

# Comparative Study of Safety Management System for Application in Municipal Engineering Enterprises

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**Abstract:** With the rapid development of new-energy industry, improving as soon as possible the common phenomenon of crossover & waste of resources, and lax system implementation in the management is a problem that needs to be urgently solved. In recent years, occupational health, safety and environmental issues have attracted increasing attention in countries around the world. Despite the world-renowned high-speed growth of economy in China, occupational safety and health, one of the important contents of social progress, has lagged far behind the pace of economic construction. Thus, on the basis of the comparison of four world recognized occupational health and safety management system (OHSMS) standards, this paper studies reasons for the emergence and development of OHSMS and summarize the core construction content by analysing the domestic and foreign backgrounds, the operation mode and basic elements of OHSMS to give necessary suggestions on the application and establishment of OHSMS for Chinese municipal new-energy enterprises so as to well support their production and management.


## 1 INTRODUCTION


In the late 1980s, the rapid development of industry brought about a series of problems such as accidents and occupational diseases, which seriously affected the safety and health of workers and restricted the harmonious development of enterprises and society (Zhang et al. 2014). A scientific, advanced, and dynamic modern management model of safety production has gradually emerged internationally with the name of occupational health and safety management system (OHSMS). Some developed countries took the lead in the implementation of occupational health and safety management system activities, and formulated the corresponding standards. Relevant legislative policies and measures are constantly issued and improved. In order to strengthen their social attention and due to the need to control losses, some multinational companies and large modern joint enterprises have also begun to


establish self-disciplined occupational safety, health and environmental protection rules and regulations. They gradually formed a relatively complete system (Miao et al. 2008). Since the development of OHSMS, the problem of production safety has been resolved to a certain extent. Many countries have their own OHSMS. In western industrialized countries, OHSMS can not only reduce the economic loss of enterprises caused by occupational injury, but also improve the self-image through strengthening social responsibility.

At present, municipal new-energy companies that make a living by manufacturing charging piles still lack an effective safety management system. This has caused its safety management to face many unclear problems. According to the latest statistics, in 2019, there were a total of 773 construction and municipal engineering safety accidents and 904 deaths in China. The unclear management system is one of the root causes of so many accidents. There is an urgent need

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to establish a safety management system in line with national conditions in the municipal industry. Therefore, in this paper, four mature and widely used OHSMS standards including BS8800 from BSI (BSI 1996), ILO-OSH 2001 from ILO, OHSAS 18001 (BSI 1999, BSI 2007) and ANSI/AIHA Z10 from American national standard institute (ANSI) (ANSI 2005, ANSI 2012) are selected as study objects to discuss the development trend of OHSMS, summarize the potential mechanism of the system standard and finally clarify the core content of safety management by means of comparative analysis, so as to find the development and improvement direction suitable for Chinese municipal new-energy enterprises while providing basis for OHSMS construction.

## 2 RESEARCH FOUNDATION

### 2.1 Development Status of OHSMS in China

Occupational safety and health management is an important part of enterprise management, whose purpose is to make the enterprise away from the occurrence of occupational diseases, personal injuries and other safety accidents. The effective establishment, implementation and maintenance of OHSMS is able to promote the continuous enhancement of enterprise occupational safety and health performance while improving image and market competitiveness of enterprises. Overall, OHSMS implementation is an important way for enterprises to establish a modern standardized management mode. In this context, China promulgated the Trial Standard for Occupational Safety and Health Management System in 1999, and then approved and issued the GB/T28001-2001 Standard for OHSMS on November 2001, which is the equivalent introduction of OHSAS 18001. With the republication of OHSAS 18000 series of standards since 2007, the GB/T28001 was updated again in 2011 (Fan et al. 2015). Since the advanced OHSMS and its standards have many years of history and experience in foreign developed countries, they certainly have important reference value to the domestic standard formulation and improvement as well as the safety construction of enterprises.

### 2.2 Necessity of Implementing OHSMS for Municipal New-energy Enterprises

With the promulgation and implementation of the new version of safety laws and regulations in China, it is anticipated that the national and industrial safety supervision will be more and more detailed and strict according to the related requirement from governmental agencies such as opinions on the reform and development of the safety production field. With the continuous reform and all-round progress of energy and construction industries, the new historical period gives new tasks to safety production and provides rare opportunities for the development of occupational health and safety management. In addition, new safety risks in municipal new-energy projects are growing rapidly. Briefly, the shift of safety production from the central position to the basic position has brought about the dilution of safety culture. The weakening of safety standards is reflected in the lack of perfect standard system, neglect of process control, insufficient accident accountability and weak timeliness of accountability. The lack of safety production responsibility system, maladjustment between old equipment with new standards, and mismatching of old indicators and new situations all indicate municipal new-energy enterprises have the problem of insufficient safety management. The technical means are seriously lagging behind, resulting in the inability to accurately grasp the safety characteristics of municipal construction, the lack of perceived control of equipment and the lack of information security guarantee capability. Enterprise safety management system is not perfectly constructed, leading to inadequate implementation of safety responsibility, out-of-control on-site management and weak safety awareness of grass-roots staff.

