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# **Impacts of Activities in Crushing Plant on Environment and Occupational Health of Workers Involved**

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## **PRESENTATION**

With the development of societies there is a growing demand for raw materials for the construction industry, among them, crushed stone, available in several categories, as set down the specifications of the service agencies. In the long term and as a result of sobreutilização such demands lead to exhaustion of mines and environmental degradation. These materials are produced in crushing plants, which have characteristics of development of its activities, being an aggressive environment for the people involved and, likewise, to the surrounding environment, deteriorating air, water and soil. As for the workers, since the production process, may present in the medium and long term, the emergence of so-called occupational diseases or occupational diseases, these diseases that can lead people to the inability to work and even to death. It should be noted that occupational diseases relating to mineral extraction are properly characterized in the literature. In Brazil there's labor and welfare legislation they impose on public and private sectors, the zeal with health workers, and the non-compliance, characterizes the disrespect for life and health of employees, liable to punishment. Likewise, today, there is a growing concern in the world, both in public and private sectors, about the legacy of extractive activities, the need to reassess the system of production and exploitation of mineral resources used to make it sustainable and ensure the existence of future generations, compared to its current unsustainable, and especially with regard to the costs involved. The aim of this study is the importance of the process of comminution in the environment and humans. It will use a literature review, theoretical and descriptive method, as well as statistics from the Ministry of Social Security in Brazil.

**Keywords: Environment, crushing facilities, safety, occupational diseases.**

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## **1. Introduction**

To develop a nation's economic production of materials used in the process of expansion or creation of new roads, in order to increase the supply routes for the flow of products and technologies becomes imperative. These materials, crushed rock in various particle sizes are specified by the competent bodies in this area.

The risks to which employees are exposed are crushing many an installation and can quote the physical and chemical hazards. The previous recognition of these risks, their analysis and the search for solutions for eliminating or reducing exposures becomes critical to maintaining the physical and psychological integrity of employees, because a healthy and safe environment to work, allows employee satisfaction, reflecting directly social life of the worker and increase productivity in the company.

Moreover, there is a growing concern with environmental issues in various activities among them the implications of mineral extraction activity, as a major risk to the environment, both locally and from surrounding activities. If mismanaged these aspects, the environmental liabilities can derail an economic activity, since the penalties in existing law.

The paper presents the environmental aspects involved in mineral extraction, topics about the Brazilian legislation on the subject, the main risks to which employees of crushing plants are exposed to and comments on the specific laws designed to maintain health and safety workers in developing their activities.

## **2. Economic development, the environment and the increasing need for productive resources.**

CARVALHO (2004) argues that the Brazilian mineral sector can be assessed as an important part of the global economic system, capable of transforming and improving a development perspective, economic, social and ecological sustainable, compared to the current reality, since, for obvious reasons there will be no sustainable development as much of the population live in extreme poverty levels. It adds, however that it is necessary to impose limits on the expansion of production and at the same time, that this is perfectly feasible to produce new conditions for sustainability, considering that the development should not only harmonize with the environment and nature, ensuring appropriate environmental conditions.

To understand what is understood in the crushing plants, one must understand that facilities are structured, ie, composed as METSO (2005) the following sequence: primary crushing, with the function of enabling the transport of material in a belt carrier; crushing middle, aiming to produce several coarse (clusters) and fine crushing, to produce fine particle sizes (finished products).

According defined by Slack et al. (2002, p. 207) this type of activity is characterized by being a physical layout for the product, ie, each product follows a pre-defined in the sequence of activities required coincides with the sequence in which the cases were arranged physically.

But in developing this sequence of steps, depending on the characteristics of equipment and materials (rocks) used for the emergence of unfavorable working conditions for people, and the occurrence of particulate matter (silica), excessive noise and vibration the jobs are more features. Sum up the appearance of degraded areas, air pollution, the need to remove vegetation, among other possible consequences.

## **2.1 Environmental Aspects**

According to Carvalho (2004), several effects and negative impacts are caused to the environment, generated by mining activity, and its many and varied phases, from development to the abandonment of the area after the closure of mining activities. Already according to Barreto (2001), and according to a study prepared by the Institute of Technological Research of São Paulo (IPT), can be highlighted as the main environmental impacts of mining activity: change of ground water, water pollution , air, soil and noise, impacts on fauna and flora, sedimentation and erosion, land instability and the general release of debris and vibration.

To do so, with the growing awareness of the need for control of resources and environmental pollution, was created in the 1980s, the Federal Law No. 6.938/81, which regulates the National Environment Policy, its mechanisms formulation and implementation. The same shall, in its art. 2, the goal of this is the preservation, enhancement and restoration of environmental quality conducive to life, to ensure, in the country, conditions for socio-economic development, the interests of national security and the protection of the dignity of human life, given between other principles which include: monitoring the status of environmental quality and protection of areas threatened by degradation.

