

Raising environmental awareness among miners in Iran

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Abstract

Generation of waste is inevitable but controllable in minerals industry. The aim of this research is to find ways for raising environmental awareness among miners. Miners' attitude towards environmental mining has been investigated. A survey has been done collecting mine managers' point of view coupled with current trend on mine waste management in Iran. Their opinions on methods used for minerals extraction and waste production are sought in order to investigate possible educational schemes for waste reduction and mine waste disposal. The type and quantity of waste produced by respondents have been identified to prioritise the wastes produced in minesites. Environmental legislations and policies for good practice minerals extraction are surveyed and demonstrated. These are regarded as our clients' preferences on managing mining waste. When combined with other existing policies and methods, they could become part of a learning program to boost awareness among miners.

Keywords: Vocational learning, environmental awareness, mine wastes, research survey.

Introduction

The human need for use of mineral commodities is developing fast. This increasing demand for minerals production has resulted in economic use of low grade mineral reserves. Excavation of low grade mines brings about higher waste production, which in turn damages the nature with additional pollution release into the environment (Blight, 2011). More than 235 million tones of different minerals are extracted from large and small mines in Iran annually. This figure calls for a huge awareness to be raised among miners.

The damaging effect of mining to the environment is partially due to the tailings generated in mines, which could be toxic. However, some mining residues left in stone quarries and mines are typically dry and less pollutant (Blight, 2011). Yet, the waste-to-ore ratio can range between 1 and 5 for underground mines and between 1 and 60 for open pit mines. This is the tonnage of non-mineralised waste material removed to allow the mining of one tonne of ore. The waste remaining from stone mining also encompasses some considerable percent of mineral extracted. Hard rock quarries produce variable amounts of quarry waste. Some produce small amounts of overburden while others may have large amounts of overburden and interburden that is not of sufficient quality for the desired product (British Geological Survey, 2009). Quarry fine and unwanted broken rocks resulting from excessive blasting

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operations are the most well-identified residues in limestone and tuffstone mines (Ministry of Industry and Mines, 2008).

In the current research mine managers are targeted to find out the most effective methods that could be adopted to educate them. Thus, a survey has been conducted aiming at acquiring miners' viewpoint in terms of managing mining waste. The questionnaire is designed to deal with the miners' awareness and attitudes towards reduction of waste and also their familiarity to mining legislation. In addition to the questionnaire, a number of professional reports (Ministry of Industry and Mines, 2006) were reviewed to find out mining methods used and to survey the quantity of minerals produced and to estimate the associated wastes left. The questionnaire was sent to 70 mine managers, out of which 32 responses returned. The survey outcome is then combined with other measures acknowledged by academics and government bodies to develop new curriculum for educating mining workforce.

National curriculum for vocational learning programs for Iran manufacturing and industrial sectors has been developed since decades. This is well-established in metals and food industries, for example (Occupational Training Organisation, 2013). Nevertheless, little is done within the mining sector throughout the country. Therefore, the need for such educational agenda is apparent to a great extent. Such program has been advanced in most developed countries. In Great Britain the number of national vocational qualifications (NVQ) held is numerous and increasing in the field of environment including NVQ Environment, NVQ Environment distance learning, NVQ Waste management, NVQ Waste disposal, NVQ Recycling distance learning, NVQ environmental management, NVQ environmental health, NVQ environmental conservation and NVQ environmental impact (Emagister, 2013). Employees are urged to attend these courses and learn the necessary skills to perform their role more effectively. Each award can be tailored to the role an employee performs to cover every aspect of the waste operation. Distance learning programs are now supplemented to boost waste recycling plans.

Resource efficiency initiatives have been found to be successful in UK businesses, implementing materials reduction measures is an example. Personnel are trained how to walk around the site and mark on the map the visible and potential areas where waste is generated. They also learn how to put some figures to these materials and resources followed by recording the material use and reducing it (WRAP, 2013a). Undoubtedly, education is an inevitable part of a conceptual framework for solving mine environmental issues. An example of an academic led program is a series of "Be Aware" workshops organized by the UK government to identify cross-sector waste streams/products. In these workshops representatives of several product manufacturers and consultants met to discuss common issues relating to waste production, mapping, and recycling challenges and opportunities. The workshop outcomes have been used by consortium partners to produce a series of BeAware sector guidance reports that can be downloaded from the publications page (BeAware Project, 2007).

Mining methods and minerals type

The purpose of asking about the type of minerals and mining methods used is to understand the type and quantity of wastes produced in different mines. 89% of respondents were managers of surface mines while 11% of them were associated with underground mines. Surface mining generates more waste than do underground mining. Waste in some quarries such as silica, kaolin and feldspar mines comprises mostly overburden and top soil, which needs replacing and stockpiling. In underground mining backfilling of mined areas is known to comply with environmental laws (Gilchrist, 2007).

However, backfilling is only applied in some coal mines in Iran, and is not considered in this survey, because none of our respondents were coal miners.

