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Evaluation of Quarry Dusts in Terms of Occupational Health and Safety in an Open Pit Mining Operation

Bir Açık Ocak Maden İşletmesinde Ocak Tozlarının İş Sağlığı ve Güvenliği Açısından Değerlendirilmesi

ABSTRACT

The production method in the mining sector is determined by taking into account the way the ore is deposited in the earth's crust. The mining industry is considered within the scope of very dangerous business lines in the hazard classification. In this respect, it is important to evaluate the risks from a sectoral point of view. In the study, the presence of dust generated during open pit mining activities was evaluated in terms of employees, environment, and machinery equipment. PM10 and precipitated dust parameters were taken into account in the measurements. Dust sampling was used for PM10 with MCZ LVS 1Dust device and PM 10 head, and the gravimetric method was used for precipitated dust. Coal, clay, and sand are extracted in the enterprise where the study is carried out. Coal, clay, and sand are extracted in the enterprise where the study is carried out. The immission points of the measurement made by considering these points and the parameters performed at these points; P-1 (North January), P-2 (January midpoint), P-3 (South January), ÇT-1 (North January), ÇT-2 (South January), ÇT-3 (Area-1), was determined as CT-4 (Area of Influence-2) and measurements were made at these points. Dust, in open pit mine production processes; occurs in processes such as drilling, blasting, loading unloading, crushing, and screening. If adequate health and safety precautions are not taken, it can cause occupational diseases in the long run. Employees can get occupational diseases as a result of long-term exposure to these dusts. In the study, points, where the presence of dust could pose a risk (suspended and settled dust), were determined and measurements were made at these points. Protective and preventive practices for employees, the environment, and machinery-equipment are mentioned, taking into account the measurement results and the limit values specified in the legislation.

Keywords: Dust in the mining industry, Occupational health and safety, Occupational disease.

ÖZET

Madencilik sektöründe üretim yöntemi, cevherin yer kabuğunda depolanma şekli dikkate alınarak belirlenmektedir. Madencilik sektörü, tehlike sınıflandırmasında çok tehlikeli iş kolları kapsamında değerlendirilmektedir. Bu açıdan risklerin sektörel açıdan değerlendirilmesi önemlidir. Çalışmada açık ocak madenciliği faaliyetleri sırasında ortaya çıkan tozun varlığı çalışanlar, ortam ve makine teçhizatı açısından değerlendirilmiştir. Ölçümlerde PM10 ve çökelen toz parametreleri dikkate alınmıştır. PM10 için MCZ LVS 1Dust cihazı ve PM 10 başlığı ile toz örneklemesi, çöken toz için gravimetrik yöntem kullanıldı. Çalışmanın yürütüldüğü işletmede kömür, kil ve kum çıkarılmaktadır. Çalışmanın yürütüldüğü işletmede kömür, kil ve kum çıkarılmaktadır. Bu noktalar dikkate alınarak yapılan ölçümün imisyon noktaları ve bu noktalarda gerçekleştirilen parametreler; P-1 (Kuzey Ocak), P-2 (Ocak orta noktası), P-3 (Güney Ocak), ÇT-1 (Kuzey Ocak), ÇT-2 (Güney Ocak), ÇT-3 (Bölge-1), oldu CT-4 (Area of Influence-2) olarak belirlenmiş ve bu noktalarda ölçümler yapılmıştır. Toz, açık ocak maden üretim süreçlerinde; delme, patlatma, yükleme boşaltma, kırma, eleme gibi işlemlerde meydana gelir. Yeterli sağlık ve güvenlik önlemleri alınmadığı takdirde uzun vadede meslek hastalıklarına neden olabilmektedir. Çalışanlar bu tozlara uzun süre maruz kalmaları sonucunda meslek hastalıklarına yakalanabilmektedir. Çalışmada toz varlığının risk oluşturabileceği noktalar (askıda ve çökmüş toz) belirlenmiş ve bu noktalarda ölçümler yapılmıştır. Ölçüm sonuçları ve mevzuatta belirtilen sınır değerler dikkate alınarak çalışanlar, çevre ve makine-teçhizat için koruyucu ve önleyici uygulamalara değinilmiştir.

Anahtar Kelimeler: Madencilik sektöründe toz, İş sağlığı ve güvenliği, Meslek hastalığı.

