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Research on the method of quality control in the process of coal geological exploration

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ABSTRACT

Quality control plays a vital role for the effective development of coal geological exploration and also has a very important impact on effectively carrying out the work of coal mining. From the essence of quality control, coal exploration process can guarantee the smooth development of the work and at the same time provide timely and effective solutions for problems in coal exploration, making sure of the feasibility of coal mining work and maximizing the value of the process of coal geological exploration. However, from another perspective, method of quality control in the process of the coal geological exploration is mainly used for the effective supervision of the survey process, so as to ensure the the continuous improvement of exploring quality. The accuracy and effectiveness of the survey process can be fully reflected, which reflects the value in the process of coal geological exploration. The paper makes a research on constitution of supervision organization, and discusses its supervisory duties. And combining with analysis of the corresponding quality control procedures, the paper discusses the method for its quality control, to solve the existing problems better. This is the main idea of this study which can also reflect its main purpose.

KEYWORDS

Coal geological exploration; Quality control; Program technique; Analysis and study.



INTRODUCTION

Coal Survey can effectively guarantee the accuracy of coal mining, and survey quality is one of the key factors. And the effective control of its survey quality is the prerequisite for analyzing feasibility of coal mining, the importance of which is self-evident. This research is carried out mainly combining the constitution of the supervision organization, the analysis of the keys of quality control, analysis of quality control progress, the existed problems and control measures. Therefore the discussing ideological of the research becomes more closely, effectively promoting to improve the quality of the coal geological exploration process.

THE CONSTITUTION OF THE SUPERVISION ORGANIZATION

In coal geological exploration process, the key of effective quality control lies in the formation of its geological exploration project process, which makes the whole exploration process obtain more effective management, and ensures that the project geological exploration work can be carried out in an orderly manner and its quality can be effectively controlled. The focus is to establish the key elements of the organization, maximizing the value of its supervision personnel and effectively carrying out the functions of all aspects of the quality control work^[1]. In this process, the constitution of each position should be made clear. First, the chief supervision engineer, as person in charge of a geological exploration project, should make instructions on the relevant documents, taking the role of corresponding leadership. As for the representative of director, it is an important post responsible for arranging daily work, and taking on the specific duties of the director to some extent. Technical consultant provides effective technical guidance for the geological exploration process, and at the same time plays a core role in determining the quality of the geological exploration process.

THE ANALYSIS OF THE KEYS OF QUALITY CONTROL

In geological exploration process, there is a certain complexity and difficulty in carrying out the work. Thus, it is particularly important for effective quality control in the process of geological exploration. And the keys of quality supervision are efficiently supervising the feasibility of the two-dimensional seismic construction in the terrain, at the same time measuring for specific requirements in drilling construction, and carrying out effectively the survey of geophysical logging. The difficulty coefficient of these three processes is higher, but they can correspondingly reflect the measurable quality.

The keys of surveying seismic construction are continuously improving the accuracy of measuring lateral line position and point position, so that effectively ensuring the measuring data, and effective calculation of the hole depth, makes the geological measurement results being able to effectively guarantee the smooth later coal mining engineering.

The key of quality control of drilling engineering is the effective survey of the borehole logging, determining whether the hydrological observation process can be effectively carried out to obtain the observed data. It produces an important effect on the latter part of coal mining^[2]. And it also can make an evaluation on the quality of coal geological exploration, fully reflecting the significance and value of the coal geological exploration work.

THE ANALYSIS OF QUALITY CONTROL PROGRESS

In the process of exploration of coal address, effective control of the survey quality is mainly divided into three parts, which are the cores of ensuring the smooth development of the coal mining work. These three parts are respectively: pre-control before the survey, control during the survey and check and acceptance after the survey. However, these parts of the progress should be designed appropriately to be effectively completed as a measure or specific basis of quality control of geological exploration. The quality control process of the geological survey needs to be carried out based on actual data, and make quality monitoring according to the actual problems, so that the quality of geological exploration process can be fully guaranteed, and the measuring result of key parts can be more convincing. At the same time, the dynamic real-time control for the entire survey process and construction of the key parts can effectively ensure the improvement of quality of geological exploration work, playing the role of coal geological exploration. Effectively monitor the quality of the exploration according to different survey environments, effectively guaranteeing the work. The details are shown in Figure 1.

