

PAPER • OPEN ACCESS

## Discussion on the concept and definition of mine water

To cite this article: Nan Zhang *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **300** 022021

View the [article online](#) for updates and enhancements.

## Discussion on the concept and definition of mine water

**Nan Zhang<sup>\*</sup>, Hongmou He, Xinwei Guo, Jinxu Han and Haobing Li**

Yellow River Water Conservancy Commission Yellow River Institute of Hydraulic Research, Zhengzhou, He'nan 450003, China.

<sup>\*</sup>Corresponding author e-mail: zhangnan19810202@126.com

**Abstract.** The definition of mine water related concepts involves 6 relevant standards in 6 sectors, 2 mandatory standards, 3 recommended standards, and 1 industry standard. Multi-sectors are inconsistent in the concept and definition of statistical caliber, and the concept of policy is confusing during the formulation and implementation of relevant policy documents, resulting in large errors in statistical data. This paper is based on the analysis of the concept of mine water and the integration of doubts. In conjunction with the relevant requirements of the “Guiding Opinions of the Ministry of Water Resources on the Unconventional Water Sources incorporated into the Unified Allocation of Water Resources”, Conceptual definition of regular mine water quantity, mine water availability, mine water development and utilization, and mine water development and utilization potential, unify the statistical caliber of each department and minimize the difference in statistical data. It is conducive to water resources investigation and management, which are conducive to the integration of unconventional water resources into water resources, alleviating the contradiction between water supply and demand, and improving regional water resource allocation efficiency and utilization efficiency.

### 1. Introduction

Relevant documents of various ministries and commissions for the use of unconventional water resources and mine water resources have been released, which has greatly promoted the rapid development of mine water utilization. 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”. Ecological civilization concept. In 2012, “Opinions on Implementing the Most Strict Water Resources Management System” (Guo Fa [2012] No. 3) proposed[1] to encourage and actively develop wastewater treatment and reuse, development and utilization of rainwater and brackish water, seawater desalination and direct utilization. Unconventional water source 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) [2] 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 Controlling Water Pollution Prevention and Control Action Plan” (Guo Fa [2015] No. 17) proposed in 2015[3] 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' Guidance on the Unconformity



of Water Sources into the Unified Allocation of Water Resources (Water Resources [2017] No. 274) clearly includes unconventional water sources into the unified allocation of water resources[4], alleviating the contradiction between water supply and demand and improving the region. Water allocation efficiency and utilization efficiency.

Mine water is one of the existing water sources. For areas that are not short of water, mine water is waste water, but for water-deficient areas, mine water is a valuable resource. Mine water utilization rate in the mine water development planning[5], coal industry development plan[6], "twelfth five" [7], "thirteen five" [8] energy saving and emission reduction comprehensive work plan proposed 2010 coal mine Mine water production is about 7.26 billion m<sup>3</sup>. The coal industry is accountable for more than 84% of the total, with a utilization rate of 59%. In 2015, coal mine water utilization rate was 64%[3]. Related scholars survey[9]: China's coal industry annual mine water utilization rate is only about 25%, the annual loss of mine water volume is about 6 billion m<sup>3</sup>. Obviously there is a great difference in the utilization rate of mine water between the two. So far, there is no unified understanding of the concept and definition of mine water. The concept and definition of statistical caliber are inconsistent. The concept of the policy file is easy to produce confusion in the process of formulation and implementation, resulting in large errors in statistical data. Water resources investigation and management have caused extreme big inconvenience. This paper sets out the differences and linkages between the definitions of mine water related concepts in water conservancy and coal mines, and discusses the definition of mine water related concepts. It is hope that it will benefit the mine water research work.

## 2. About mine water related concepts

### 2.1. Source of mine water related concepts

The main sources of mine water related concepts are the current relevant standards of the Ministry of Water Resources and the Ministry of Ecology and Environment (formerly the Ministry of Environmental Protection) [10-15] (Table 1). Among them, there are 2 mandatory standards, 3 recommended standards, and 1 industry standard.