1. INTRODUCTION

Mining is a business that is mostly done in places far from city centers. The determining factor in the production of the ore is the bedding type and geology of the ore. The method of production is determined by taking into account the necessary studies in the mining sector. In mining, drilling and blasting is the most basic stage in the production process. If the strength (hardness) of the ore is high, the ore is separated from the parent rock by explosion. Before being sent to the facility, it is converted into smaller sizes with the breaker attached to the excavator in the quarry. It is then sent to the crusher unit by transport vehicles.

When the mining industry is mentioned, the first thing that comes to mind is methane gas. The mixture of methane with air causes grizzlies. If adequate precautions (ventilation, ambient measurement, etc.) are not taken, it causes serious losses. The presence of dust is a serious hazard for workers as much as the presence of methane. Dust is defined as particles found in the workplace environment and capable of spreading, according to Article 4 of the Dust Fighting Regulation. Inert dust refers to dust that enters the body through the respiratory tract but does not cause any damage to the lungs, crystalline powder (SiO2) tridymite, quartz, and cristobalite. Respirable dust is amorphous or crystalline powder with a diameter of 0.1-5 microns and fibrous powders with a diameter of less than 3 microns and a length of 3 times its diameter. Pneumoconiosis refers to the disease that occurs as a result of the accumulation of dust in the lungs. Dust measurement is determined according to the fiber count of dust, fibrous dust in the ambient air of the workplace, or the gravimetric basis of the dust amount.

Dust emerges as a result of the work done in the mining industry and spreads to the mining environment. The presence of dust, as well as the presence of gas in the mining sector, poses a serious threat to employee health and mine safety. Dust is produced as a result of the crushing of large rocks during the blasting, crushing, screening, and drilling processes. Gravimetric method (1mg/m3) or particle counting method (particle count/cm3) is used to determine the concentration of dust (Ergün, 2007). There are generally two types of dust sources during mining activities. Of these, the primary source of dust is the dust caused by comminution and fragmentation during the recovery of rock or coal. Secondary dust source causes the precipitated dust to swirl in the air due to various reasons (wind, ventilation, transportation, etc.). Reasons for dust control in mining activities; To create a healthy environment for employees, to prevent work accidents caused by visibility, and to prevent dust-induced machinery and equipment damage (Ediz vd., 2001). This is important in terms of both production and sustainability of occupational safety. There are many studies in the literature on dust and the risks caused by dust. Mannetje et al. (2002) In their study, they examined the relationship between crystalline silica and silicosis and mortality rates in case of exposure according to six occupational groups. Accordingly, they found that the upper respiratory limit value of silica dust is 0.1mg/m3 and the risk of death is 13 per 1000 in workplaces. In workplaces where the threshold limit value of respirable silica dust is 0.05 mg/m3, this rate was 6 per 1000. Didari et al. Çakır (1991) Between 1980-1989, respirable dust density and conditions were investigated in TTK-affiliated enterprises. They determined the respirable dust density of 1.08-1.96 mg/m3 in the existing feet in the hanging plant. Çevikler (2009) TTK Sadzl institution investigated respirable dust densities and quartz contents in foot workplaces. Bulut ve Göktepe (2012) investigated the chemicals used in mining and ore preparation processes. Miçooğulları ve Ural (2018) investigated the risk of stone dust in terms of occupational safety in the quarries in the Hatay Kuruyer area. Duran et al. (2021) conducted a literature search on the release of particulate matter in open pit mines. Demirarslan and Kaya (2017) conducted a study on particulate matter and methane emissions of air pollution from coal mining. Şafak et al. (2018) conducted an application study for occupational safety in open pit enterprises. Dust causes damage to machinery and equipment in a short time if the necessary precipitation process is not carried out. This situation often causes delays in production and increases the cost. In such places, various devices are used for monitoring and measuring the environment. However, due to factors such as dust, noise, vibration, and water, the calibration settings of the devices placed to measure the environment may be impaired. Incorrect or incomplete readings of the devices can cause the process of healthy execution of occupational health and safety measures to be mismanaged. This poses a serious risk for employees (eg, dust spreading to the environment after blasting and pollution caused by harmful chemicals).

In general, mining is an important line of business that ensures the development of countries, employment of people, and increase in people's income levels. However, as in every sector, various risk factors may arise in the mining sector that disrupts the production processes. For this reason, to ensure a healthy and safe working environment, taking into account national and international standards or legal regulations; Observations and measurements should be made to ensure that they remain within the limit values. Otherwise, the negative effect it will create can cause serious loss of life and property. This study is a study conducted in an open pit operation. The exposure limit values of the dust generated during the open pit production process were measured. Protective and preventive applications for the machine, human and environmental safety that can be taken against dust are mentioned.