### 2.3 Comparative Analysis Method

The comparative analysis of this study will be realized based on literature method. It is characterized by objectivity and high efficiency. Since the main objects of this study are various OHSMS standards, the collection of these standards is convenient, and the analysis content has a certain time span, it is suitable to sort out the research problems by literature method. Thus, we will respectively compare and analyse the background, operation mode and basic elements of OHSMS standards by literature review to explore the building laws and characteristics of

OHSMS and discuss its development trend and application in municipal new-energy enterprises.

### 3 COMPARATIVE ANALYSIS OF VARIED TYPES OF OHSMS

#### 3.1 Background Comparison of OHSMS Standards

The background comparison of OHSMS standards is mainly based on two dimensions including birth time and safety management objectives. The origin of

OHSMS can be traced back to the presentation of the Robens report in 1972 (Robens 1972). The report provides important support for the establishment of a more effective safety protection system, which plays an irreplaceable role in the field of occupational safety and health legislation in the world. The self-regulation mode and employee participation mechanism pointed out in the report show a new direction and new strategy for the development of occupational health and safety (Zhang 2014), laying a solid foundation for subsequent OHSMS standards. Based on literature analysis, differences in the background of four OHSMS standards are shown in Table 1.

Table 1: Comparison of background of OHSMS standards.

Standards	Birth time	Organizations or institutions	Cause and background
Robens report	1972	Safety committee chaired by Robens	Production methods and equipment change rapidly and the old method is difficult to adapt to new social development; 144 persons died in the Aberfan disaster
BS8800	1996	British standards institute (BSI), employers, employees and insurance	The enterprise management system establishment lacks guidance documents
OHSAS 180001	1999	BSI, DNV and other 13 international well-known certification organizations	Repeatability and complexity of certification standards
ILO-OSH: 2001	2001	International Labour Organization (ILO)	To obtain united criteria generated by sorting, analysing and comparing 24 OHSMS standards formulated by 15 countries, regions and organizations
ANSI/AIHA Z10 (ANSI 2005, ANSI 2012)	2005	American Industrial Hygiene Association (AIHA) and American National Standards Institute (ANSI)	To establish a management system suitable for the United States and its enterprises based on ILO-OSH: 2001

In conclusion, all the four OHSMS standards hope to provide an advanced safety management system to enable the organization to control risks and improve its occupational health and safety performance. Specifically, ILO-OSH focuses more on establishing its own OHSMS system according to national conditions, but ultimately it still pays attention to the health and safety of employees. Comparatively, both BS 8800 and AIHA Z10 mention the establishment of the organization's image in their objectives. This is because the enterprise image is the core of enterprise culture. By virtue of the OHSMS with self-

management concept, the enterprise or organization is able to improve the safety performance and strengthen the cultural construction, so as to get comprehensive development in the market.

#### 3.2 Operating Mode Comparison of OHSMS Standards

Based on the literature method, the operating mode of four OHSMS standards can be summarized in the following figure.

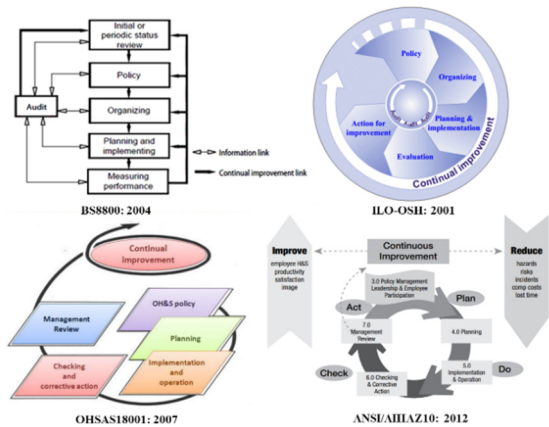


Figure 1: Comparison of operating mode of OHSMS standards.

According to the above statistics, the four OHSMS operating modes can be further summarized as follows:

- The main structure of the operation mode in BS8800: 2004 is *initial and regular status review -- policy -- organization -- planning and implementation -- performance evaluation*.
- The main structure of ILO-OSH: 2001 operation mode is *policy -- organization -- planning and implementation -- evaluation -- improvement action*.
- The operation mode of OHSAS18001: 2007 is *OH&S policy -- planning -- implementation and operation -- checking and corrective action -- management review -- continual improvement*.
- The main structure of ANSI/AIHAZ10: 2012 operating mode is *planning -- implementation review -- corrective action -- management review -- continual improvement*.

