Preliminary Study on the Water Quality Standard of Mine Water Discharge in China

Nan Zhang1, *, DaoXi Wang1, Lin Li2 and Shu Li1

1Yellow River Institute of Hydraulic Research, Zhengzhou, He’nan, China
2North China University of Water Resources and Electric Power, Zhengzhou, He’nan, 450046, China

*Corresponding author e-mail: zhangnan19810202@126.com

Abstract. The requirements of mine drainage water quality indicators in China involve 6 relevant standards of 4 ministries, which four standards are mandatory standards and one is occupation standard. During the implementation period of the many ministries standards, their "mandatory" has not been fully reflected. There are differences among the 6 requirements of mine drainage water quality, such as a different quantity of water quality indicators, non-corresponding indicators and different limit values of indicators. We analyzed of 6 standards of mine water quality index, this paper tries to perfect the current mine water drainage index requirements and construct the standard system of mine water drainage in China, so as to achieve the goal of mine water discharge and gradually implement "zero discharge". These will contribute to realize the transformation of mine water into waste and integrate unconventional water resources into water resources for unified allocation. These will alleviate the contradiction between supply and demand of water resources, and improve the efficiency and efficiency of regional water resources allocation.

1. Introduction
China is a vast mineral resource country and a major mining country. It has discovered 172 kinds of minerals and 162 kinds of proven resource reserves. According to the Development and Reform Commission and the National Energy Administration Bureau jointly issued the "Mineral Water Utilization Development Plan"(National Development and Reform Commission, 2013) clearly stated that the mine water discharge in 2015 was about 7.1 billion m3, accounting for more than 80% of the total mine water discharge. Gu (2016) pointed out that the annual mine water utilization rate in China's coal industry is only about 25%, and the annual mine water loss is about 6 billion m³, while the annual industrial and civil water shortage in China is about 10 billion m³. For areas that are not short of water, mine water is wastewater, but mine water is a valuable resource for areas that lack water.

In order to implement the concept of “Green Water and Green Mountain is Jinshan Yinshan” and promote the construction of ecological civilization. The state has carried out a series of reforms on environmental protection. In the case of enterprises gradually paying attention to environmental protection and expanding environmental problems such as mine water discharge and comprehensive
utilization, the mine water discharge water quality standard is an important basis for judging whether the enterprise meets the standard discharge.

At this stage, China's coal mine industry water resources argumentation is based on the "surface water environmental quality standard (GB3838-2002)" to determine whether the mine drainage is up to standard discharge, the coal industry to "sewage comprehensive discharge standards (GB 8978-1996)" and "coal industry pollutants the emission standard (GB20426-2006) determines whether the mine drainage is up to standard.

In summary, combing the current mine water discharges water quality standards, clarifying the water quality indicators and limit requirements, and improving the current mine water discharges water quality index requirements, can help ease the compliance or non-compliance of enterprises under different environmental protection supervisions. The dilemma will help enterprises realize the transformation of mine water into waste, realize the unconventional allocation of unconventional water resources into water sources, alleviate the contradiction between water supply and demand, and improve the efficiency and utilization efficiency of regional water resources allocation.

2. Necessity of setting water quality standards for mine water discharge

Before the founding of the People's Republic (Tian et al., 2018), coal mining considers mine water, gas, and coal gangue from a safety perspective. After the founding of the People's Republic of China, from 1949 to 1978, China's coal output increased from 322.4 million tons to 618 million tons. Coal production began to take shape. The comprehensive environmental management of the mining area gradually took comprehensive management as an important aspect of the basis of the original blank. In August 1973, the State Council convened the first national environmental protection conference and formulated the "Several Provisions on the Protection and Improvement of the Environment". This is a Chinese first comprehensive environmental protection regulation and puts forward the "three simultaneous" system. In the 1990s, it was the preparation period of the "Eighth Five-Year Plan" and "Ninth Five-Year Plan". Environmental protection work was gradually implemented. After more than 10 years of environmental protection constructions, the national coal mine wastewater treatment capacity increased from 545 million t/a to 835 million during the "Ninth Five-Year Plan" period. T/a, utilization rate of 15%. During the period from 2002 to 2012, the coal industry entered a period of 10 years of glory. Coal environmental protection work also began to go into a stage of rapid development during this period, and the transformation of mine water into waste became a treasure. The state, industry and other departments have issued relevant documents on the discharge and utilization of mine water. In June 2005, the State Council's Notice on Doing a Good Job in the Construction of a Conservation-oriented Society in the Near Future clearly stated that it is necessary in order to promote the requirements for the utilization of water resources in mines (State department, 2005).