2. DUST CONCEPT AND DUST-RELATED OCCUPATIONAL DISEASES

Dust, Chemistry Glossary (IUPAC, 1990) according to; Small, dry particles with sizes in the range of 1-100 µm, which are mixed into the air as a result of natural forces such as volcanic eruption, wind, crushing, or mechanical, grinding, grinding, demolition, drilling, transport, packaging, sieving, and sweeping. According to the World Health Organization, dust is small solid particles smaller than 100 microns that remain in the air for a while and settle due to their weight (Calvert, 1990). Powders are divided into two groups inorganic and organic powders in terms of chemical origin. While inorganic dusts are stored in the lungs and cause textural disorders, organic dusts are not stored in the lungs (General Directorate of Occupational Health and Safety, 2021). Inorganic powders; Since they are not stored in the lung, they do not have a direct fibrogenic effect. However, due to the allergic effect, they can cause chronic lung diseases as a result of spasms in the respiratory tract. Organic powders; animal dusts (feather, hair, etc.), vegetable dusts (hay dust, flour dust, cotton dust, etc.), and synthetic component dusts (DDT, trinitro toluene, etc.) can be given as examples. Inorganic powders; metal powders (zinc, iron, etc.), non-metal powders (sulfur, coal dust, etc.), natural compound powders (mine ore, mineral, etc.), asbestos dust (aluminum silicate fibers). Dust is classified into six groups in terms of its biological effects. These are mainly; fibrogenic dust, toxic dust, carcinogenic dust, radioactive dust, allergen dust, and inert dust (Erol, 2007). Asthma, allergy, cancer, pneumoconiosis, skin diseases, etc. in people exposed to dust. can be seen (Eruş et al., 2015; Atılgan et al., 2015; Kalaycıoğlu et al., 2015). As a result of dust reaching the alveoli and settling in the lungs, a lung disease called pneumoconiosis occurs. Disease-causing dusts are defined according to their types. For example, diseases such as quartz dust silicosis, asbestosis due to asbestos dust, and siderosis due to iron dust occur (Erol, 2012; Kuempel et al., 1995). Many factors such as personal characteristics, exposure time, ventilation system, and personal protective equipment are effective in the emergence of diseases resulting from dust exposure (Sandal et al., 2020). Considering its dimensions and the effect it creates on the person; If the inhaled dust is >25µm in diameter, separation occurs in the nasal and nasal passages, in the 10-25µm range, in the bronchial trachea, and the case of <10µm, in the alveoli of the lungs (Babalık, 2007). As the duration of dust exposure increases in the workplace and the necessary protective and preventive practices are not implemented, work-related discomfort may occur in the employees. Dust is an insidious risk factor. It does not show a sudden effect as in occupational accidents. However, occupational diseases are inevitable in the long run. An employee's contracting an occupational disease occurs as a result of his exposure to this risk within a certain period. Implementing proactive measures against dust-related risks is important in terms of providing a healthy and safe working environment.

Solution-oriented approaches to occupational diseases can remove this element from being a risk. For example, risks (type of dust, hazards and harms in terms of health and safety, dust measurement results, health surveillance reports, etc.) should be evaluated comprehensively.

The evaluation should be shared with the employee and employee representative in the enterprise and their opinions and suggestions should be included in the study (Kayınova, 2020). Control measures; primary protection (control of dust at the source, engineering measures, administrative measures, personal protective equipment, etc.), secondary (health surveillance), and tertiary protection (Kahraman and Özdemir, 2022).

3. MATERIAL and METHODS

Sand, lignite coal, and clay are produced in the enterprise where the study is carried out. The capacity of the facility is 412,360 tons/year and production is carried out in a single shift. The total area of the facility is 120,360 m^2. The area where the facility is established is $100m^2$. The production process of the process consists of the raw material, truck, stock area, truck, and buyer company stages. Since the raw material (sand, clay, and coal) is not produced from the quarry during the winter months, the ore transported to the stock area in the summer is used. In some cases, run-of-the-mill ore is loaded from the stock area and delivered to the buyer. Dust emission may occur both during the loading phase and during the transportation of trucks. For this reason, irrigation is carried out periodically with aerators. In the study, dust sampling in the environment with the MCZ LVS 1Dust device and PM10 head for PM10, and the gravimetric method for precipitated dust were used. The points where the measurement was made are indicated in Figure 1.

