ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 14, Issue, 04, pp. 65500-65504, April, 2024
https://doi.org/10.37118/ijdr.28141.04.2024

RESEARCH ARTICLE OPEN ACCESS

THE INFLUENCE OF MINING ACTIVITIES ON THE QUALITY OF GROUNDWATER AND ITS IMPLICATIONS FOR HEALTH

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ARTICLE INFO

Article History:
Received 17th January, 2024
Received in revised form
26th February, 2024
Accepted 04th March, 2024
Published online 30th April, 2024

Key Words:
Physical parameter, Chemical parameter, Primarily investigation, Gastrointestinal, Potable Water, Respiratory problem etc.

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ABSTRACT

This study shows water pollution around mining areas and hazardous effect on human life. How mining effect, the life of human whose are living near or around mining areas.Analyse the physio-chemical parameter, primarily investigation and interpretation of the ground water-rock interactions and solute acquisition processes that control groundwater composition around the Stone Crushers or near mining region. Ground water is expected to be potable with presence of Chloride (Cl^-), Fluoride (F^-), Arsenic, Nitrates in slight excess amount as per the international standard The quality of ground water has been altered due to pollution and is denoted by knowing the physical parameters like pH, TS, TDS, TSS and Chemical parameters like total alkalinity, dissolved CO_2, Mg-Hardness, Ca-Hardness, Total Chlorinity etc. Diseases related to these ions may be mild to severe (such as Respiratory Problem, Gastro Intestinal, Neurogenic, Carcinogenic Condition) in different locations and in different age groups in both the genders. These diseases may be related to work either as a direct, causal agent or as being aggravated by work exposure.The presence of heavy metals such as Mn, Ni, Fe, Cu, Si and Pb in high concentration in groundwater can cause an adverse effect on human health and making that water may not be potable.

Citation*: *Jyoti Rajoria and Dr. Chitra Gupta, 2024. *"The influence of mining activities on the quality of groundwater and its implications for health". International Journal of Development Research*, 14, (04), 65500-65504.

INTRODUCTION

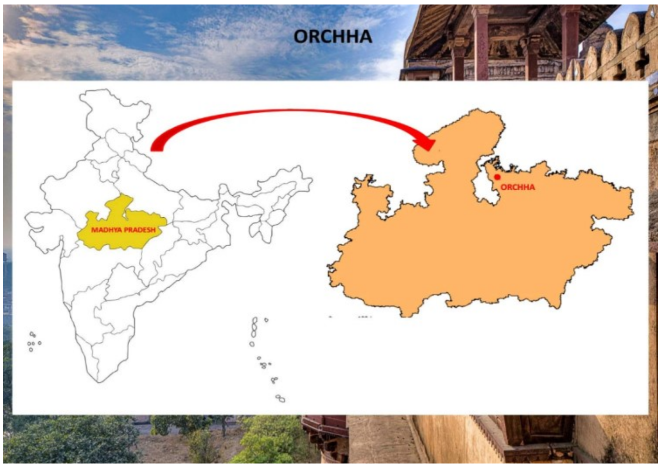
Water being one of the most indispensable resources constitutes about 70% of the body weight of all living organisms. Life exists in three states namely solid, liquid and gas and is not possible without water on the planet. Water acts as a media for both chemical and biochemical reactions. It also acts as an internal and external medium for several organisms. About 97.2% of water on earth is salty and only 2.8% is present as fresh water among which only 20% constitute ground water. Ground water is highly valued because of certain properties not possessed by surface water (Goel P.K.[10], 2000). Groundwater is one of the primary freshwater sources for drinking, irrigation, and industrial uses in most communities worldwide (Foster *et. al*.[7], 2013; Dhanasekarapandian *et al*.[6], 2016). Groundwater is typically less polluted than surface water because of its self-cleaning ability and ease of treatment (UNESCO[18], 2003). In developing countries, a lack of access to clean drinking water adversely affects the population's general health and life expectancy. Clean surface water is radically subordinate, and people are devoted to groundwater sources. Due to rapid population growth, urbanization, agricultural fertilizers, and planting industrial waste, drinking water quality in many cities and rural areas are affected (Akhtar *et al*.[2], 2019). Its quality is determined by the appropriate monitoring of its various physical, biological, and chemical parameters as defined by the World Health Organization (WHO, 2006)[19]. The Bundelkhand region occupies an almost 70,000 km^2 area in central India covering 7 districts of South Western Uttar Pradesh (Jhansi, Lalitpur, Jalaun, Hamirpur, Banda, Mahoba and Chitrakoot) and 6 districts (Sagar, Chhatarpur, Tikamgarh, Panna, Damoh and Datia) of North Eastern Madhya Pradesh Bundelkhand region is also known for its socio-economic backwardness. Most districts of Bundelkhand region have lowest levels of Per Capita Income and are identified as the poorest districts of the country by the planning commission. Along with its rich culture heritage.

