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Assessment on control effect of occupational hazards in the expansion project of Nanyu coal

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Assessment on control effect of occupational hazards in the expansion project of Nanyu coal

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Abstract. Through the occupational hazard control effect of Nan yu mine in Taiyuan, the investigation, inspection and examination methods of occupational health scene were confirmed for qualitative and quantitative evaluation. The total layout of the mine, personal protective facilities, emergency rescue, health auxiliary room, occupational health management are in line with national standards, the existing occupational risk factors in the production process to determine are dust, free silica, noise, hand-vibration, carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide, ammonia, hydrogen sulfide, manganese and its compounds, microclimate, power frequency electric field, but parts of the dust and noise concentration (or intensity) have exceeded. The mine occupational hazards control measures are feasible and effective, but some post still need to strengthen governance.

1. Introduction

According to Article 15 of the Law of the People's Republic of China on the Prevention and Control of Occupational Diseases: “New construction, expansion, reconstruction projects, technological transformations, and technology introduction projects (collectively referred to as construction projects) which may cause occupational disease hazards, the construction unit shall submit an evaluation report on the effects of occupational hazard control to the administrative department ^[1-5]. In order to implement the national laws, regulations and rules and effectively protect the health and related rights and interests of workers, we evaluate the effects of occupational hazards on the mine in accordance with the current occupational health related laws, regulations, norms and standards of the People's Republic of China ^[6].

2. Overview of Mine

The mine was integrated and rebuilt in 2012 with a production scale of 900,000 t/a and a mining area of 15.28 km². The mine ground construction mainly consists of ground production area, ground auxiliary area and living area; the underground consists mainly of two excavation working surfaces, one mining working surface and other auxiliary facilities underground.

The mining area is a structural erosion terrain, with bare rocks and long and horizontal valleys. The larger valleys have Nanzhao ditch and Huanglou ditch, which shows the northwest - southeast direction through the mine field. The main ditch has large and small gullies on both sides, which are mostly V-shaped. The mine is developed with inclined shafts, and a horizontal level is adopted. The full-scale coal mining process is adopted by the comprehensive mechanization of the receding type.



At present, the total number of employees in the mine is 585, including 90 management personnel, 345 production personnel and 150 support personnel. The personnel in the underground operation area and the ground operation area are all three shifts, with an 8-hour shift. The management and auxiliary staff are often in white shifts, with 8 hours per shift and 330 days of production per year.

3. Evaluation content and method

3.1 Evaluation content

It mainly includes the rationality of overall layout and equipment layout, occupational disease hazard factors and distribution, the degree of impact on workers' health, occupational hazard protection facilities and effects, building hygiene and auxiliary rooms, occupational disease protection products for personal use, occupational health monitoring, emergency plans and facilities, occupational health management measures and implementation, occupational health management funds, etc. [7].

3.2 Evaluation basis

This evaluation is mainly based on the Law of the People's Republic of China on the Prevention and Control of Occupational Diseases, the Labor Law of the People's Republic of China, the Law of the People's Republic of China on Safe Production, the Regulations on the Prevention and Control of Occupational Hazards in Coal Mine Workplaces, "Catalogue for Risk Classification Management of Occupational Disease Hazards in Construction Projects", "Code for Evaluation of Occupational Disease Hazards in Construction Projects", "Catalogue of Classification of Occupational Disease Hazard Factors", "Regulations on Supervision and Administration of Occupational Health in Workplaces", "Administrative Measures on Occupational Health Surveillance of Employers", "Regulations on the Supervision and Administration of Labor Protection Products", "Provisions on Prevention and Control of Occupational Hazards in Coal Mine Workplaces", "Notice on the Work of "Three Simultaneous Work" of Strengthening the Occupational Health of Construction Projects by Shanxi Safety Production Supervision Administration", etc. And related information provided by the company [8-10].