Figure 1. Measurement points

Precipitated dust measurement according to the Annex-2 article of the SHKKK regulation; at least 2 (two) measurement points within the facility inspection area, taking into account the prevailing wind direction. If there are other sources of dust emission in the same area, the number of measurement points can be increased to determine the contributions of other sources outside the facility. The measurement period is 2 (two) one-month measurements and a total of 2 (two) months. The values to be found on a monthly basis are divided by the number of days and the average amount of dust settled in a day is calculated.

4. FINDINGS and DISCUSSION

Provisions specified in the Industrial Air Pollution Control Regulation (SKHKKY) have been taken into account in operations such as the production, filling, transportation, processing, discharge and classification of dusty substances in enterprises. According to this regulation; operations such as sorting, filling, crushing, conveying, screening and grinding of substances with a grain size of 5 mm or more in diameter; If it takes place in closed areas or facilities, the dust emissions thrown by the chimney must be within the limit values specified below.

Dust emissions,

- Dust emissions 200 mg/Nm^3 against emission values of 1.5 kg/h or less
- Dust emissions 150 mg/Nm^3 for emission flow rates between 1.5 kg/h and 2.5 kg/h
- 100 mg/Nm^3 for emission flow rates of 2.5 kg/h or more

Operations such as sorting, filling, crushing, conveying, screening and grinding of substances with a particle size of 5 mm in diameter or larger; If it is carried out in open area or fixed facilities, the amount of dust measured within the operation site should not exceed the monthly average value of 450 mg/m^2-day, considering the wind direction (S.K.H.K.K. Regulation).

Machines that produce (separating, filling, transporting, screening, crushing and grinding) materials with a particle size of less than 1 mm are not operated in closed environments in order to prevent uncontrolled emissions into the atmosphere in any way. The dust in these facilities is collected and passed through the dust separation system. In these facilities, the dust emission limit value thrown through the chimney should not exceed 75 mg/Nm^3. For the presence of dust in the facilities where the separation, filling, transportation, sieving, crushing and grinding of materials with a particle size of 1mm-5 mm are carried out; pressure sprayed water or chemical dust suppression methods are applied. In this process, the prevailing wind direction is taken into account. Dust concentration (PM10) at a distance of 3 m from the dust source should not exceed 3mg/Nm^3 (S.K.H.K.K. Regulation).

Table 1. S.K.H.K.K. Limit values specified in the regulation (S.K.H.K.K. Regulation)

Emissions	**Total Mass Flow (Kg/Hour)***	
	From the chimney	**From Places Outside the Chimney**
Dust	10	1
Bullet	0.5	0.05
Cadmium	0.01	0.001
Thallium	0.01	0.001
Chlorine	20	2
Hydrogen chloride and Gaseous Inorganic Chloride Compounds	20	2
Hydrogen fluoride and Gaseous Inorganic Fluoride Compounds	2	0.2
Hydrogen Sulfide	4	0.4
Carbon Monoxide	500	50
Sulfur dioxide	60	6
Nitrogen Dioxide [NOx (as NO2)]	40	4
Total Volatile Organic Compounds	30	3

Table 1 shows the limit values specified in the Regulation on Control of Industrial Sources Pollution. Accordingly, considering the values measured from the chimney and outside the chimney according to the total mass flow values in dust emission; Limit values for dust, lead, cadmium, thallium, chlorine, hydrogen chloride and gaseous inorganic chloride values, hydrogen chloride and gaseous inorganic fluoride values, hydrogen sulfide, carbon monoxide, sulfur dioxide, nitrogen dioxide and total volatile organic compounds are stated. The hourly mass flow rates of the emissions released into the atmosphere from the enterprises according to the Annex-1 article of SKHKKY; determination is made by measuring from the chimneys in the existing facilities. It is determined by using emission sources for the newly established establishment and non-chimney sources. In case the hourly mass flow rate (kg/hour) values in Table 1 are exceeded, the Air Pollution Contribution Value (HKD) of the emissions in the plant impact area is calculated hourly, if this is not possible, daily, monthly or yearly. In case the threshold limit values specified in Table 1 are exceeded, the parameters specified in Table 2 are taken into account. In Table 2, air quality limit values are given in the facility impact area. In case the limit values specified in Table 2 are exceeded, the air quality can be continuously monitored by measuring with devices at the points where the facility is located, provided that it does not exceed 60% of the air quality limit values in the existing facilities (SKHKKY Annex-1 Regulation).