REVIEW OF LITRETURE

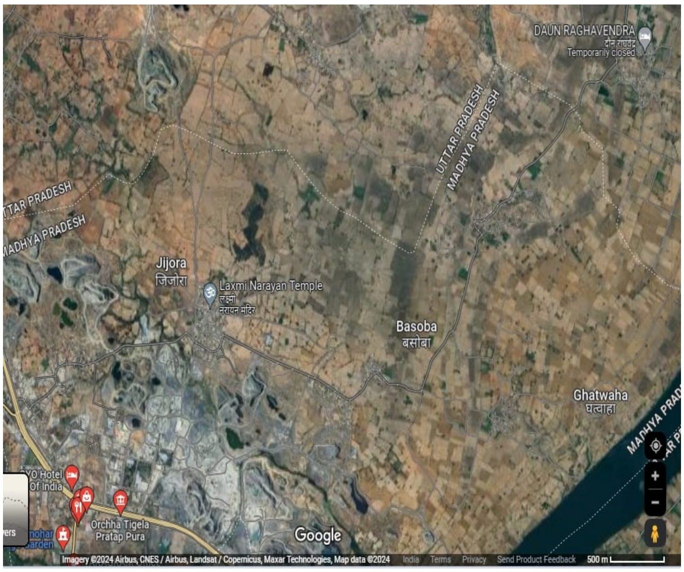
Mining is a major economic activity in many developing countries causing water pollution. Though reliable statistics are lacking for this industrial sector, it is estimated that there are more than 12,000 stone crushers in India which provide direct employment to about 500,000 rural migrant and unskilled in India (Gottesfeld *et al*.[11], 2008). Stone crushers in India are basically a labour-intensive small-scale industry, where most of the operations are performed manually (Aslam *et al*.[4], 1992). All major opencast mining and stone crushing which produce dust and granite mining is not an exception. Most major mining activities contribute directly or indirectly air pollution (Kumar*etal*.[13], 1994; CMRI[5], 1998). Operations release particulate emissions that not only deteriorate environmental quality but also cause serious health problems in human. The conversion of naturally occurring rock into crushed and broken stone products involve a series of distinct physical operations. The mining areas generally include these activities comprising of drilling, blasting, hauling, loading of waste, transport of overburden loading and unloading, road transports and losses from exposed overburden dumps (CMRI,1998)[5] crushing of ore is having considerable impacts on the air, environment and wellbeing of living organism. Mining either by opencast or by underground methods damages the water regime and thus causes a reduction in the overall availability of water in and around the mining areas and plant process operations (such as crushing, screening, converting and transfer operations). They are significant sources of particulate emissions. Stone crushing and allied activities generally have a considerable impact on the air, water, land and biological resources as well as socio-economic setting of local population. Mining activities always have negative impact on environmental quality (Allen L. Clark[3], 1995; Ripley *et al*.[16], 1996; Gabler and Schneider[9], 2000). Operations whether small or large magnitude affects the environment, enormous quantities of dust and other pollutants. The dust clouds can also pollute nearby around mining areas surface waters and stunt crop growth by shading, clogging the pores of the plants and gaseous pollutants in and around the mining complexes deposition are both visible and tangible in communities around industrial activities or construction sites (Hall *et al*.[12], 1993; Fuglsang K.[8] 2002). Dust not only deteriorates the environmental quality in and around mining areas but also creates the serious health hazards of living being. In brief this topic presents an overall review Analysis data that is collected from chemical abstracts, Universal Journals like *Water Quality Assessment (CSIR)*, *Water Research (Elsevier), Nature, Central Mining and Fuel Research Institute, Dhanbad, India, ResourcesPolicy Central Ground Water Board, Faridabad, Ministry of Jal Shakit, Asian Journal of Water, Environment and Pollution, Environmental Earth Sciences Springer, Hydrogeoloogy Journal, Groundwater, National Groundwater Association. Org (NGWA), International Research Journal of Environment Sciences, International Journal of Current Research, International Journal of Advanced Scientific and Technical Research, Journal of African Earth Sciences, International Journal of Occupational and Environmental Health, Environmental Geology Earth Sciences, Measurements of Airborne Pollutants, Applied Ecology and Environmental Sciences, Journal of Occupational and Environmental Hygiene, Environmental Geology, International Journal of Engineering Science Invention (IJESI), Recent Research in Science and Technology (Pollution and Environmental Sciences). International Journal of Prevention and Control of Industrial Pollution,* of studies conducted in abroad as well as in India Jhansi most area is found underneath granitic rocks containing excess quartz minerals and it infiltrate in to the highly rechargeable groundwater as a SiO_2 forms (Abhimanyu *et al*.[1], 2013). Among stone miners (Mahendra Kumar Upadhyaya [14], 2021), the higher the concentration of Silica content as a silicon ion percolate in groundwater producing the greater health hazard as a Silicosis is one of the major problems to human beings as occupational lung diseases (Silicotuberculocis). It is found that, for sandstone mines, the mean respirable dust samples collected from crystalline silica concentrations were 0.12 mg/m^3 and for masonry stone and granite stone mines, the mean respirable crystalline silica concentrations were 0.17 mg/m^3(Shivkumar S. Prajapati *et al*.[17], 2020). Exposure to heavy dust concentration from stone crushers may produce several diseases, chief among them being pneumoconiosis (Zenz *et al*.[22], 1994). Silicosis, caused by inhalation of dust containing silica, is an important form of this disease. Respiratory damage resulting from such exposures causes reversible damage to the lungs and in some extreme exposures causes' lung cancer (Mathur and Chaudhary [15]).