**Table 1.** Mine water related concept source summary table

Standard name	Standard release / submission department	Standard level	The term
<i>Coal industry pollutant discharge standards</i> (GB20426-2006)	The State Environmental Protection Administration proposed that the State Environmental Protection Administration and the General Administration of Quality Supervision, Inspection and Quarantine	Mandatory	Coal mining wastewater, coal industrial wastewater
<i>Mine hydrogeology engineering geological exploration specification</i> (GB12719-91)	The National Mineral Reserves Committee proposed that the State Bureau of Technical Supervision release	Mandatory	The normal water volume of the pit and the maximum water inflow from the pit
Coal mine water classification(GB/T 19223-2015)	China Coal Industry Association proposed that the General Administration of Quality Supervision, Inspection and Quarantine and the China National Standardization Administration	Recommended	Coal mine water
<i>Water terminology</i> (GB/T 30943-2014)	The Ministry of Water Resources proposed that the General Administration of Quality Supervision, Inspection and Quarantine and the China National Standardization Administration	Recommended	Drainage drainage
<i>Hydrogeological terminology</i> (GB/T 14157-93)	The Ministry of Geology and Mineral Resources of the People's Republic of China proposed that the State Bureau of Technical Supervision release	Recommended	Mine water, mine water inflow, maximum water inflow from mine pit, normal water inflow from mine pit
<i>Technical Guidelines for Environmental Impact Assessment - Coal Mining and Selection Project</i> (HJ 619-2011)	Ministry of Environmental Protection proposed and released	Industry	Mine water, pit water, and drained water

## 2.2. Discrimination of concepts and definitions

As can show in Table 1, the names of the concepts related to mine water are different. The root cause of these is that the specific issues of the study are different. What is the source of mine water? What is the right way of being? Is it up to standard? Are there any water users after the platoon? It is precisely because of the peculiar problems of the research that the "mine", "mine pit", "draining water", "water inflow", "drainage" and "waste water" are different. In order to facilitate research and management, this paper analyzes the distinctive meaning of each keyword.

Based on the existing research and the intrinsic link between the above keywords, this section divides these keywords into three groups. Analysis, namely "mines and pits", "drainage and water inflow" and "drainage and wastewater".

**2.2.1. Mine and pit.** The two terms of mine and pit reflect the difference between the research objects. Before analysing mines and mines, it is first necessary to mention open pit mines and mines. Open-pit mine means that coal mining is to remove the floating soil and surrounding rock covered in the upper part of the ore body and to excavate directly from the open ore body; the underground mining refers to underground mining, which must be dug into the stratum during coal mining. Mining coal. The biggest difference between the two is whether the coal seam is burned or buried.

In summary, the mine describes the deep mining and underground mining of coal mines, and the pits describe the open pits of coal seams buried and exposed.

**2.2.2. Dredging water and water inflow.** The amount of water and water inflow is mainly distinguished from the source of the water source. Dewatering water refers to the amount of water released from the aquifers into the mining face during coal mining; the amount of water inflow refers to the amount of water that each aquifer remits into the mine. The biggest difference between the two is to determine whether they exist in the mining face or the mine.

In summary, dewatered water describes the mine water present in the mining face. The amount of water inflow describes the mine water that exists in the mine (shaft, inclined shaft, flat shaft, roadway, water tank, etc.).

**2.2.3. Drainage and wastewater.** The two terms of drainage and wastewater reflect whether the target is used for external discharge and external discharge. Water Resources Terminology (GB/T 30943-2014) states that drainage is drained: the aqueous medium is drained. "Coal Industry Pollutant Emission Standards" (GB20426-2006) points out coal mining wastewater: coal mine water released to environmental water bodies or open-pit coal mines in the process of coal mining. "Coal Mine Water Classification" (GB/T 19223-2015) points out mine water: in the process of coal mine construction and coal mining, the wastewater produced by underground water inrush, surface infiltration water, and downhole production drainage.

Comprehensive definition of three standard terms: mine water / drained water = wastewater.

Access to relevant standards, no precise definition of wastewater terminology. The Technical Guidelines for the Management of Sewage Discharge port into the River[16] (SL 532-2011) points out waste water: the general term for tail water discharged from production and living activities. "Hydrological Basic Terms and Symbol Standards"[17] (GB 50095-2014) points out industrial wastewater: industrial production, including processes, and equipment cooling, flue gas washing, equipment and site cleaning processes.

In summary, the definition of drainage and wastewater in the relevant standards has the following doubts:

- ① It is not clear whether the drainage is equal to the wastewater.
- ② Does the unclear drainage mean the location where the mine water/drainage water is directly discharged (mining surface? mine?) or is it discharged outside the plant?

③ For example, drainage refers to the location where the mine water/drainage water is discharged. At this time, the drainage = wastewater can be used for production, living and ecological use outside the plant after a certain technical treatment.

④ If the drainage means that it is discharged outside the factory, there are three possibilities: it is discharged into the river outside the factory, and the drainage = wastewater; the water quality of the water users outside the factory (irrigation, aquaculture, landscape, industrial water, etc.) Demand, at this time, draining wastewater; not discharging, and drainage = wastewater.