Table 2. Air quality limit values in the facility impact area

Parameter		**Duration**	**Unit of**	**Year**						
				2014	**2015**	**2016**	**2017**	**2018**	**2019-2023**	**2024 and beyond**
SO2		Hourly (not to be exceeded more than 24 times in a year)	µg/m^3	500	470	440	410	380	350	350
		24 hour		250	225	200	175	150	125	125
		UVS		60	60	60	60	60	60	60
		**Annual and winter semester (1 October-31 March)		20	20	20	20	20	20	20
NO2		Hourly (not to be exceeded more than 18 times in a year)	µg/m^3	300	290	280	270	260	250	200
		Yearly		60	56	52	48	44	40	40
Total Organic Compounds (in carbon)		Hourly	µg/m^3	280	280	280	280	280	280	280
		KVS		70	70	70	70	70	70	70
Precipitated dust		KVS	mg/m^2 gün	390	390	390	390	390	390	390
		UVS		210	210	210	210	210	210	210
Precipitated dust	Pb and its compounds	UVS	mg/m^2 gün	250	250	250	250	250	250	250
	Cd and its compounds	UVS		3,75	3,75	3,75	3,75	3,75	3,75	3,75
	Tl and its compounds	UVS		5	5	5	5	5	5	5

The Short and Long Term Time reduction process is given in Table 3. According to the Air Quality Assessment Regulation; UVD refers to the average of all measurements made. KVD is the maximum monthly average value that should not be exceeded, unlike settling powders. Air quality limit values are the levels expressed in concentration units determined by taking into account the harmful effects of air pollutants in the atmosphere when they are present together, for the protection of human health and the prevention of negative effects that they may cause on the environment in the long and short term.

Table 3. Short- and long-term term (SVS) reduction process

Parameter	Time	Limit Value
Precipitated dust	UVS	210 mg/m2 -day
		210 mg/m2 -day (2021for the year)
		210 mg/m2 -day (2022 for the year)
		210 mg/m2 -day (2023 for the year)
	KVS	390 mg/m2 -day
		390 mg/m2 -day (2021 for the year)
		390 mg/m2 -day (2022 for the year)
		390 mg/m2 -day (2023 for the year)

Table 4 shows the results obtained from the four measurement points. Accordingly, in the measurements made at four different points between 27.03.2023 and 27.04.2023; the first point (for the plant) was 177.47, the second measurement point (for the plant) was 163.88, the third point (out of the plant) was 181.41 and the fourth point (out of the plant) was 194.26. In the measurement results made between 27.04.2023 and 27.05.2023, 152.80 at the first point (for the facility), 128.81 at the second point (for the facility), 158.74 at the third point (out of the facility), 160 at the fourth point (out of the facility). It was measured as .83.

Table 4. Measurement points

Measuring Point	1. Point (Onsite)	2. Point (Onsite)	3.Point (Off site)	4.Point (Off site)
27.03.2023-27.04.2023	177,47	163,88	181,41	194,26
27.04.2023-27.05.2023	152,80	128,81	158,74	160,83
Total	330,27	292,69	340,15	355,09

In Table 5, the parameters used in the measurement process, measurement method, measurement date, measurement results and limit values are given. When the measurements made and the limit values were compared, the following results were obtained; As a result of the UVS measurement made at the 1st point, 66.87 mg/m^2 is obtained, while the limit value is 450 mg/m^2. As a result of the UVS measurement made at the 2nd point, 59.26 mg/m^2 is obtained, while the limit value is 450 mg/m^2. In the measurement results of UVS at the 3rd point, the highest value was 68.87 mg/m^2, the limit value was 210 mg/m^2, the highest value was 72.27 mg/m^2 from the results of the KVS measurement at the 3rd point, and the limit value was 390 mg/m^2 is. As a result of the UVS measurement made at the 4th point, 71.89 mg/m^2 is found, while the limit value is 210 mg/m^2. While the other KVS measurements made at the 4th point are 77.39 mg/m^2, the limit value is 390 mg/m^2. The measurement results in UVS and KVS were found below the exposure limit values.