In the 11th and 12th Five-Year Plan, it is noted out that seawater desalination, direct use of seawater and utilization of mine water are actively carried out. In November 2012, the 18th National Congress of the Communist Party of China made ecological civilization construction an important part of the overall layout of the “five in one” for the first time. General Secretary Xi proposed that “green water and green mountains are Jinshan Yinshan” and “accelerate the process of ecological civilization construction”. As the concept of ecological civilization, environmental protection has grown up to be a new national policy as a basic national policy. In 2012, “Opinions on Implementing the Most Strict Water Resources Management System” (Guo Fa [2011] No. 3 (State department, 2012) proposed to encourage and actively develop unconventional water sources such as sewage treatment and reuse, development and utilization of rainwater and brackish water, seawater desalination and direct utilization. Development and utilization, unconventional water source development and utilization into the unified allocation of water resources. In 2015, "Opinions on Accelerating the Construction of Ecological Civilization" (Zhong Fa [2015] No. 12) (State department, 2015) proposed to actively develop and utilize unconventional water sources such as reclaimed water, mine water, air cloud water and sea water. Article 9 of the “Notice of the State Council on Printing and Discharging Action Plan for Water Pollution Prevention and Control” (Guo Fa [2015] No. 17) (State department, 2015) proposes...
to include unconventional water sources such as reclaimed water, rainwater and brackish water into the unified allocation of water resources. In 2017, the Ministry of Water Resources' Guiding Opinions on Unconventional Water Sources Integrated into Water Resources Allocation (Water Resources [2017] No. 274)( Ministry of Water Resources,2017) clearly included unconventional water sources into the unified allocation of water resources, alleviated the contradiction between water supply and demand, and improved regional water resources allocation. Efficiency and utilization benefits.

From the perspective of national demand and discipline development, the comprehensive utilization of mine water resources has important practical significance for the safe and efficient use of water resources and the protection of the water environment.

3. Differences in water quality standards for mine water discharge

3.1. Current standard

The current water quality standards for mine water discharge are mainly issued by the Ministry of Water Resources, the Ministry of Ecology and Environment (formerly the Ministry of Environmental Protection), the Ministry of Housing and Urban-Rural Development, and the Ministry of Natural Resources (Table 1). Among them, the mandatory standard occupies 4 items, the recommended standard 1 item, and the industry standard 1 item.

| Name | Standard release/ submission department | Number of indicators | Standard level |
|------|----------------------------------------|----------------------|---------------|
| `<Surface Water Environmental Quality Standard > (GB3838-2002)` | State Environmental Protection Administration | 24 | Mandatory |
| `<Groundwater Quality Standard> (GB/T 14848-2017)` | The Ministry of Land and Resources and the Ministry of Water Resources jointly proposed that the national quality supervision and inspection release | conventional indicator (37)/ Unconventional indicator (54) | recommended |
| `<Sewage Integrated Emission Standards > (GB 8978-1996)` | State Environmental Protection Administration | 52 | Mandatory |
| `<Coal Industry Pollutant Discharge Standard > (GB20426-2006)` | State Environmental Protection Administration | 16 | Mandatory |
| `<Code for Green Mine Construction in Coal Industry> (DZ/T 0315-2018)*` | Ministry of Land and Resources | 16 | industry |
| `<Water Functional Zone Division Standard >(GB50594-2010)` | The Ministry of Water Resources proposed that the Ministry of Housing and Urban Development issued | Refer to surface and groundwater quality standards | Mandatory |

3.2. Different number of indicators

`<Surface Water Environmental Quality Standard (GB3838-2002)>` refers to 24 indicators. `<Coal Industry Pollutant Discharge Standard> (GB20426-2006)` 16 items. The `<Integrated Wastewater Discharge Standard > (GB 8978-1996)` clarifies 52 maximum allowable discharge concentrations of
construction units after January 1, 1998. And 16 <Dynamic Mine Construction Specifications for Coal Industry> (DZ/T 0315-2018). <The Groundwater Quality Standard> (GB/T 14848-2017) states that Class IV water quality should not be used as drinking water source. Other water can be selected according to the purpose of use. As a result of mine water discharge, there are 37 general indicators and 54 non-conventional indicators. <The Water Functional Zone Division Standard> (GB50594-2010) refers to the surface and groundwater quality standards.