In the art.5, single paragraph provides that public or private business activities are carried out in accordance with the guidelines of the National Environmental Policy. The same law in his art. 10 which describes: the construction, installation, expansion and operation of establishments and activities using environmental resources considered effective or potential polluters, as well as able, in any form, to cause environmental degradation, require prior licensing by the competent state agency, of the National System of Environment (SISNAMA) without prejudice to other required licenses.

Failure to comply with environmental legislation in various sectors is punishable by the application of Federal Law No. 9.605/98 which provide for criminal and administrative sanctions derived from conduct and activities harmful to the environment. Federal Law No. 9.605/98 was regulated by Federal Decree No. 3179/99, which provides for the specification of penalties for conduct and activities harmful to the environment.

As for monitoring the effective implementation of Federal Decree No. 3179/99, did the resolution of the State Council on the Environment (CONSEMA) No. 006/99, regulating Decree, resolving that the enforcement of its provisions shall be held by the Secretariat State of the Environment (SEMA) and their related environmental agencies.

As a result of the legislation cited, they have created mechanisms for including the analysis of environmental aspects, before overlooked by companies that produce mineral aggregates (in this case, various grain sizes in gravel), possessing the crushing plants, given the high potential pollution, both in the aspect of noise as the emission of particulates (dust).

In addition, other legal aspect that involves the production of mineral aggregates with respect to the possible health implications for workers involved in activities.

### **3. Occupational Diseases Resulting from Activities in Crushing Plant**

According to the Brazilian social security legislation, in its Decree No. 611 of 21.07.1992, Article 140, there are two types of occupational diseases, the first being called an occupational disease, defined as the produced or triggered by exercise work peculiar to a particular activity and appearing in the special relationship in the decree and, second, occupational disease, understood as acquired or triggered due to special conditions under which the work is done and it directly relates, provided that, in the same way the previous Mentioned in paragraph of the decree.

Thus, we observe that, for diseases related to occupational activities in crushing plants stand out due to exposure to three key players, which are: silica, noise and vibration.

#### **a) Diseases resulting from exposure to silica**

Silica, according to Neto (1995), can be defined as a mineral of great hardness, the quantity found in nature, they can be found in the sands and in most rocks. This mineral can be seen in two forms, which are: crystal-like quartz, tridymite, cristobalite, etc. and amorphous, such as silica gel or colloidal silica. The quartz, crystalline silica is not combined with any other chemical element best known, being called silica crystallized. Ordinance No. 3214 of June 8, 1978, in NR 15, anexo12, the Ministry of Labour, which is always understood that "quartz" means silica crystallized.

Results from exposure to silica crystallized a disease called silicosis, pneumoconiosis principal in Brazil, Mendes et al. (1995). It is understood only by pneumoconiosis disease caused by inhalation of aerosols and the resulting solid tissue reaction of the lung parenchyma. Mendes et al. (1995).

Already Saliba (2002, p. 15) adds saying that the damage caused by silica is directly proportional to the concentration of particles inhaled and duration of exposure.

#### **b) Diseases due to exposure to noise**

Noise from the point of view of Occupational Hygiene, according Saliba (2001, p. 16), is the physical phenomenon of vibration characteristics undefined pressure variation (in the case air) in function of frequency, ie for a given frequency can exist in random through time, variations of different pressures. But according to Ordinance No. 3214 of June 8, 1978, NR 15, Annex 1, the Ministry of Labour, is defined by continuous noise or intermittent, for purposes of applying the Limits of Tolerance, the noise is not impact noise. The same decree, the NR 15, Annex 2, defined as those that impact noise has peaks of acoustic energy of less than 1 (one) second at intervals greater than 1 (one) second. The main effect of chronic exposure to excessive noise is hearing loss, Mendes et al. (1995). But it is observed that occupational exposure is not the only factor causing hearing loss. Consider themselves, as well as factors that cause hearing loss: military service, entertainment and sport.

In order to differentiate the work-related hearing loss, the Committee on Noise and Hearing Conservation at the American College of Occupational Medicine (1989) described the noise-induced hearing loss as usually bilateral, permanent, slow and progressive development of the Over many years as a result of exposure to loud noise, continuous or intermittent. They have, according to the Committee, certain features, which are: to be always sensorineural, affecting the cells of the inner ear, is usually bilateral (audiometric patterns are usually similar on both sides), permanent, almost never produces a profound hearing loss (usually, limits for losses at low frequencies are around 40dB and at high frequencies around 75dB (A), since the exposure is discontinued, there will be no significant progression in hearing loss resulting from exposure to noise.

The above, Mendes et al. (1995, p.368), corroborates the claim that continuous exposure to noise over the years is more harmful than exposures interrupted.

Already in 1994 the National Committee on Noise and Hearing Conservation defined the noise-induced hearing loss related to work as a gradual decrease of auditory acuity, resulting from continued exposure to high noise levels, with the aim of presenting the position of the scientific community Brazil on the subject (Mendes, 1995, p. 377).