Table 5. Parameters used in the measurement process

Measuring Point	Measuring Parameter	Measuring Method (Passive/Active	Measurement Date	Results of the measurement (mg/ m2 gün)	Limit Value (mg/ m^2 day) (2016)
1	Toz	Pasif	27.03.2023-27.05.2023	66,87	450 (UVS)
2	Toz	Pasif	27.03.2023-27.05.2023	59,26	450 (UVS)
3	Toz	Pasif	27.03.2023-27.05.2023	68,87	210 (UVS)
4	Toz	Pasif	27.03.2023-27.05.2023	71,89	210 (UVS)
3	Toz	Pasif	27.03.2023-27.04.2023	72,27	390 (KVS)
3	Toz	Pasif	27.04.2023-27.05.2023	65,35	390 (KVS)
4	Toz	Pasif	27.03.2023-27.04.2023	77,39	390 (KVS)
4	Toz	Pasif	27.04.2023-27.05.2023	66,21	390 (KVS)

The ambient temperature was measured before the measurement was made within the scope of the study 22^{o}C, ambient pressure is approximately 1 ATM. When the ambient temperature is measured again after the measurement, the temperature is approximately 23 ^{o}C It has been seen that the ambient pressure is 1 Atm. There was no situation (rain, storm, etc.) that could affect the operation during the measurement.

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the measurement, the temperature is approximately 23 °C It has been seen that the ambient pressure is 1 Atm. There was no situation (rain, storm, etc.) that could affect the operation during the measurement.

Table 6. Results of emission measurements performed at the facility and limit values according to the SHKKK regulation

Emission Source		**PM_{10}**	
Name	**Code**	**Average**	**SD**
PM 10 1.Point	PM1	0,98	3
PM 10 2. Point	PM2	1,20	
PM 10 3. Point	PM3	1,28	
PM 10 4. Point	PM4	1,21	

The measurements made were taken into account in the SKHKK regulation. Accordingly, dust measurements should be made under isokinetic conditions (without deterioration of the current conditions at the source). Emission measurement times should be short. In cases where it is necessary to measure flue gas, waste gas, and exhaust air duct sections and measurements are difficult, the measurement time should not exceed 2 (two) hours. Evaluations and reports should contain the measurement methods and operating conditions, together with the detailed measurement data necessary for the evaluation of the emission measurement values and measurement results. None of the emission values measured three consecutive times should exceed the limit values given in the regulation. It has been determined that the PM10 result of the furnace dust measured by the study does not exceed the limit values when the legislation is taken into account. According to the emission measurement results carried out at the facility and the SKHKK Regulation, the Limit Value (SD) is 3. Considering the measurement results made in the study, the measurement result for PM10 1st point is 0.98, the measurement made for PM10 2nd point is 1.20, the measurement made for PM10 3rd point is 1.28, the measurement result for PM10 4th point is 1.21 was detected. When the result of the study was evaluated, it was determined that the dust measurement points were below the limit values specified in the legislation.

5. CONCLUSION and RECOMMENDATION

Dust poses a serious risk in terms of production, employee, and environmental health in the mining industry. Extracting the ore from the bedrock and converting it to the final product; consists of processes such as drilling, blasting, loading, transportation, unloading, and storage. At these stages, the presence of serious dust occurs. Dust can pose a risk for the worker (pneumoconiosis) and the environment if the necessary protective and preventive measures are not taken (pressing, wetting, watery, etc.).

It also shortens the service life of machinery and equipment and often causes production to stop. At this point, those who work in places where there is dust;

- Dust and the risks caused by dust
- Supply of personal protective equipment
- Methods of active struggle with dust
- Occupational diseases caused by dust
- Integration of water systems for operations such as drilling and breaking
- Integration of dust extraction systems
- Periodic performance of machine worker and ambient dust measurements
- Various measures can be implemented to cover production, employee health, and safety issues such as occupational health and safety training for employees

The majority of occupational respiratory system diseases do not have a specific treatment (Kahraman and Özdemir, 2022). For this reason, it is necessary to approach the issue of dust control seriously. Considering the results obtained in the study, it has been observed that the presence of dust does not pose a risk to the employees and is even below the limit values specified in the legislation. However, the increase in production capacity and different production methods, and natural events (wind, storm, flood, etc.) are among the issues that can increase these risks. For this reason, safer working environments can be provided thanks to the occupational safety measures that can be taken in very dangerous business lines such as mining. Whatever the case, the measures to be taken at the source of the danger should be supported and the measures for the employees should be supported. This is important for the sustainability of production and occupational health and safety.

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