Pre-control before the survey

Pre-control before the survey refers to the prospective control the possible emergencies in coal geological exploration work began before and this kind of behavior is initiative to some degree. The main range contains effectively establishing the rules of the exploration activity is, effectively understanding the survey technology and reviewing construction plan of implementation.

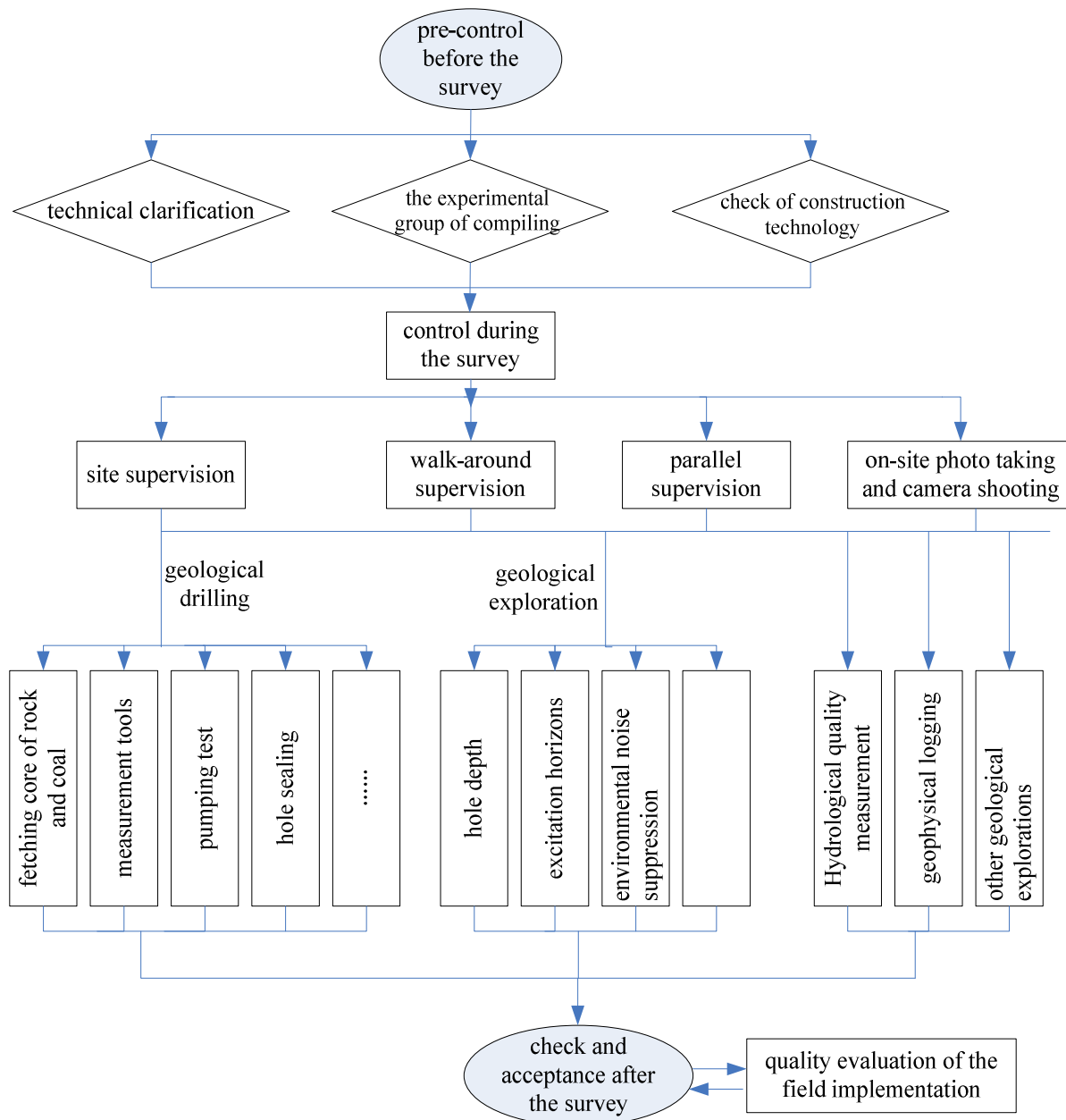


Figure 1 : The progress of monitoring quality control

Establishing the rules of the exploration activity is understanding related project data before geological exploration work and make its specific steps according to different exploration projects, which is the premise to ensure the quality of geological exploration, but also an important basis for the expected quality evaluation of exploration. Make effective quality control through the corresponding data, constantly improving the accuracy of its working links and the work direction and strengthening the quality of geological exploration^[3].