RESEARCH AND METHODOLOGY

Research Area – Orchha Tigela Paratpara: Orchha located at just 16KM from Jhansi. Orchha is a town in Niwari district in Madhya Pradesh near Jhansi U.P. India. The town was established by Rajput ruler Rudra Pratap Singh Bundela sometime after 1501, as the seat of an eponymous former princely state of covering parts of central and North India, in the Bundelkhand region. Orchha lies on the Betwa River, 80 km from Tikamgarh and 16 km from Jhansi Uttar Pradesh(source- from Wikipedia Encyclopaedia[21]). Environment health assessment of stone crushers especially in Bundelkhand region (Orchha). Since, this is the pre-dominant industrial activity of this region, occupational health problems associated with this industry needs to be addressed. Present study has been undertaken to evaluate the health status of workers and working environmental conditions in and around stone crushing units of Jhansi district and access the water quality and health status under the operative influence of stone crushers at various study locations.



Map from Google map of India



MATERIAL AND METHODOLOGY

***Sampling of Water*:** Water samples were obtained from both the hand pump and tap water sources in the Orchha mining vicinity. These samples underwent filtration and were preserved by acidification with HNO_3. Subsequently, the water samples were stored in Polyethylene plastic bottles with a capacity of 250 ml. The samples were then analysed to determine the concentrations of the following heavy metals: Cd, Pb, Mn, Fe, Si, and Cu. In the field, the Electrical Conductivity (EC) and pH values were measured using a portable conductivity and pH meter. The collection of water samples took place in one mining area and one residential area near the mines located in Tigela Orchha, Niwari, Madhya Pradesh.

Methodology used to be Measurement of Physio-chemical Parameter: following Table No.1 shows methods used to analyse physio-chemical parameter of water samples.

Table 1. Parameters and methods/Instruments to be used during analysis of physio-chemical analysis of water

S. No.	Parameters	Method/ Instruments
1.	pH	pH-meter
2.	EC (mmhos/cm)	Electronic Conductivity Meter
3.	Turbidity	Nephelometric method
4.	Total Solid (TS)	Oven, Desiccators
5.	TDS (Total Dissolved Solids) (mg/l)	Oven, Filtration
6.	TSS (Total Suspended Solids) mg/l	Oven, Gravimetric Method
7.	Total Alkalinity (mg/l)	Titration
8.	Ca-Hardness (mg/l)	Titration
9.	Mg-Hardness (mg/l)	Titration
10.	Total hardness (mg/l)	Titration
11.	D.O.	Titration (Iodometry)
12.	Nitrates	Reverse osmosis
13.	Chloride (mg/l)	Titration
14.	Fluorides (mg/l)	Ion exchange method
15.	Iron (mg/l)	Iron treatment method