### 3. The importance of correctly defining the concept of mine water

In 2013, the “Mineral Water Utilization Development Plan” proposed “focusing on mining enterprises with annual water inflow (or displacement) of 600,000 cubic meters and above.” The amount of water in the document = displacement, that is, agree with the section 1.2.3③.

In 2016, “Guidelines for Water Resources Argumentation in Mining Construction Projects” (SL 747-2016)[18] proposed “analysing the impact of mine water and efflux in construction projects”. The standard amount of water inflow ≠ Exhaust volume, that is, the approval of the 1.2.3 subsection④.

In 2008, “Clean Production Standard Coal Mining and Selection Industry” (HJ 446-2008)[19] gave indicators for raw coal production water consumption (m<sup>3</sup>/t) and coal preparation water supply (m<sup>3</sup>/t). Water supply = 0.2~0.55 (m<sup>3</sup>/t)

Above all, if amount of water inflow ≠ Exhaust volume, That is, there is a coal mine self-water consumption between the water inflow and the external discharge. According to the calculation of the coal consumption of the raw coal production water consumption, the national raw coal output in 2015[6] is 3.75 billion tons, and the self-use mine water volume=0.2~0.55\*37.5=7.5~2.625 billion m<sup>3</sup>. In 2015, the national water resources bulletin accounted for 0.85~2.33% of other unconventional water sources, and sewage treatment and recycling accounted for 14.27~39.23% (Table 2).

If the mine's self-contained water consumption is included in the displacement, the mine water utilization and utilization rate will be greatly reduced. The development target of 80% of mine water utilization in 2020[6] will be difficult to complete.

**Table 2.** 2015 National Unconventional Water Source Statistics Summary

Data Sources	Name	Quantity (100 million m <sup>3</sup> )	Self-use mine water volume ratio(%)
Water resources bulletin	Brackish water	4.276	175.4~482.34
	Sewage treatment and recycling	52.57	14.27~39.23
	Rainwater harvesting project utilization	11.22	66.84~183.82
	Desalination of seawater	0.71	1056.34~2904.93
	Direct seawater use	814.8	0.92~2.53
	<b>Total</b>	<b>883.576</b>	<b>0.85~2.33</b>
National Seawater Utilization Report	Desalination seawater development scale	3.68	203.8~560.46
The 13th Five-Year Plan for Water Saving Society	Desalination water volume	0.74	1013.51~2878.16
China City Statistical Yearbook	Urban industrial wastewater discharge	195.16	3.84~10.57
China Urban and Rural Construction Statistical Yearbook	Total urban sewage discharge	466.62	1.61~4.42

### 4. Definition and extension of the concept of mine water

In 2017, the Ministry of Water Resources' Guidance on the Integration of Unconventional Water Sources into Water Resources (Water Resources [2017] No. 274) clearly states that “by 2020, the national

unconventional water source allocation will strive to exceed 10 billion cubic meters (excluding Seawater Utilization) “Incorporate unconventional water sources into the water supply and demand balance analysis and water source allocation system, and clarify the water demand and allocation of unconventional water sources”. As an unconventional water source, mine water needs to be clear when the water supply and demand balance analysis are included, the mine water quantity, mine water availability, mine water development and utilization, and mine water development and utilization potential.

This section incorporates the definition of the above-mentioned mine water related concepts, and is organized as follows:

**Mine water volume:** During the foreseeable period, during the coal mining and the development process, after the aquifer and the underlying aquifer are merged into the mine, the amount of mine water discharged to the ground through the pipeline or open channel. That is, the amount of water in the mine.

**Mine water availability:** In the foreseeable period, the mine water inflow can be used for the water consumption of the living, production and ecological environment outside the plant on the basis of economically reasonable and technically feasible storage and treatment measures.

**Mine water has been exploited:** Under the current conditions, the mine water inflow has been used for living, production, and ecological environment water consumption that meets relevant regulations and has ecological protection significance through economically rational and technically feasible storage and treatment measures.

**Mine water development and utilization potential:** In the foreseeable period, the mine water availability can be deducted from the development and utilization of mine water. That is, the discharge of mine water.

## 5. Conclusion

This paper mainly discusses the related concepts and definitions of mine water related to 6 relevant standards of 6 departments. There are inconsistencies in the selection and use of standards and documents, mainly in the use of keywords such as “mine”, “mine pit”, “draining water”, “water inflow”, “drainage” and “waste water”. Based on the analysis of the related concepts of mine water, based on the integration of doubtful points, combined with the relevant requirements of the “Guiding Opinions of the Ministry of Water Resources on the Unconventional Water Sources Incorporated into the Unified Allocation of Water Resources”, the mine water volume, mine water availability, and mine water have been adjusted. Conceptual definition of development utilization and potential of mine water development and utilization.