In the process of different coal geological exploration projects, carry out effective supervision and management of the survey process to play the due role of the detailed rules for the project implementation. While the rules mainly include the basic procedure of quality control, means and methods of quality control and so on.

In coal geological exploration, the key of quality control lies in the effective understanding of its technology, which can forecast the problems that may produced, making positive effect on its prevention work. From the process of understanding the exploration technologies, basic information of exploration project can be correspondingly cleared, and basic information of the surface layer can be understood, so that the anticipated target of the survey work could be formed, making fully use of the relevant information and data information and avoid the problems in advance. And plan for the emergency of possible future technical problems can be made^[4]. The preliminary evaluation process for the quality of geological exploration can be formed, in order to provide powerful technical support for the quality control. The table of regional stratum is shown as TABLE 1.

TABLE 1 : The table of regional stratum

| Erathem | System | Series | Group | Symbol | Thickness |
|-------------------|----------------------|--------------------------|----------------------------|-------------------------------|-----------------|
| Cenozoic erathem | Quaternary system | Holocene series | | Q ₄ | 12 |
| | | upper Pleistocene series | | Q ₃ | 100 |
| | | mid Pleistocene series | | Q ₂ | 60 |
| | | down Pleistocene series | | Q ₁ | 6 |
| | Tertiary system | Pliocene series | | N ₂ | >35.2 |
| | | Oligocene series | | E ₃ | >367.1 |
| | Jurassic system | Upper series | | J ₃ ² | >216.2 |
| | | | | J ₃ ² | 451.8 |
| | | mid series | | J ₂ | 316.4 |
| | | down series | | J ₁ | 233.0 |
| Mesozoic erathem | Triassic System | | | T _{3yn} ⁵ | 222.1 |
| | | | | T _{3yn} ⁴ | 479.9 |
| | | Upper series | Yanchang Formation | T _{3yn} ³ | 492 |
| | | | | T _{3yn} ² | 465.5 |
| | | | | T _{3yn} ¹ | 327.6 |
| | | mid series | Zhi Fang Formation | T _{2zh} | 920.5 |
| | Permian system | Upper series | Shiqianfeng Formation | P _{3sh} | 404.0 |
| | | | Upper Shihezi Formation | P _{2s} | 209.7 |
| | | down series | Lower Shihezi Formation | P _{1x} | 280.7 |
| | Paleozoic erathem | Carboniferous system | | Shanxi Formation | P _{1s} |
| Upper series | | | Taiyuan Formation | C _{2t} | 402.0 |
| | | mid series | Yanghugou Formation | C _{2y} | 488.0 |
| Ordovician system | | | Jingyuan Formation | C _{2j} | 83.1 |
| | | down series | Tingshan Formation Shangya | O _{2t} ² | 458.0 |
| Cambrian system | | Upper series | Changshan Formation | □ _{3c} | 90.0 |
| | | | Gushang Formation | □ _{3g} | 142.4 |
| | | | Zhangxia Formation | □ _{2r} | 201.3 |
| | | mid series | Xuzhuang Formation | □ _{2x} | 175.0 |
| | | | Maozhuang Formation | □ _{2m} | 57.6 |
| Sinian Suberathem | Jixianian System | Wangquankou group | Zjwn | 118.3 | |
| | Changchengian System | Huangqikou group | Zchn | 283.3 | |
| Archean erathem | | The third group | Ayzn ³ | >5777.7 | |
| | | The second group | Ayzn ² | 4950.6 | |
| | | The first group | Ayzn ¹ | >4675.2 | |

The review process of the so-called construction plan in different regions is the effective research on regional characteristics existing in coal geological exploration, and specific exploration to corresponding exploration progresses. This is an important part of pre-control before the survey, as well as the key factor to quality control of the exploration. The construction design of the geological exploration process can scientifically clarify the procedures of survey work, positively preventing the related problems.