Table 2. Range of Physico-chemical Parameters and their Comparison with World Health Organization (WHO, 1996)[20] Standard for Drinking Water:

S. No.	Parameters	Average Detective Value in Water Sample	ACC to WHO
1.	Colour	6 Unit (Dusty)	5 Unit
2.	Taste	Bitter, Salty	…..
3.	pH	7.79-8.19	…..
4.	EC (mmhos/cm)	1000-1200 (mmhos/cm)	…..
5.	Turbidity (NTU)	1.8-2.5	<1(NTU)
6.	Total Solids(mg/l)	570(mg/l)	540(mg/l)
7.	Total Dissolved Solid (TDS)ppm	525(mg/l)	500(mg/l)
8.	Total Suspended Solid (TSS)ppm	535(mg/l)	500(mg/l)
9.	Total Alkalinity(mg/l)	1.89-2.79(mg/l)	500(mg/l)
10.	Ca-Hardness(mg/l)	89-42(mg/l)	40(mg/l)
11.	Mg-Hardness(mg/l)	57-40(mg/l)	120-180(mg/l)
12.	Total Hardness(mg/l)	300(mg/l)	120-180 (mg/l)
13.	DO(mg/l)	9.7-7.4(mg/l)	13-14(mg/l)
14.	Nitrates(mg/l)	52(mg/l)	50(mg/l)
15.	Chlorides(mg/l)	89-42(mg/l)	250(mg/l
16.	Fluoride(mg/l)	2.0-2.4(mg/l)	1.0(mg/l)
17.	Iron(mg/l)	0.18-2.0(mg/l)	0.1(mg/l)

Table 3. Health status of mining and nearer living areas humans

Mining areas and living areas near mining site	Skin Problem	Cardiac Problem	Respiratory Problems	Fever	others
Male	70	50	50	60	70
Female	30	20	30	25	30

RESULT AND DISCUSSION

A field survey was conducted where we visited granite mines and their spa sites. During the survey, we collected water samples and had conversations with the labourers and their families working in the mines. Through these interactions, we gathered information about their health-related issues and discovered the common diseases that arise from consuming water in an unsanitary manner. These diseases include diarrhoea, kidney stones, heart problems, stomach ulcers, and skin problems. The mining areas are often filled with dust, which leads to a high concentration of suspended soil particles in the water. These particles prevent sunlight from reaching the microorganisms in the water, resulting in toxic and polluted water. This polluted water is particularly harmful as it contains heavy metals, which can cause serious illnesses such as cancer, heart attacks, and kidney stones. The severity of these health hazards depends on the concentration of toxicants in the drinking water. National Regulatory Agencies and the WHO have recognized the risks associated with unsafe drinking water and have taken measures to address this issue. Prolonged exposure to the chemicals presents in the drinking water can lead to complications and deterioration of health. Immediate impacts on human health can occur due to certain hazardous chemicals. Heavy metal exposure is associated with severe health implications such as cardiovascular and skeletal diseases, infertility, and neurotoxicity. Additionally, exposure to metals can result in liver and kidney problems, and some toxicants are considered genotoxic carcinogens. Table 2 displays the different values of physical and chemical parameters that were found during the survey.

Table 3. Health Status of Mining and Nearer Living Areas Humans

Mining Areas and Living Areas Near Mining Site	Skin Problem	Cardiac Problem	Respiratory Problems	Fever	Others
Male	70	50	50	60	70
Female	30	20	30	25	30

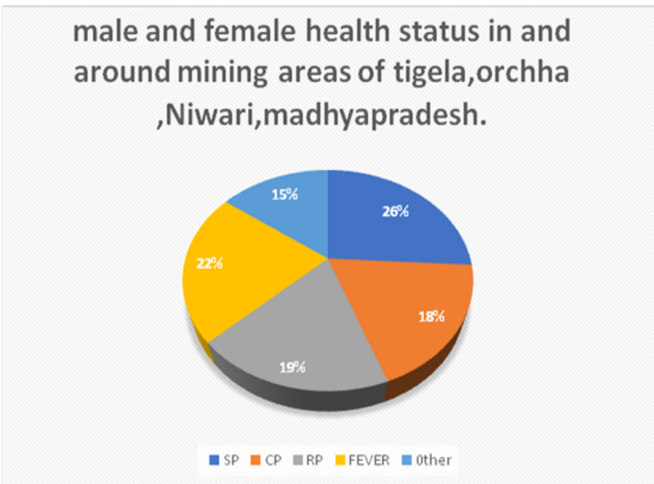


Figure 1. Showing Health Status Percentage of Human being in and Around Tigela, Orchha, Niwari, Madhya Pradesh