In 2017, the “Notice on Printing and Implementing the “Implementation Measures for Expanding the Water Resources Tax Reform Pilot” (Cai Shui [2017] No. 80) clarifies that Beijing, Tianjin, Inner Mongolia, Ningxia, Shanxi and other nine provinces and municipalities are piloting the expansion of water resources tax reform. After the resource tax is levied, it is determined that the actual water consumption of the mine drainage is determined in accordance with the displacement. According to the concept of mine water, the statistical caliber of various departments is unified, and the differences in statistical data are minimized, which is conducive to water resources investigation and management. It helps to the unconformity of unconventional water resources into water resources, alleviating the contradiction between water supply and demand, and improving regional water supply. Resource allocation efficiency and utilization benefits.

## Acknowledgments

This research was financially supported by National key research and development plan No.2017YFC0403505 and the research of National Natural Science Foundation of China (NSFC) No.51309107. We also thankful to anonymous reviewer for his constructive comments in the manuscript review.

## References

- [1] State department. Opinions on the implementation of the strictest water resources management system[S]. [2012]3.2013.
- [2] State department. Opinions on accelerating the construction of ecological civilization[S]. [2015]12,2015.
- [3] State department. Circular of the state council on printing and distributing the action plan for prevention and control of water pollution[S]. [2015]17.2015.
- [4] Ministry of Water Resources. Ministry of water resources on the integration of unconventional water resources into the unified allocation of water resources guidance[S] [2017]274.2017.
- [5] National Development and Reform Commission .Development plan of mine water utilization[S]. [2013]118,2013.
- [6] National Development and Reform Commission, National Energy Board. The 13th Five-Year Plan for the Development of the Coal Industry (Public Release) [R].2016.
- [7] State department. Notice of the State Council on Printing and Distributing the Comprehensive Work Plan for Energy Conservation and Emission Reduction in the 12th Five-Year Plan. [R]. Guofa [2011]26. 2011.
- [8] State department. Notice of the State Council on Printing and Distributing the Comprehensive Work Plan for Energy Conservation and Emission Reduction in the 13th Five-Year Plan[R]. Guofa [2016]74. 2016.
- [9] Gu Dazhao,Zhang Yong,Cao Zhiguo.Technical progress of water resource protection and utilization by coal mining in China[J]. Coal Science and Technology. 2016,44(1):1-7.
- [10] Ministry of Environmental Protection. Technical Guidelines for Environmental Impact Assessment - Coal Mining and Selection Project.(HJ 619-2011)[S].2011
- [11] National Environmental Protection Agency, State Administration of Quality Supervision, Inspection and Quarantine. Coal industry pollutant discharge standards(GB20426-2006) [S].2006.
- [12] National Technical Supervision Bureau. Hydrogeological terminology(GB/T 14157-93) [S]. 1993.
- [13] State Administration of Quality Supervision, China National Standardization Administration. Water terminology. (GB/T 30943-2014) [S].2014.
- [14] National Technical Supervision Bureau. Mine hydrogeology engineering geological exploration specification. (GB12719-91) [S].1991.
- [15] State Administration of Quality Supervision, China National Standardization Administration. Coal mine water classification. (GB/T 19223-2015) [S].2015.
- [16] Ministry of Water Resources. Technical guidelines for the management of sewage outlets into the river. (SL 532-2011) [S].2011.
- [17] Housing and Urban-Rural Development, State Administration of Quality Supervision, Inspection and Quarantine. Hydrological basic terminology and symbolic standards. (GB 50095-2014) [S].2014.
- [18] Ministry of Water Resources. Guidelines for water resources argumentation in mining construction projects. (SL 747-2016)[S].2016.
- [19] Ministry of Environmental Protection. Clean production standard coal mining and selection industry.(HJ 446-2008)[S].2008.
- [20] Ministry of Water Resources. Water resources bulletin [R].2016.
- [21] State Oceanic Administration. National Seawater Utilization Report[R].2016.
- [22] National Development and Reform Commission. The 13th Five-Year Plan for Water Saving Society. [R].2017.
- [23] National Bureau of Statistics. China City Statistical Yearbook[R].2016.
- [24] Housing and Urban-Rural Development. China Urban and Rural Construction Statistical Yearbook. [R].2016.