TABLE 2 : The basic situation of coal resources and reserves

| Regions | coal field, mining area | resources/reserves | | rank | |
|------------------|--|--------------------|--------------------|--------------------|--------------------|
| | | reserves | basic reserves | resources | resources volume |
| | Subtotal | 25892155.97 | 42961454.71 | 78245261.99 | 121206716.7 |
| | coal field in Xiaokumuer of Morin Dawa | | | 8 | 8 |
| | Dayangshu coal field | 14866.8 | 37475.33 | 2096 | 39571.33 |
| | Daxing coal field | 5935.25 | 10269.64 | 468 | 10737.64 |
| | Yimin coal field | 2392886.4 | 2767990.8 | 3287483.90 | 6055474.70 |
| | Dayan coal field | 681748 | 1084985 | 771879 | 1856864 |
| | Madamuji coal field | | | 1331106 | 1331106 |
| | Chenqi coal field | 2391420.64 | 4265508.42 | 6189445 | 10454953.42 |
| Hulunbuir City | Baiyinzhan colliery | 3724 | 6317 | 1633 | 7950 |
| | Xihulitu coal field | 2118 | 4269 | 633846 | 638115 |
| | Zhasainuoer coal field | 1711059 | 2976967 | 6643336 | 9520303 |
| | KaifangMontain coal field | 7103 | 10187.24 | 831 | 11018.24 |
| | Miandu river coal field | 49609.2 | 64663.30 | 12806.9 | 77470.20 |
| | Wujiu coal field | 11601 | 19410 | 21148 | 40558 |
| | Xinglong River coal field | 953 | 1615 | | 1615 |
| | Labudalin coal field | 4264 | 7149.5 | 225378 | 232527.5 |
| | Subtotal | 73742.50 | 116904.53 | 95460 | 212364.53 |
| | Anggen colliery | 5390 | 12060.3 | 1727 | 13787.3 |
| Bayannaer league | Bayinhuduge colliery | 64658 | 99475 | 57043 | 156518 |
| | others | 3775.50 | 5369.23 | 36690 | 42059.23 |
| | Subtotal | 727728.29 | 11156807.23 | 19121464.80 | 30278272.03 |
| Wu league | Jining coal field | | | 250290 | 250290 |
| | Others | 194 | 3059 | 1787 | 4846 |
| | Subtotal | 194 | 3059 | 252077 | 255136 |
| Hinggan League | Mangniuhai coal field | 19034 | 42138.75 | 4344 | 46482.75 |
| | Yumin colliery coal field | | 919 | 318 | 1237 |
| | Subtotal | 19034 | 43057.75 | 4662 | 47719.75 |
| | Shengli coal field | 2973753 | 4241300 | 18260760 | 22502060 |
| Xilin gol league | Xilinhot colliery | 875.5 | 1546.5 | 1758 | 3304.5 |
| | BaYanbaolige coal field | | | 1909650 | 1909650 |
| | Baiyinhuduga coal field | 25595 | 42695 | | 42695 |
| | Baiyinwula coal field | 7783 | 9847.5 | 2954631 | 2964476.7 |
| | Saihantala coal field | | | 481960 | 481960 |
| | HamaTemple colliery | 26983 | 35977 | 3562 | 39539 |
| | ManiteTemple coal field | 2714 | 4510 | | 4510 |
| | NewTemple coal field | | | 7914 | 7914 |
| | WuniteTemple coal field | | 5419 | 3163901 | 3163901 |

Control during the survey

The so-called control during the surveying refers to the corresponding supervision while the construction is being carried out, so to make the construction plan can be carried out smoothly, and reflects the existing problems. Thus the problems can be solved within a short period of time, reducing the risk in the process of geological exploration. It can effectively control the quality of coal exploration work, and provides the corresponding solutions for formed problems.

Establish reporting system of construction quality

During the coal geological exploration work, in order to improve the exploration quality, and reelect the problems in the first time, reporting system must be scientifically clarified. By this way can the problems be solved effectively in a short period of time, and provide the powerful support for effectively improving the working quality. This is a powerful means of quality control for coal exploration^[5].

The on-site supervision

The on-site supervision refers to taking pictures and collecting data by the supervision and management personnel in coal exploration process. This work is effective ways and means of the control during survey which can provide the image information and data for the later coal mining exploration work.

(1) Site supervision is the specific form of real-time supervision in the construction of the coal exploration work. In this process, the supervisory personnel through station observation of the key procedures, make records of key technologies using process, and report to the leadership in the written form. It can enable the survey quality being reflected in the first time, and at the same time, these data will be effectively preserved to provide the realistic basis for the implementation of coal mining work in the future. This is one of the important means of quality control of coal exploration, and it can effectively reflect the reserved storage of the coal, providing a powerful guarantee for the feasibility of coal mining work. (Details are shown in TABLE 2)