3.3. Indicator does not correspond

According to the <Environmental Standards for Surface Water Quality> (GB3838-2002)" (Table 2), the <Coal Pollution Standard for Coal Industry (GB20426-2006)> contains 10 indicators, <Integrated Wastewater Discharge Standard> (GB 8978-1996) Contains 14 indicators, <Groundwater Quality Standard> (GB/T 14848-2017) contains 26 indicators, <Coal Mine Green Mine Construction Code> (DZ/T 0315-2018) contains 10 indicators. Among the 24 indicators, only the PH value and the fluoride standard are specified in the five standards. The water temperature, DO, permanganate index and TN are not specified in the four criteria. The five-day BOD5, TP, There are no provisions in the three criteria for fecal coliforms.

According to the 16 indicators of <Coal Industry Pollutant Discharge Standard > (GB20426-2006)(Table 3) as the standard, <Surface Water Environmental Quality Standard> (GB3838-2002) contains 10 indicators, <Sewage Integrated Emission Standard> (GB 8978-1996) contains five indicators, <Groundwater Quality Standard> (GB/T 14848-2017) contains 11 indicators, <Coal Mine Green Mine Construction Code> (DZ/T 0315-2018) contains 16 indicators. There are no provisions in the total Cr standard. There are no provisions in the α radioactivity, β radioactivity, total suspended solids, and total iron standards.

3.4. Different indicator limits

According to the 24 indicators of <Surface Water Environmental Quality Standard> (GB3838-2002) (Table 2), none of the five standards have the same limit. <The groundwater quality standard> (GB/T 14848-2017) has a pH value. The required limit is opposite to the other four standards. < the Groundwater Quality Standard> (GB/T 14848-2017) requires strict limits on the three indicators of NH3-N, As and sulfide.

According to the 16 indicators of <Coal Industry Pollutant Discharge Standard > (GB20426-2006) (Table 3) as the standard, none of the five standards have the same limit. <The Surface Water Environmental Quality Standard> (GB3838-2002) is for fluoride. The limits of the three indicators of chemical oxygen demand and petroleum are strict. <The groundwater quality standard> (GB/T 14848-2017) requires strict limits on the total indicators of As, α radioactivity,β radioactivity, Fe and Mn.

In summary, the discharge of mine water to the standard is the key factor to realize the transformation of mine water into the waste. To effectively play the supporting role of comprehensive utilization of mine water, it is extremely urgent to construct a standard system for water quality requirements of mine water discharge in China.
Table 2. Indicators of Environmental Quality Standards for Surface Water (GB3838-2002)

| Indicators  | Water temperature (Dimensionless) | pH | DO | Permanganate index | CO D | BOD5 | NH3-N | TP |
|-------------|-----------------------------------|----|----|--------------------|------|------|-------|----|
| GB3838-2002 | The maximum temperature of the week is less than 1; the average weekly maximum temperature drop is less than 2. | 6-9 | 2 | 15 | 40 | 10 | 2.0 | 0.4 (Lake, Reservoir 0.2) |
| GB20426-2006 | | | | | | | | 100 |
| GB 8978-1996 | | | | | | | | 6-9 |
| GB/T 14848-2017 | | | | | | | | 500 |
| DZ/T 0315-2018 | | | | | | | | 6-9 |

| Indicators | TN | Cu | Zn | Fluoride | Se | As | Hg | Cd |
|------------|----|----|----|----------|----|----|----|----|
| GB3838-2002 | 2.0 | 1.0 | 2.0 | 1.5 | 0.02 | 0.1 | 0.001 | 0.01 |
| GB20426-2006 | | | | | | | | 10 |
| GB 8978-1996 | | | | | | | | 2.0 |
| GB/T 14848-2017 | | | | | | | | 5.0 |
| DZ/T 0315-2018 | | | | | | | | 2.0 |

| Indicators | Cr | Pb | Cyanide | Volatile phenol | Petro | Anionic surfactant | Sulfide | Fecal coliform (unite/L) |
|------------|----|----|---------|----------------|-------|-------------------|--------|------------------------|
| GB3838-2002 | 0.1 | 0.1 | 0.2 | 0.1 | 1.0 | 0.3 | 1.0 | 40000 |
| GB20426-2006 | 0.5 | 0.5 | | | | | | |
| GB 8978-1996 | | | | | | | | 1.0 |
| GB/T 14848-2017 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.1 | 1000 |
| DZ/T 0315-2018 | 0.5 | 0.5 | | | | | | 10 |


