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Geotechnical Investigation on Ore Reserves in India

Boga Rakesh*1, Mr. Vinay Kumar Patel*2

1. Post Graduate Student, Department of Mining, Bhagwant University, Ajmer, Rajasthan, India.

2. Assistant Professor, Department of Nano Technology, Bhagwant University, Ajmer, Rajasthan, India.

ABSTRACT

Coal is the primary sources of energy and there is an increase in demand for coal production to meet the requirements of the industries and the amount of refuse generated is also increasing alarmingly. Increased mining of thinner seams or of inferior coal may even lead to larger amount of coal refuse, resulting in serious environmental and stability problems. This refuse is mostly disposed in the form of refuse piles and behind embankment type remaining structures. At present, with the exception of some small scale underground waste disposal operations in abandoned coal mines, most of this waste is disposed at the surface, which inevitably requires excessive planning and control to minimize the environmental impact of mining. It also results in non-productive use of land, air and water pollution, possible failure of waste embankments, and the loss of aesthetic value of the land.

INTRODUCTION

At present, the power sector in India is dominated by coal. Coal currently accounts for more than 50% of total primary commercial energy supply in the country and for about 70% of total electricity generation. Coal is likely to remain a key energy source for India, for at least the next few decades, as India has significant domestic coal resources (relative to other fossil fuels) and a large set of existing installed base of coal-based electricity capacity, although recent experiences have thrown into sharp relief the uncertainties and concerns regarding the adequacy of coal supplies to satisfy the growing hunger for power. At the same time, with the growth of the coal-based power, local environmental and social challenges relating to coal mining, processing, and use are becoming more pressing. India now ranks 3rd amongst the coal producing countries in the world. According to the 2008 BP Statistical Energy Survey, India had end 2007 coal reserves of 56498 million tonnes, 6.66% of the world total. Through a sustained programme of investment and greater thrust on application of modern technologies, it has been possible to raise the production of coal from a level of about 70 million tonnes at the time of nationalisation in the early 1970's to production of 478.18 million tonnes in 2007. Most of the coal production in India comes from open pit mines which contribute over 81% of the total production. A number of large open pit mines of over 10 million tonnes per annum capacity are in operation. Underground mining currently accounts for around 19% of national output. At present, with the exception of some small scale underground waste disposal operations in abandoned coal mines, most of this waste is disposed at the surface, which inevitably requires excessive planning and control to minimize the environmental impact of mining. It also results in non-productive use of land, air and water pollution, possible failure of waste embankments, and the loss of aesthetic value of the land. It is important to find alternative uses for coal mine refuse and fly ash, the two important byproducts of coal industry, so that their disposal, without adverse environment effects becomes possible. Realizing the economic and environmental consequences, efforts have recently been made to study the physical and engineering properties of stabilized and

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un-stabilized mixtures of coal refuse and fly ash for construction of highway embankments and base courses.

MAJOR PROBLEMS OF COAL MINING WASTES

The waste materials are dumped on agricultural land. So, huge loss of land is there as height of disposal cannot be more than 60m as per Indian rules. Disturbance of the land topography by dumping of debris or stripping of land hence flow pattern of the area is changed. Diversion of streams and alteration of drainage is there. There is leaching of debris and thereby pollution of water resources. Lowering of water table of area of influence due to zonal drawdown of aquifer. There is a disturbance of subsoil water regime due to micro-deformation of the slope. Pyrite is a relatively common iron sulphide in some of the coal. They are highly unstable and break quickly because of oxidation and forms Ferrous and Ferric sulphates and sulphuric acid. Oxidation of pyrite within spoil heap waste is governed by the access of air that in turn depends upon the particle size, distribution, amount of water saturation and degree of compactness.

NEED OF BACKFILLING IN MINES

To get rid of all the wastes economically and without hampering environment, backfilling in mines can be a viable solution. Backfilling of coal mines can be performed in conjunction with mining (in case of underground mines), or even after a mine has been abandoned. In addition to reducing mining subsidence, other potential benefits that might be gained include increased coal recovery, enhanced ventilation control, reclaiming mined out surface land etc. Coal refuse can also be disposed, provided that it is deemed a stowing material. It may be possible to increase coal recovery with the proper placement of backfill. If the in situ fill has sufficient strength to provide support to the overburden, or to increase the strength of pillars by providing lateral support, less coal would be required to be left out in pillars. Ventilation control can be enhanced by improving ground control. Leakage in under ground coal mine is experienced when stoppings, overcasts, etc. experience damage from ground movements. If backfilling helps improve ground control, leakage caused by ground movements would be also reduced.

OBJECTIVE

Geotechnical investigation of coal mine refuse is required to be carried out as it can help to judge and make the area safe for work and development. It is necessary to know the compactness of the material that is being used for backfilling, which can be achieved by geotechnical methods. Stability and performance of the waste dumps on steeply sloping terrain is an important issue, as it is a cause of many accidents. These parameters can be monitored with the help of geotechnical investigation. To have a control over the geomechanical process during the formation of quarry slopes we need geotechnical investigation. With the help of geotechnical investigation we can judge how temperature and climate will have affect on the stability of the backfill. This work has therefore been planned to be carried out with the following objectives:

LITERATURE REVIEW

This chapter presents the important findings of a few researchers regarding backfilling of coal mine wastes brief. It may be mentioned here that the investigations only relevant to the present research work are described in chronological order from the past to the present. Chugh and Deb (1997) successfully demonstrated that extraction ratio at an Illinois mine can be increased from 56% to about 64% with backfilling done from surface upon completion of all mining activities, by using fine coal processing waste (FCPW) and coal combustion

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byproducts based paste. This concept has the potential to increase mine productivity, reduce mining costs, manage large volume of CCB's (coal combustion byproducts) and FCPW'S beneficially, and improve miner's heath, safety and environment. Palarski (2002) has reviewed the method of disposing coal waste on the surface at low costs. His assertion that using hydraulically transported, densified and cemented fills with fly-ash ad flue gas desulphurization by products has a major economic and environmental advantage over normally used method of waste fill by dumped rocks and hydraulically or pneumatically placed crushed rocks specifically in coal mines. Karfakis et al. (1996) described the physical and mechanical properties of coal mine waste from different sites and the effect of these properties on the duty requirements of fill materials were assessed. For environmentally acceptable and economically viable method of backfilling by coal mine refuse important properties to be considered are strength characteristics, deformability, and ability to dispose pressure and slake durability. On analyzing these properties we can determine if the design objectives of the fill can be met or not. As a result of this testing, it is concluded that if improving ground control is the only reason for backfilling, coal refuse alone does not appear to be a suitable stowing material. If coal-refuse disposal is also a consideration, then it may be more attractive stowing and backfilling material.

CONCLUSION

Geotechnical tests were performed for the coal mine refuse samples of different mines to evaluate the their suitability as filling material. These test include Slake Durability, Standard Proctor Compaction test, Triaxial test, Permeability test and Atterberg limits test. From the result of these tests it may be concluded that coal refuse of sample no. 1, sample no. 5 and sample no. 7 can be used for the purpose of backfilling without much treatment. But all other samples need some treatment such as removal of some fine particles, mixing with some amount of cement or some other binding material so that its strength increases and it does not deteriorate when subjected to wetting and drying cycles

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