(2) Walk-around supervision refers to the understanding process of development of coal exploration by the supervisory personnel by the means of regular or irregular inspection, which ensures that the survey work to conduct within the plan. This means, as a specific method to carry on the effective quality control, can ensure the supervisory equipment and personnel being in state of normal working^[6]. From another perspective, walk-around supervision can help to effectively understand the problems and hand it out within the shortest time, making effective assessment on the value of the survey work and ensuring the concrete value of coal geological exploration work. The working process of an internal coal supervision organization is shown as Figure 2

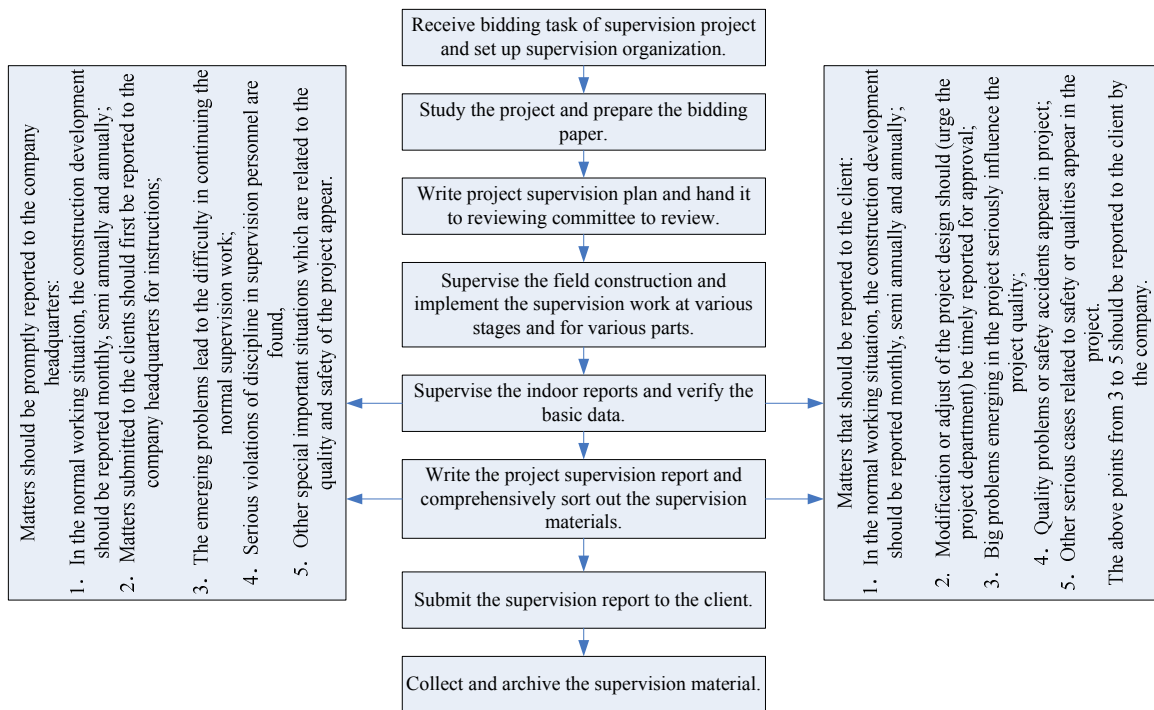


Figure 2 : Working process of an internal coal supervision organization

(3) Parallel supervision. It mainly refers to the recording a supply and demand process in some construction unit by the supervisors, which makes the construction units directly under the corresponding supervision, reached the spot checks of the site construction process. Through this supervision, the production process of construction unit can be scientifically controlled and quality control of every survey work could be scientific and effective. And, the main content of the parallel supervision includes hole depth, and the accuracy of measuring line position and etc.

(4) On-site photo taking and camera shooting. This part is mainly to retain the degree of supervisory progress and appeared situation by the form of image data, which have a positive effect on developing other follow-up work, and at the same time provide the realistic basis for the acceptance of the results, having a certain significance for the effective quality control of the construction survey process.