By comparison, the operation modes of the four standards in this study are basically the same in the main structure. They are all constructed based on the management theory of PDCA cycle (i.e. plan-do-check-act). They all have planning, implementation, checking and continuous improvement stages. Although BS8800 does not explicitly mention the continuous improvement after the implementation evaluation stage, the direction of the continuous improvement line in the operation mode shows that this OHSMS also follows a circular working logic.

### 3.3 Basic Element Comparison of OHSMS Standards

Finally, the basic elements of each standard were compared to understand the core content of OHSMS.

For instance, Tab. 2 shows the differences between elements from BS8800: 2004 and ILO-OSH: 2001. It is confirmed that ILO pays more attention to employee participation and management than BS8800.

Table 2: Comparative analysis of basic elements of BS8800: 2004 and ILO-OSH: 2001.

	Basic elements	Main differences
1	Initial review	ILO-OSH further recommends that the initial status review should provide analytical data from the health status of workers.
2	OH&S policy	ILO-OSH further recommends to declare compliance with voluntary projects.
3	Organization	ILO-OSH puts more emphasis on worker participation
4	Planning and implementation	ILO-OSH further recommends that workers should have access to occupational health and safety records for a specified period of time.
5	Performance monitoring and measurement	BS8800 contains the contents of ILO-OSH.
6	Audit	ILO-OSH further recommends that the audit examines employee participation.
7	Management review	Periodic check is not recommended in ILO-OSH. ILO-OSH recommends that the results of management review should be communicated to safety and health committees, employees and their representatives.

## 4 DISCUSSIONS

### 4.1 The Development Trend of OHSMS based on the Background

Based on the background of OHSMS and its origin as well as development in various countries, the main causes of OHSMS can be summarized into the aspect below:

- Improved demand of enterprises for production and expansion

With the rapidly accelerating industrialization process promoting the continuous development of society, the scale of enterprises is expanding and the

degree of production intensification is improving. Thus, the self-regulation OHSMS comes into being and gradually forms a relatively perfect system (Robens 1972).

For a long time, OHSMS has developed vigorously all over the world. The reasons behind it and the underlying trend are also obvious:

- The trend towards integration of international standards

With the rapid development of international trade, developing countries are also increasingly participating in world economic activities. International uniform standard has gradually formed, promoting the mutual imitation and learning among countries. Meanwhile, due to the successful implementation of quality and environmental management system standards in the world, the international OHSMS standard has developed more rapidly.

- The people-oriented concept which is deeply rooted in people's hearts

In many OHSMS from varied governments, enterprises and organizations, people-oriented concept and policy have been an important embodiment. In the context of economic globalization, it is no longer acceptable for a country to gain unfair competitive advantages by sacrificing the safety and health of its employees.

#### **4.2 Application of OHSMS Core Elements in Chinese Municipal New-energy Enterprises**

The key driving force in OHSMS is the continuous improvement idea in PDCA cycle. Its connotation is to constantly improve the features and characteristics of the working results, continuously adapt to management needs and objectives, and constantly improve the process used for production. According to the idea of continuous improvement, the key point of OHSMS cycle operation is at the inspection stage in which the main elements are hazard identification and risk control. Hazard identification and risk assessment are the main inputs of OHSMS, and all other elements of the system are based on or considered by the results of hazard identification and risk assessment. For municipal new-energy enterprises, the establishment and maintenance of OHSMS are based on comprehensive identification of risk and hazard factors as well as the risk assessment implementation. The control and management of the assessed unacceptable risks would become the core of OHSMS.

However, there are still many problems in the work of hazard identification and risk control in municipal new-energy projects. For example, there is no perfect organization in hazard identification and risk analysis, and some operating environments have not been re-identified for new hazards after transformation, exposing a problem that hazard identification is not comprehensive enough. In addition to risk identification & control, the other elements in OHSMS, such as employee training, documentation and data control which do not directly interact with hazard factors and do not propose standards for risk management, have their own functions and are indispensable and considerable in the safety management, providing a necessary guarantee for the implementation and maintenance of enterprise development.

## **5 CONCLUSIONS**

Based on the analysis and discussion presented above, the core points for municipal new-energy companies to establish a safety management system are as follows:

- (1) OHSMS, which is promoted by the needs of enterprise safety development, is constantly improved and updated under the trend of international standard integration. People-oriented concept is an important content that OHSMS constantly preaches.
- (2) With the idea of continuous improvement, PDCA cycle is the most basic and main operation mechanism in the mature OHSMS, which ensures the systematic operation of safety management.
- (3) Hazard identification & risk control are core elements and main input for municipal new-energy enterprises to establish OHSMS. The results are one of the important basis for the implementation of all other elements.

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