3.3 Evaluation method

According to the characteristics of the occupational hazards of the project, data and material are collected through occupational health on-site investigation, occupational health test, occupational health check, etc., combined with occupational disease prevention facilities, personal occupational disease protection level and quantitative grading results, occupational diseases of operators during operation, the exposure level of hazard factors and occupational health effects were evaluated, and the overall layout, equipment layout, and occupational health management measures were evaluated by checklist analysis.

4. Evaluation results

4.1 Site evaluation

There are no natural environmental protection targets and schools around the coal mine construction project; the area is not a natural disease origin place, and there is no infectious or endemic disease appeared. The site selection is in accordance with the provisions of the Industrial Hygiene Standards for Industrial Enterprises.

4.2 Overall layout evaluation

The overall layout of the construction project basically meets the requirements of "Industrial Enterprise Design Hygiene Standards" (GBZ1-2010), "Industrial Enterprise General Plan Design Code" (GB50187-2012) and "Coal Industry Small Mine Design Code" (GB50399-2006). . 22 inspections were carried out, 21 were in compliance, and 1 was basically in line (currently not

equipped with CO, SO₂, NO₂, NH₃ gas detectors).

4.3 Analysis of possible occupational hazards

According to the actual production situation of the mine, through the investigation and analysis of the occupational health, production process and equipment layout, on-site production environment and operation mode of the project, it is determined that the occupational hazard factors of the on-site inspection are dust, free silica and noise. Hand-transmitted vibration, carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide, ammonia, hydrogen sulfide, manganese and its compounds, microclimate, power frequency electric field.

4.4 Test results of occupational hazards

The monitoring results of occupational hazards in the mine are shown in Table 1. The workers in the mine workplace are exposed to carbon monoxide, sulfur dioxide, nitrogen dioxide, ammonia, hydrogen sulfide, carbon dioxide, manganese and their compounds, bracelet vibration and power frequency electric field results. Occupational exposure limits are not exceeded. Among them, Yanjingang is a manual operation, and the difference in coal from the chute to the mine is large, and large amount of dust will be generated without spraying. There is no manual work on the loading rock, and the operation personnel will use the hoe to pour the meteorite into the mine car process, which will generate a lot of dust. The reason for the excessive dust in the Hangmugang is that the circular saw will generate a large amount of dust during the sawing process. When the machine is not sealed, the dust will not exceed the standard in the case of no dust removal facilities; the blasting department will use the high-noise wind coal drill to drill the eye, then causing noise exceed the standard. The anchor spray department uses the wind coal drill with large noise to drill the anchor eye. The noise of the mixer is large, and no noise reduction measures such as the shock absorbing base are provided. Although the main fan is equipped with a muffler and a damping base, the main fan has a large noise, and the muffler has a poor effect, resulting in excessive noise.

Table 1 Judging the monitoring results of occupational disease hazards in the mine

Test item	Test number		Acceptance number		Percent of pass	
	Post	Check Point	Post	Check Point	Post	Check Point
Carbon monoxide	6	6	6	6	100%	100%
Sulfur dioxide	6	6	6	6	100%	100%
Nitrogen dioxide	6	6	6	6	100%	100%
Ammonia	6	6	6	6	100%	100%
Hydrogen sulfide	8	8	8	8	100%	100%
Carbon dioxide	6	6	6	6	100%	100%
Manganese and compound	1	1	1	1	100%	100%
Respiratory dust	23	51	20	48	87%	94%
Total dust	27	56	23	52	85%	93%
Noise	12		6		50%	
Hand-transmitted vibration	5		5		100%	
Power frequency electric field	1		1		100%	

4.5 Investigation and evaluation of occupational hazard protection facilities

4.5.1 Dust-proof and anti-virus measures

The coal mining surface of the mine uses two axial flow ventilators to speed up the discharge of toxic and harmful gases on the working surface. The coal mining holes are drilled by wet drilling, and the blistering uses blister mud. Artificial priming is carried out in the surrounding 20m roadway before and after blasting. In the working face inlet and the return airway, measures such as automatic spray water curtain are set to reduce the dust concentration in the air. The excavation working face also adopts wet drilling, blisters, artificial sprinkling, automatic spray water curtain device in the main return airway and distance of 50m from the excavation point. Water is added in advance when mixing concrete, and wet spraying method is adopted.