Table 3. Index Items of Pollutant Emission Standards for Coal Industry (GB20426-2006)

| Indicators | Hg  | Cd  | TCr | Cr  | Pb  | As  | Zn  | Fluoride |
|------------|-----|-----|-----|-----|-----|-----|-----|----------|
| GB20426-2006 | 0.05 | 0.1 | 1.5 | 0.5 | 0.5 | 0.5 | 2.0 | 10       |
| GB3838-2002  | 0.001 | 0.01 | 0.1 | 0.1 | 0.1 | 2.0 | 1.5 |          |
| GB 8978-1996 |       |     |     |     |     |     |     | 5.0 20   |
| GB/T 14848-2017 | 0.002 | 0.01 | 0.1 | 0.1 | 0.05 | 5.0 | 2.0 |          |
| DZ/T 0315-2018 | 0.05 | 0.1 | 1.5 | 0.5 | 0.5 | 2.0 | 10 |          |

| Indicators | α radioactivity | β radioactivity | PH | Total suspended solids | COD | Petro | Fe | Mn |
|------------|----------------|----------------|-----|-----------------------|-----|-------|----|----|
| GB20426-2006 | 1 | 10 | 6-9 | 100 | 100 | 10 | 7 | 4 |
| GB3838-2002 | 6-9 | 40 | 1.0 | | | | | |
| GB 8978-1996 | 300 | 20 | 5.0 | | | | | |
| GB/T 14848-2017 | 0.5 | 1.0 | | | | | | 2.0 1.5 |
| DZ/T 0315-2018 | 1 | 10 | 6-9 | 100 | 100 | 10 | 7 | 4 |

4. Mine water discharge water quality standard system framework

4.1. Standard architecture principle

The logic is clear and forms feedback control. Clearly the relative relationship between the current standards and form a feedback system.

Clear hierarchy and overall coordination. The standard system should have a clear hierarchical relationship and a clear sequence of links. The hierarchical relationship mainly reflects the virtual master-slave relationship between standards, and the link timing mainly reflects the consistency or coordination between the same level standards.

Clear division of labor, standards for their duties. Once the relationship between the standards is understandable, the technical content should be determined according to their respective functions, avoiding overlapping and conflicting with each other. In order to simplify the standards of each department, it is necessary in order to integrate the existing standards, and there are standards for the differentiation of standards due to the division of labor.

Breaking monopoly and promoting fair competition. It is necessary in order to distinguish and deal with the relationship between national standards, industry standards, local standards and enterprise standards, to avoid standards across categories, cross-levels, and cross-links.

Easy to operate, complete with their own functions. Each standard should determine its independent function in terms of its position and setting purpose in the standard system. It does not realize its function to determine the complete technical content and avoid the fragmentation of standard functions.
4.2. Standard system framework design

According to the provisions of Chinese laws, national standards are general technical regulations; if there are no provisions in national standards, they may be stipulated by industry standards and local standards when necessary; if national standards make provisions, industry standards and local standards may be stricter than national standards. The efficiency of industry standards and local standards is higher than national standards, and enterprise standards should conform to national standards, industry standards and local standards.

Under the premise of following the general rules of the above categories, the conceptual mine water discharge standard system is shown in Figure 1.

![Figure 1. Schematic diagram of the framework of mine water discharge water quality standard system](image)

5. Conclusions and suggestions

5.1. Conclusions

1. China's mine water drainage water quality standards involve 6 relevant standards of 4 departments, 4 mandatory standards, 1 recommended a standard, and 1 industry standard.

2. 6 mine water drainage water quality standards have different differences in the quantity of water quality indicators, the indicators do not correspond, the index limits are different.

3. The current mine water discharge water quality standard is to be incorporated, the mine water quality standard system framework is constructed, and the mine water discharge water quality standard system is gradually established.
5.2. Suggestions
Under the weight of the national “zero emission” environmental protection policy, enterprises have gradually adopted mine water treatment technology to meet the standards and strive to achieve “zero emissions” of pollution. Differences in hydrogeology, some mines have large water inflows, limited water users in the surrounding areas, limited comprehensive utilization, and local areas are seriously deficient in water, some rivers are dry, surface vegetation is deficient, even after deep treatment of mine water treatment To meet the standards, the company is also unable to accept the policy of “zero emission” and cannot find acceptable water bodies and users. In this case, it is difficult to achieve "zero emissions." Therefore, improve the current mine water drainage index requirements, build China's mine water discharge water quality standard system, achieve mine water discharge standards, and gradually implement “zero emissions”, which will help mine water to turn waste into treasure, and realize the integration of unconventional water resources into water sources. Unified configuration, alleviate the contradiction between water supply and demand, improve regional water resource allocation efficiency and utilization efficiency.

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