Around 43% of quarries surveyed are stone quarries including limestone and tuffstone mines; other non-metallic minerals such as silica, kaolin and feldspar are also included.

Waste quantity and type

Acid mine drainage, which is a major problem in many metallic mines is likely to be a less crucial problem in non-metallic mines. However, damages due to dust generation and ecological changes are of most concern for stone mines and other non-metallic mines. Many dusts do contain metals which are potentially hazardous and have the potential to severely affect flora and fauna near the mine and to impact on the health of mine workers (British Geological Survey, 2009).

According to this survey most of the wastes produced in non-metallic mines are dry residues. Dust emission in quarries is regarded as one of the most disturbing problems associated with wastes (Ministry of Industry and Mines, 2008 & British Geological Survey, 2009). The dust originates mainly from blasting as well as top soil removal by mining machinery. Also, unwanted broken rocks in stone mines resulted from blasting is massive in quantity, 30% of total ore extracted in average (Ministry of Industry and Mines, 2006). These wastes are stockpiled somewhere near the quarries and may require control of water runoff, surface water conditions and flood flow design and drainage basin analysis (Renteria, 2001).

Mining licensing and environmental legislation

Approximately, 80% of miners responded that they are familiar with environmental legislation in some respect, but 20% were not accustomed to it. Common elements in mining licensing such as clear legal authority are vital to avoid misuse of mineral wealth and also are essential for national income growth (World Bank, 1998). More examples in mining licensing, as World Bank reported are exclusivity of exploration and mining rights in designated concession areas and special licensing and regulatory regime for small-scale mining. Making use of mineral resources and taking public right into account at the same is an indispensable prerequisite for environmental mining. One major concern the legislator may have is the tax income due to mining practices, however this in turn could be achieved by providing a fair condition for the mining industry to produce saleable minerals commodity. In order to maintain public prosperity and development in the country he needs to take environmental issues into consideration. Consequently, it is essential to support integrated approaches for sustainable development within the mining sector. More importantly is publicising this important concern among miners through holding vocational courses and learning workshops.

The costs and benefits

It is important to find out miners' attitudes towards environmental costs and benefits. Around 36% believe that environmental laws related to mining could bring about some benefits alongside the associated costs. But, approximately 64% stated that they are only costive.

When it comes to the implementation of environmental laws more than 95% of miners revealed that both penalty and incentive strategies are very effective means. Knowing mining managers' opinions will help making more viable decisions on designing professional courses especially for mining workforce. For instance, whether praising and/or penalizing approaches are adopted by government the miners should be aware of the reason behind it and the environmental benefits associated with it. Around 40% of clients

reveal that motivating rules are more effective while only 13% believe in opposite way with 47% indicating that both incentive and fine policies should be used.

Reasons for disregarding environmental issues

Knowing what makes miners disregard environmental issues would help devise more informative learning programs. Filling this gap could be one of the key targets when designing occupational learning curriculum. 57% of respondents believe that lack of mining standard in Iran is the main reason for not pursuing environmental laws, while 33% of them believe that lack of knowledge about its detrimental impacts may be the main reason. The rest also disclose that dealing with waste is time consuming and therefore impractical. While implementing rules to advance mining standard is the key improving mining managers' knowledge on economic and environmental benefits are likely the most viable way to practise environmental laws in Iran.

Changing the way of dealing with mine wastes

Planning for waste reduction in mines and quarries in Iran needs a change in minerals waste management. Thus, information about miners' present circumstances could help change their attitude towards waste production. Whilst 38% of clients respond positively to such change the rest are reluctant to alter the way they deal with minerals waste.

Discussions

Sustainable mining requires a waste reduction strategy that is well-known to all mine managers. Such strategy cannot be gained without raising awareness among miners, which in turn requires sustainable learning and cultural strategy. According to this survey to deal with wastes in non-metallic mines training courses on the following subjects are likely to be effective: a) reduce and control dust emission in quarries. b) familiarity with mining licensing and taxation. c) good understanding of environmental costs and benefits.

First, conventional mining and operation needs re-examining to reduce mine waste and associated hazardous residue. Topsoil stripping and blasting are identified to be the major origins of dust in mines and quarries. Integrating dust control provisions into these operations planning are among the best practice principles applied to controlling dust (Needham and Brooks, 1998). Some clients in stone quarries expressed more concern than others did on dust emissions. There are limited options for controlling dust from blasting. On time watering of the blast area may assist, particularly to combat dust emissions from certain quarries. Delaying blasting under unfavourable wind and atmospheric conditions is another method that can be effective in protecting areas adjacent to the mine from blasting dust involves. These resolutions need to be understood by mine managers; they are therefore advised to enrol the learning programs concerned.