In the dust-producing point with two large gaps between the turning point and the turning point, a sprayer is set to reduce the dust concentration. The coal storage yard, the storage yard and the pit wooden house are sealed to prevent secondary dust. The operators frequently sprinkle water on the coal yard and the quarry. It is equipped with a dust sampler, an analysis of the daytime dust monitoring equipment, and daily sampling analysis for each major dust-producing point.

The mine is equipped with H₂S alarms in the underground coal mining face and its return airway and main return airway, and equipped with mobile toxic substance alarms for the operators. Notification cards and warning signs for toxic and harmful gases are installed in the coal mining face, the heading face, the coal yard and the coal gangue yard.

4.5.2 Anti-noise and vibration measures

The ventilation room is set to operate to reduce the harm of the fan noise to the workers; the main ventilator, the underground local ventilator, the screw air compressor, the water pump, the emulsion pump, the main hoist winch, the mining winch and the muffler and the vibration-damping base are installed. The pit wooden house is set separately in the far away from the living area, and is placed in a relatively closed room to reduce the impact of noise on the surrounding; in order to reduce the noise of coal mining, tunneling and anchoring, a new type of coal is introduced. Drill and add a hood to reduce noise.

The types of work that exposed to the occupational hazard of hand-transmitted vibration are mainly coal mining and drilling blasting, drilling and blasting, and anchoring and spraying. When the wind coal drill is used, the project is equipped with anti-vibration gloves for the operators.

4.5.3 Evaluation of protective facilities

The coal mine is relatively complete in terms of the installation of protective facilities, and the effect is good. It basically meets the relevant requirements of "Industrial Enterprise Hygienic Design Standards" (GBZ1-2010) and "Technical Specifications for Integrated Dust Control in Coal Mines" (AQ1020-2006). It is recommended that underground operations should improve the degree of mechanization automation to protect the health of workers, continue to strengthen the dust-removing effect of loading rock and loading rock, and set dust-proof spray on the slip surface of coal mining face. When spraying, remote spray device should be set up. A dust collector should be provided. Vibration damping facilities are installed for the circular saw and anchor spray mixer. The making-acid point is equipped with a flushing facility, and an ammonia, carbon monoxide, and nitrogen dioxide alarm are added. Establish protective equipment maintenance records and fill them out regularly.

4.6 Investigation and evaluation of occupational disease protective equipment for personal use

According to the "Regulations on the Prevention and Control of Occupational Diseases of the People's Republic of China" and the "Specifications for the Selection of Personal Protective Equipment" (GB/T1651-2008), the mine has set up a labor supply department and set up three special labor insurance product managers to ensure the safety of employees. Health, specially formulated the "Occupational Diseases Protective Equipment Management System", according to the nature of

occupational hazard factors and the nature of the post, the workers are equipped with corresponding personal protective equipment (see Table 2). After investigation and evaluation, the parameters, cycle and post of the personal protective equipment provided by the mine for the operators are in line with the relevant requirements of the national occupational health. The correct use of personal protective equipment by the operators in accordance with the regulations can play a personal protective role against the occupational hazards arising from the production of the employer.

Table 2 Personal protective equipment parameters

Name	Brand	Model	Parameter
Dust mask	3M	9001A	Protection level: KN90
Noise-proof earplugs	3M	1100	SNR: 25 dB
Anti-vibration gloves	Delta	209904	/
Acid resistant gloves	Lianfeng	H002	/
Welding goggles	3M	10197	/

4.7 Building hygiene and auxiliary room evaluation

(1) Ventilation, lighting

The underground mine operation of the project is currently using explosion-proof lighting for lighting, supplemented by portable miner's lamps to provide illumination, and there is insufficient illumination. Mine ventilation mainly uses mechanical ventilation. The excavation working surface is provided with local ventilator press-in ventilation, and the coal mining surface and other roadways are exhausted by the main ventilator. The lighting conditions of the ground auxiliary room are natural lighting and artificial lighting. The ventilation is mainly natural ventilation. The air conditioning is provided in the canteen, office building and dormitory.