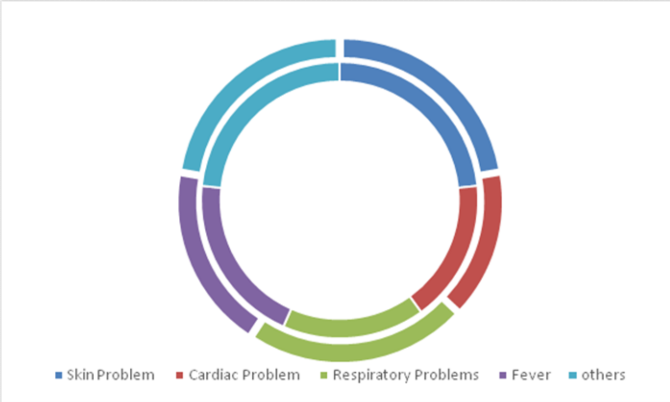


Figure 2. Showing Health Status Percentage of Human being in and Around Tigela, Orchha, Niwari, Madhya Pradesh

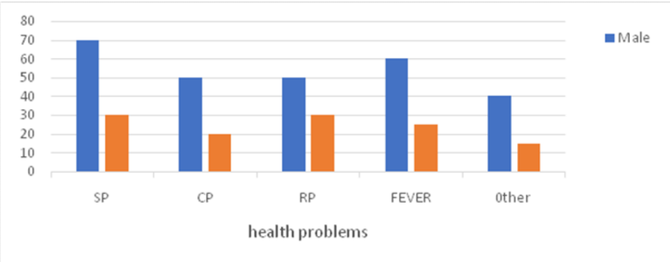


Figure 3. Showing Health Status of Human being in and Around Tigela, Orchha, Niwari, Madhya-Pradesh

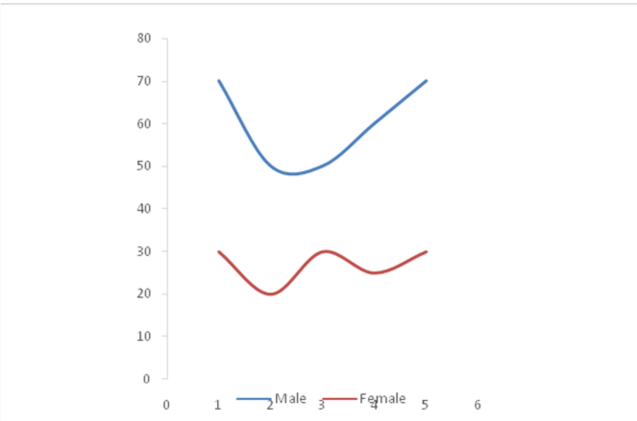


Figure 4. Shows Health Status of Male and Female Workers in Granite Mining Areas of in and Around Tigela, Orchha, Niwari, (M.P.)

CONCLUSION

The water in the mining areas of Orchha, Niwari, Madhya Pradesh is contaminated as it contains a high concentration of toxic elements and has a high pH level. The individuals residing in these mining surroundings, including mine workers and other residents, are experiencing various health issues such as Fever, Heart problems, Skin problems, Migraines, Thyroid issues, Stomach problems, and other Chronic diseases. The presence of elevated levels of Iron, Chloride, Magnesium, and Fluoride in the groundwater signifies that it is unsuitable for drinking purposes.

Acknowledgement

We express our gratitude to P. K. University Karera, Shivpuri (M.P.), and Bundelkhand University Jhansi (U.P.) for their invaluable support in this research endeavour. Their provision of a laboratory for water testing has been instrumental in our study. Additionally, we extend our heartfelt thanks to the citizens of Orchha and the mining workers for their cooperation and assistance in providing crucial information during our field survey in the mining sites.

REFERENCES

Abhimanyu S., Zaidi J., Ganesh S., Beenu Raj, Swati G. and Imtiyaz A. (2013) "Monitoring of the Ground Water Around the Heidelberg Diamond Cement Factory, Jhansi District, Bundelkhand", *International Journal of Advanced Scientific and Technical Research,* 3:107-114.

Akhtar N. and Rai S. P. (2019) "Physio-chemical Analysis of Ground Water for Irrigation and Drinking Purposes Around Moth of Jhansi District, Uttar Pradesh, India", *Journal of Hydrology,* 46(2): 250-66.