TABLE 3 : Main supervision content, method and work schedule of some coal survey

| The stage of the project | Supervisory contents | Supervisory methods | Workload | | Remarks | |
|-------------------------------------|---|---|-------------------------|--------------|---------------------------|----|
| | | | unit | quantity | | |
| Preparing stage | Construction group, personnel and equipment plan | verification | times | 1 | including every processes | |
| | The management plan of the quality, technology and safety and guarantee measures | review | times | 1 | | |
| | The report of the project commencement (personnel equipment) and other related materiel | review | copy(times) | 20 | focus on drills | |
| | Design modification(increase drill number) | review | times | 1 | | |
| | Geology and drilling | Mapping of the geology, water, engineering and environment | spot check | times | | 3 |
| | | Records of the drill class table | walk-around supervision | stand(times) | | 35 |
| | | Drill hole geologic record | spot check | times | | 12 |
| | | A large number of drilling tools record | walk-around supervision | times | | 20 |
| | | Simple hydrological observation records | walk-around supervision | times | | 30 |
| | | Management of core and coal core | walk-around supervision | times | | 35 |
| The implementation stage | Recovery rate of core and coal core | walk-around supervision | times | 35 | | |
| | The quality of the construction personnel and properties of the instrument | verification | times | 2 | | |
| | The measurement parameters, speed, playback curve and measurement content | verification | times | 5 | | |
| | Well logging | The data acquisition process of well logging | site supervision | holes(times) | 12 | |
| | | Implement logging principle, submit the logging results, on-site approval on coal quality | supervision | times | 10 | |
| | Hole sealing | Safety protection and preservation of radioactive sources | spot check | times | 1 | |
| | | Design paper of hole drilling and sealing | verification | times | 9 | |
| | | Sealing material (cement) and proportioning of materials | verification | times | 9 | |
| | | Sealing procedures and construction process | site supervision | holes(times) | 14 | |
| | | Drilling site cleaning and landscape restoration | spot check | holes(times) | 19 | |
| Design of the drilling construction | | review | times | 2 | | |
| Pumping | Pumping test scheme | review | times | 2 | two hydrological holes | |
| | Geological catalog of drilling hydrology and construction | spot check | times | 3 | | |

Check and acceptance after the survey

Check and acceptance after the survey refers to the arrangement, of the corresponding data by the corresponding supervisory departments after the coal exploration work and the verification of the conclusion for the exploration process, making the assessment on the quality of the exploration process. This process is an evaluation phase on the whole survey work, and also a repeated examination of the results which will draw the final conclusion^[7]. In this stage, the method used is three level approvals. On the basis of the qualification of the basic supervisory data, verify them again, and ensure the absolute accuracy of the survey results. Meanwhile, it analyzes the feasibility of coal mining. Thus it can avoid unnecessary losses and serious accidents during coal mining work.

THE EXITED QUALITY PROBLEMS AND SOLUTIONS

The quality problems

In Tang Street of JiaZhaiJia County, Baofeng County of Henan province, the quality problems occurred in the parts of seismic exploration and geological drilling during coal survey construction and it did not appear other serious quality problems. The quality problems existed in seismic exploration are: hole well depth is not sufficient enough to achieve the below diving level for the excitation; Artificial drill cannot meet the requirements of construction in mountain areas, leading to the low recording quality; In the mountainous, terrain is relatively complicated terrain so the drill cannot make holes. But when pit gun is use, the excitation energy is short, leading to the low quality of some individual shot. The quality problem of geological drilling are: low collection coefficient of mining during some coal mining work; pollution of the coal column; low recovery rate of coal core by some drills; loess of coal bed by some drills.

Solutions

The main solutions for the quality problems are, holding a working meeting and issuing supervision notice. The Main supervision content, method and work schedule of some coal survey is shown as TABLE 3.

The supervision department holds a working meeting, where supervision unit, investment unit and design and construction unit discuss the recent quality problem and puts forward solving methods. For example, in data collection of seismic exploration, if the hole depth can not reach the designed depth, the workers can combine two or three wells; And in mountain area, when artificial drill can not achieve the well depth, timely change mountain drill; In the mountain terrain where mountain drill is still affected, use the 3D seismic exploration data for instead; For the loess of coal bed, the lost should be made up by hands; Then construction unit should adjust the mud in the drilling process to prevent the coal pillar being polluted; and so on. (The details are shown in TABLE 3.)

Through issuing supervision notice to the construction undertaking unit, ask them to put forward solutions as some problems appear and put record for the supervision department. For example, to solve problem of the low recovery rate of coal core, the construction unit should improve staff's comprehensive quality to improve the recovery rate of coal core.

CONCLUSIONS

The above content is related research and exploration on the method of quality control in the process of coal geological exploration. The focus of the research lies in the analysis of quality control progress which makes clear of the specific factors of quality control in coal exploration and provides theoretical foundation for ensuring the continuous improvement of its quality. And it is expected that the researching process of the study can provide powerful theoretical support for further in-depth exploration.

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