(2) Auxiliary room evaluation

The mine is an underground operation, and the workshop hygiene is classified according to the "Industrial Enterprise Design Hygiene Standard" (GBZ1-2010). The coal mine underground mining area is a secondary sanitation feature. The mine currently has locker rooms, bathrooms, dormitories, canteens, washrooms, toilets, and lounges that meet the requirements.

4.8 Occupational Health Management Evaluation

In order to strengthen the occupational health management of the project, the mine has set up an occupational safety and health leading group in combination with its own actual situation, and the company's safety mine manager is the group leader. The company set up three occupational health full-time management personnel responsible for the company's occupational safety and health work, and formulated corresponding occupational disease health management systems and operational procedures, established a regular inspection system for occupational disease hazards, prevention of occupational disease risk factors, publicity and education, occupational health training, sunrise testing, emergency planning, health monitoring, occupational disease patient management and file management were all elaborated. The mine has a bulletin board at the entrance of the mine, which will specify the types, consequences and prevention methods of occupational hazards, and set warning signs for dust, noise, hand-transmitted vibration, carbon monoxide, nitrogen dioxide, hydrogen sulfide and ammonia at the mine mouth and Chinese warning instructions.

4.9 Estimation of special budget for occupational disease prevention and control

The special fund for the prevention and treatment of occupational hazards is about 1.66 million, including the maintenance of personal occupational hazard protection facilities, the replacement of personal protective equipment, regular training of occupational health knowledge, occupational health file management, and occupational health surveillance. According to the relevant requirements of

national occupational health, the special funds invested by the company, in combination with the types, nature, intensity, distribution and impact of occupational hazards caused by the project, can basically meet the needs of occupational disease prevention and work of control.

5. Conclusion and suggestions

5.1 Conclusion

The layout of the general layout of the mine is reasonable, the functional division is clear, and it meets the requirements of the Industrial Hygiene Standard for Design of Industrial Enterprises. The sanitary protection facilities for dust, noise and poisons are relatively perfect, but some dusts and noises still have certain hazards, and the corresponding work sites are still necessary to further improve the sanitary protection facilities. The protective facilities for occupational disease hazards are basically effective, the auxiliary sanitation facilities basically meet the requirements, and the occupational health management measures have been operated in accordance with relevant state regulations. Occupational health management system and emergency rescue system can basically meet the needs of enterprises to carry out occupational health work and rescue operations for acute occupational diseases. The occupational health management funds invested have basically met the needs. However, some posts still need to be strengthened to control the workplaces where the occupational hazards in the workplace exceed the national health standards should be rectified within a time limit.

5.2 Suggestions

(1) The process should be improved as much as possible. The underground mining and excavation should use mechanization and automation equipment as much as possible to reduce the frequency of personnel exposure to occupational hazards.

(2) Dust-proof spray is set up on the slip surface of the coal mining face, and the dust-proof effect of the sprinkling water of the rock-filled post is continued to be strengthened.

(3) When blasting, high-pressure remote spraying device should be set as much as possible to reduce dust during blasting.

(4) The dust of the Hangmugang exceeds the standard, and the dust collector should be installed in the pit wood to remove the dust, so that the dust concentration at the job site meets the national limit. Circular saws and anchor spray mixers are relatively noisy, and should be equipped with a damping base to reduce noise.

(5) Send special personnel to maintain various protective facilities. If there is damage, it should be replaced and repaired in time, establish maintenance records of protective facilities, and fill in regularly.

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