Allen L. Clark (1995) "Mining and the Environment: International Perspectives on PublicPolicy: Roderick Eggeat (Ed.) Resources for the Future, Washington DC, 1994", Resources Policy, 21(1):73-74.

Aslam M., Minocha A.K., Kalra P. D. and Srivastava R.S.(1992) "Fugitive Dust Emissions from Stone Crushers", Ind. J. Environ. Health, 34, 186-191.

CMRI (1998) "Determination of Emission Factor for Various Opencast Mining Activities", Report GAP/9/EMG/MOEF/97, Central Mining and Fuel Research Institute, Dhanbad, India

Dhanasekarapandian M., Chandran S., Devi D.S. and Kumar V. (2016) "Spatial and Temporal Variation of Groundwater Quality and its Suitability for Irrigation and Drinking Purpose using GIS and WQI in an Urban Fringe", *Journal of African Earth Sciences,*124:270-288.

Foster S. and Garduno H. (2013) "Groundwater-resource Governance: Are Governments and Stakeholders Responding to the Challenge?", *Hydrogeology Journal*, 21(2):317-320

Fuglsang K.(2002) "An Automatic Sampler for Measurement of Dust Deposition Rates Around FugitiveSources", Journal of Air and Waste Management Association, 52,789-795.

Gabler H. E. and Schneider J. (May, 2000) "Assessment of Heavy-metal Contamination of Flood Plain Soils due to Mining and Mineral Processing in the Harz Mountains, Germany", Environmental Geology Earth Sciences,39(7): 774-782.

Goel P.K. (2000) "Water Pollution-Causes, Effects and Control", New Age International (P) Ltd. New Delhi

Gottesfeld P., Nicas M., Kephart J.W., Balakrishnan K. and Rinehart R. (Apr-Jun, 2008) "Reduction of Respirable Silica Following the of WaterSpray Applications in Indian Stone Crusher Mills", International Journal of Occupational and Environmental Health, 14(2):94-103.

Hall D. J., Upton S.L.and Marsland G.W. (1993) "Improvments in Dust Gauge Design". In: CoulingS. (Ed.), Mesurements of Airborne Pollutants, Butterworth-Heinemann, London.

Kumar C.S.S., Kumar P., Deshpande V. P. and Badrinath S.D. (1994) "Fugitive DustEmission Estimation and Validation of Air Quality Model in Bauxite Mines", In Khuntia, G.S., (Ed.), Proceeding[s] of International Conference on Environmental Issues in Minerals and Energy Industry, IME Publications, New Delhi, India, 77-81.

Mahendra Kumar Upadhyaya (September, 2021) "Effect of Occupational Silica Exposure on Stone Crusher Workers", Applied Ecology and Environmental Sciences, 9(9):806-810.

Mathur M.L. and Choudhary R.C. (1996) "Mortality Experience of Sand Stone Quarry Workers of Jodhpur District", Lung India, XIV (2):66-68.

Ripley E.A., Redmann R.E. and Crowder A.A. (1996)"Environmental Effects of Mining", St. Lucie Press, Delray Beach, 356

Shivkumar S. Prajapati, Subroto S. Nandi, Anand Deshmukh, and Sarang V. Dhatrak (August, 2020) "Exposure Profile of Respirable CrystallineSilica in Stone Mines in India", Journal of Occupational and Environmental Hygiene, 17(11-12):531-537

UNESCO (2003) "Water a Shared Responsibility", The United Nations World Water Development Report -2 : UNICEF [Internet] (2013) "Water in India-Situation and United Nation's India Children Education Fund (UNICEF). New Delhi; P.93. Available from: http://www.indiaenvironmentportal.org.in /files/ file/water % 20 india.pdf [Accessed: 05-2014,2017& 2018].

WHO (2006) Guidelines for Drinking-Water Quality, Vol. 1, Recommendations, 3rd Edn. World Health Organization, Washington DC. 333-335.

World Health Organization 1996. "Guidelines for Drinking-Water Quality", Vol. 3. Drinking-Water Quality Control in Small-Community Supplies.

Wikipedia the free encyclopedia.

Zenz C., Dickerson B. and Horuath E. V. 1994. "Other metals and their Compounds", Occupational Medicine, Mosby, St. Louis, 167-237; C.Zenz, OB Dickerson, and EP Horvath (eds.). St. Louis: Mosby, 595-616.

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