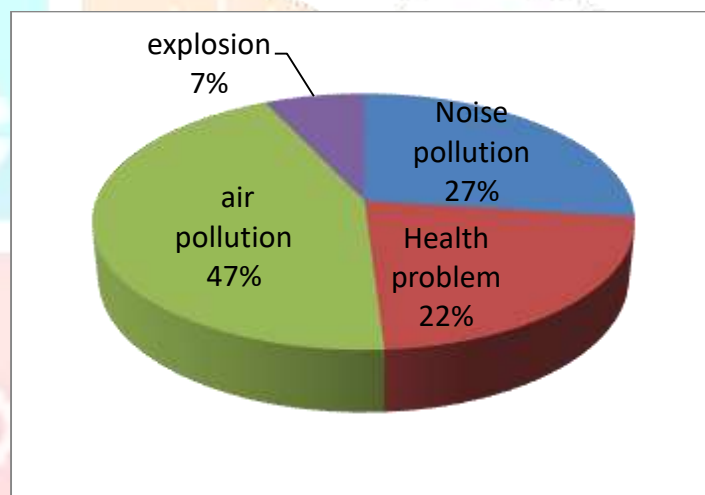


Fig. 3 Human responses on quarrying activities

Residents also claimed that the noise pollution was experienced within 1.5 km radius. From the survey it was clear that people near the quarry were subjected to various kinds of health-related problems such as bronchitis, asthma, lung disorder etc. Similarly the residents stated that during the blasting time the cracks were reported in the houses within 1 km radius.

III. RESULTS AND DISCUSSION

From the quarry site, water and soil samples were collected for conducting various laboratory tests to examine the influence of mining activities within the selected site. Samples were taken from 5 spots: from the quarry and 500m, 1.5m, 3m, 6m away from the quarry. Both the physical as well as chemical properties of soil and water were studied. Water samples were collected in glass water bottles which were thoroughly washed twice with water to be analyzed. Soil samples were collected in well-dried bags.

3.1 OBSERVATIONS

3.1.1. WATER SAMPLE

Physical characteristics of the water sample from the quarry were studied and following observations were made:

- No odour and taste
- Colour change was noticed in the water sample from the quarry
- Turbidity of all the samples except from quarry are found to be within the range of permissible limit.
- Range of temperature- 23°C to 37°C

Chemical characteristics of water sample studied are pH, electric conductivity, TDS, sulphate, fluoride, nitrate, and hardness. From the analysis, it is observed that the pH was acidic from quarry to 3km radius whereas it was found to be basic in nature above 3km radius. . The TDS and conductivity were found to be within the limit. In the case of fluoride and nitrate, it was above within the permissible limit

from quarry to 1.5km. Similarly, the concentration of nitrate was found to be extremely high in that whole region and the water sample was hard too for drinking purpose.

Table 1.Results and analysis of water quality

PARAMETERS	QUARRY	500m	1.5km	3km	6km	REMARKS	RANGE (IS CODES)
pH	4.1	4.9	4.85	5.2	6.02	Stained laundry, metallic or sour taste of drinking water, blue-green staining of sinks and other household fixtures	6.5-8.5
Conductivity	427.2	413.6	333.6	340.8	307.8		100 -2000 μ s/ppm
Hardness	300	287	200	188	155.8	Scales in the sink, foul plumbing, faded clothes and stained bathtubs	250 mg/l
TDS	458.8	255	175.8	156.6	132	High TDS in water poses a lot of health hazard	500 ppm
Sulphate	308	300	287	280	230	Intestinal discomfort, Diaphorrea and consequently dehydration	200mg/l
Fluoride	2	2	1.87	1.4	1.38	Dental fluorosis, skeletal fluorosis	1-1.5mg/l
Nitrate	25	24	22	15	14.8	Excess level can cause methemoglobinemia or "blue baby" disease	45mg/l

3.1.2 SOIL SAMPLE

Physical characteristics of the soil sample from the quarry were studied and the following observations were made:

- Soil colour is grey with a brownish tinge
- Sample invariably contains rocks and stones
- Primary particles include sand, silt etc
- Its composition is variable

The chemical characteristics of soil including the content of nitrogen, phosphorous, potassium for supporting plant was found in required levels, but the water-holding capacities are found to be lost in certain areas. Also, metal content like zinc, copper etc. was found in the quarry and nearby soils.

IV. CONCLUSION

By analyzing all the above observations, the conclusions obtained are:

- Through the site investigation and geological studying, it has been identified that nearby area of quarry has been severely affected by the mining activities. Also, the area has 2-3 active quarries, which has a more adverse effect on the environment.
- By the details collected from the nearby residents around the quarry through surveys, it is found that air pollution and noise pollution severely affect the area. The roads and transportation facilities are also found disturbed due to the movement of large-load carrying trucks. Also, cracks were noticed in old buildings due to blast.
- On conducting the air and water tests on 6 spots, the presence of certain chemicals, especially in water samples, was found above limits.

By analyzing the above information, the main area of influence of quarry was found to be in a radius of 1.5km from the quarry.

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