The noise, however, as Bellusci (2005, p. 110) and Marano (2003, p. 114-115) not only induces hearing loss in workers, as previously described, but can cause other changes in the body such as vasoconstriction, tachycardia, hypertension, digestive disorders, fatigue, irritability, anxiety, excitability, uneasiness, nervousness, dizziness, etc.. But Marano (2003, p. 114) notes that there are people who adapt to noise and are not influenced by its deleterious effects.

### **c) Diseases resulting from exposure to vibration**

According to Ximenes and Regazzi (2005), vibration is a periodic motion, or random, a structural component or piece of machinery, repetitive motion from a rest position and may, as mentioned by Marano (2003, p.123-124), causing damage to the health of workers exposed to these movements. Similarly claims that the severity of biological effects depend on many factors, such as: frequency of vibration, the intensity and duration of vibration transmitted by the working day, the position taken during the work, the segment of the body exposed to vibration, the type and machine maintenance, climate, and ultimately of preexisting conditions or factors that may affect the circulatory system (heart disease, hypertension, smoking, certain medications, etc.).

The major side effects associated with exposure to vibration and considered more damaging, ranked by Vendrame (2005) are: loss of balance, and slowness of reflexes, increased frequency of heart beat psychological effects, such as lack of concentration for the work, effects on the gastrointestinal tract, impairment, including permanent, certain organs of the body; gradual degeneration of muscle tissue and nervous.

It is observed that the three factors described above may trigger, in addition to discomfort, occupational diseases, many disorders, the inability to work temporarily or permanently of the people involved in these activities. To do so, considering the studies developed in Brazil and abroad and statistics from the Ministry of Labour and Social Security were created specific laws on health and safety, by those bodies. It should be noted that these are not just for the mining activity, but to all work activities, forcing both employers and employees to become aware of the importance and necessity of maintaining the health and safety of employees. But when it comes to activity mining, it is necessary to consider that, being an activity of great complexity, from the aspect of health workers involved, was created Norm No. 22 (NR-22) - Occupational Health and Safety at Mining, aiming at disciplining the precepts to be observed in the organization and work environment in order to make it compatible planning and development of mining activities in the continuous search of safety and health of workers (BRAZIL, 2011).

Besides the already presented, there are additional laws that lead to better labor and social security aspects in dealing with health and safety. But even with the existence of legal means, there is still a lot of work accidents and occupational diseases in this segment of productive activity, as can be verified by statistics of the relevant bodies, these statistics are available, especially in middle electronic. It should be noted that these statistics do not reflect reality, since many accidents and occupational diseases are not actually recorded or by employers or by employees themselves or entities, ie, there is an underreporting, characterizing the existing numbers.

#### **4. Statistics of Social Security on occupational diseases related to mineral extraction activity**

As stated earlier, there is an underreporting of occupational accidents and consequently of occupational diseases occurring in Brazil, however, Social Security publishes annually the Statistical Yearbook of the Social Security System (AEPS), which in its 2009 edition, presented the number of occupational diseases, which were recorded



through the Statement of Work Accidents (CAT) for the years 2007, 2008 and 2009. It was observed that, for the three categories of possible framework for mineral extraction activity to produce aggregates for the construction industry (extraction of stone, sand and gravel, nonmetallic minerals extraction NES and, finally, support activities the extraction of minerals, except petroleum and natural gas) the number of occupational diseases recorded were 86, 40 and 44 respectively for the years 2007, 2008 and 2009 for the sum of the three categories.

Considering the size of Brazil and the large number of points of mineral extraction, it appears that, indeed, there is the possibility of underreporting. To be able to record an accident, with the Social Security, it is necessary to access the internet and precedence as the remote location, facilities for mining, urban centers, often, even if having the intention to formalize the occurred, there is no available means, and that in many cases, there are no doctors, nearby, to meet people and hilly therefore there is no certificate indicating the type of injury which the person was involved (which already preclude the issuance of the CAT, since the obligation to provide this information).

## **5. Conclusion**

The development of capitalist society led to an increasing demand for goods and services and these, in turn, indicates the need for basic supplies, among them one can highlight the mineral extraction, through production of crushed stone, in various particle sizes, for use in large scale in civil works.

With increased production, there are adverse effects on workmanship and the surrounding environment. The most common diseases to workers involved in mineral extraction activity are: noise-induced hearing loss, silicosis and musculoskeletal diseases. In Brazil there's labor and welfare legislation that supports and regulates the professional activities of mineral extraction activities. Likewise, the environment is safeguarded with a comprehensive regulatory burden. However, there is an effective collection of these different rules, which makes the whole exercise of the activities below potential and ideal for both the worker and for the environment, which shows that quantity does not mean quality and efficiency.

Reducing the risks both environmental and labor (by reducing the exhibition) is the main strategy for prevention of occupational diseases. To do so, we must seek knowledge, new technologies available for the elimination of risk, at best, or mitigation. A combination

of controls, which include engineering and management techniques, education of workers through training programs and effective medical supervision, should be used to improve working conditions and, consequently, environmental, competing for it, satisfaction of those involved, through increased production and reduced costs.

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