In stone quarries over 30% of extracted rock is normally left as waste rock due to possessing unfavourable size. This waste rock dump is often stockpiled near the pit. Bench blasting techniques may be introduced as one possible remedy for waste reduction of this type (Lopez Jimeno et al.1995). Moreover, such waste rock dumps require control of erosion and soil mass movement as well as control of water runoff for surface water and flood control (Renteria, 2001). These technical matters are often disregarded in conventional mining and need further investigation. Once fulfilled for inclusion in a series of vocationally recognized workshops, it needs accreditation by law.

As surveyed in this research, miners are somehow familiar with environmental law but they rather believe that it is costive; yet some 36% of them state that it is cost-effective. Hence

there is a great potential for mine managers to become eco-miners should they appreciate the economic benefit as well as environmental benefit associated with eco-mining (Deak et.al. 2009). Training programs could be useful to establish and strengthen these promising objectives. Also, activities such as a plan scheme of miner's environmental awareness are likely to be effective.

The government should have a well-planned and well-thought-out legal programme for waste management. However it can be understood from clients' responses that an effective implementation and enforcement scheme will be a prerequisite. This also needs reliable data collection systems, procedures for raising miners' environmental awareness, and appropriate systems of adequate and dissuasive fines and penalties. It is important to design regulatory systems that can monitor and control the implementation of the environmental matters in a practical and cost-effective manner (Regional Environmental Center, 2008). In order to ensure that these systems operate as intended, the government needs policy instruments including economic instruments and incentives to promote legal compliance as well as systems of administrative, civil and criminal sanctions. Nonetheless, the mining culture in Iran should experience a change not to disregard environmental issues and join the waste reduction and recycling national scheme (Tehranimes, 2013). This may require an effective Cultural Exchange Association to establish to help transfer experience and knowledge between industries.

As it comes to the costs and benefits, lesson can be learned from non-profit organisations in other countries who have contributed to economic growth through introducing and educating "Waste Mapping: Your Route to More Profit" (WRAP, 2013b & WRAP, 2013c). The government policies are shown to be a critical component of social, economic and environmental systems influencing production. The role of government in introducing the associated benefits when becoming eco-miners is very decisive. One grown-up example is the eco-industrial development. Eco-industrial projects originate from the local community (Cohen-Rosenthal and Musnikow, 2003). It is a voluntary activity of individual firms seeking to enhance resource efficiency and save costs. It is very much likely to achieve such level of environmental awareness among miners by running well-organized educational programs as well as legislating and implementing good practice mining. Nonetheless, enforcement activities are required to safeguard the strategic and implementation plan. Thus, undertaking monitoring and other forms of assessment would also be indispensable for succession of project (Regional Environmental Center, 2008). There are a number of organizations and agencies sponsored by their governments in the developed world to plan and manage learning programs and workshops (The Waste Exchange, 2013). These workshops are for managers of different industries and for individuals who work with resources conservation and protection. These conservation education programs are advertised in designated websites and receive substantial attentions by professionals who are keen to attend. The site also provides members with search facility for a material they could use or find a market for a material they generate (IOWA, 2013 & Nguyen Ngoc and Schnitzer, 2009).

While other industries tend to use as little resource as possible, extract the maximum possible value from resources and generate as little waste as possible the mining sector also should focus on waste reduction and recycling. However, the miners' awareness and attitudes towards reduction of waste can only be achieved through holding awareness programmes. Training personnel is essential when designing clean processes and remediation/restoration measures. Mine managers can only achieve designated environmental targets by promoting their personnel's knowledge on waste reduction and

recycling. A decrease of 10% in the production of coal mining wastes by reuse of mining wastes as underground fills is an example (Bian et al, 2010). Again miners should be trained to become familiar with the backfilling process in this case.

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İran'da madenciler arasında çevre bilincinin artırılması

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Özet

Atık üretimi mineraller sektöründe kaçınılmaz ama kontrol edilebilirdir. Bu araştırmanın amacı madenciler arasında çevre bilincinin artırılmasının yollarını bulmaktır. Çalışmada, çevre madenciliğine yönelik madenci tutumları araştırılmıştır. İran'da maden atık yönetimi konusunda mevcut trendi anlamak ve maden yöneticilerinin atık yönetimi konusundaki görüşlerini toplamak amacıyla tarama yapılmıştır. Yöneticilerin görüşlerine göre mineral çıkarma ve atık üretimi için kullanılan yöntemler atık azaltma ve maden atık bertaraf için eğitim program şemaları oluşturulmak amacıyla kullanılabilir. Sorumlular tarafından üretilen atık türü ve miktarı, maden sitelerinden üretilen atıklar öncelikle tanımlanmalıdır. İyi bir uygulamayla mineral çıkarılması için çevre mevzuatı ve politikalar taranmıştır. Bu maden atık yönetimi konusunda müşterilerimizin tercihleri olarak kabul edilmektedir. Diğer mevcut politika ve yöntemler ile birlikte müşteriler, madenciler arasındaki farkındalığı artırmak için öğrenme programının bir parçası haline gelebilirler.

Anahtar Kelimeler: Mesleki eğitim, çevresel farkındalık, maden atığı, tarama araştırması

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