

Constructing early warning information release system in towns enterprise clean production

Huixin Yuwen¹, Xueqiu He², Xinming Qian³ and Mengqi Yuan⁴

^{1,3,4} Beijing Institute of Technology, 5 South Zhongguancun Street, Haidian District, Beijing

² University of Science & Technology Beijing, 30 Xueyuan Road, Haidian District, Beijing

E-mail: ywhx411@163.com

Abstract: China's industry boom has not only brought unprecedented prosperity, but also caused the gradual depletion of various resources and the worsening of the natural environment. Experts admit that China is facing serious environmental problem, but they believe that they can seek a new path to overcome it through joint efforts. Early warning information release and clean production are the important concepts in addressing the imminent crisis. Early warning information release system can monitor and forecast the risk that affects the clean production. The author drawn the experiences and lessons from developed countries, combined with China's reality, put forward countermeasures and suggestions about constructing early warning information release system in process of Chinese town-scaled enterprises clean production.

1 Introduction

China is experiencing rapid industrial development from traditional industrial mode to pollution control mode and to pollution prevention mode (clean production mode). At present, most town-scaled enterprises are still in the traditional industry and pollution control mode in China. The two models have achieved a rapid increase, but at cost of a large amount of material consumption and consumed a large amount of resources (including energy) in the gross national product. Simultaneously the resources(including energy)has not been effectively utilized. People exploited natural resources at will, which has caused the depletion of resources and energy. When many resources have been converted to waste and discharged into the natural environment, it has caused air pollution, biodiversity loss, water pollution and other environmental problems. *The Development of China 's Circular Economy: Points and Suggestions* showed that Chinese economy is 14.5% of the world's GDP, however China consumes 15.8% of the world's water, 26% of the world's steel, 47% of the world's cement. In monitoring 338 cities, air quality reaching the standard is 21.6%, air quality not reaching the standard is 78.4%. According to *The Statistics Bulletin on National Economy and Social Development of China 2015*, agricultural and sideline food processing industry increased by 5.5%, textile industry by 7.0%, production of chemical raw materials and chemical products by 9.5%, non-metallic mineral products industry by 6.5%, ferrous metal smelting and rolling industry by 5.4%, general equipment manufacturing industry by 2.9%, special equipment manufacturing industry by 3.4%, automobile manufacturing industry by 6.7%, electrical machinery and equipment manufacturing industry by 7.3%, computer, communications and other electronic equipment manufacturing industry by 10.5%, electricity, heat production and supply by 0.5%, the appreciation of six high energy consuming industry by 6.3%, the value-added of six high energy consuming industry accounted for 27.8%, and



total annual energy consumption, which grew by 0.9%, is 4.3 billion tons of standard coal, the industrial scale of the whole year was compared with that of 2014.

2 Literature review

Clean production is a concept changing with time, a concept that clean production is continuous and integrative prevention strategy, clean production increases efficiency to improve environmental performance and reduces costs though changing products, processes and services [1]. Clean production primarily originated from environmental pressures. Environmental problems were limited to local or regional levels before the industrial revolution. With the industrial scale expansion, many environmental problems such as the greenhouse effect, ozone depletion have gradually formed and eventually evolved into a global problem. The attitude of waste treatment has under gone the evolutionary process from the passive control to the active control. People initially just had taken passive measures, such as dilution and dispersion of the liquid waste, concentration and packaging of solid waste. With the rapid increase of the scale of waste production, it is necessary to take the "pipe-end technology" as a reactive measure to deal with, but it can't fundamentally solve the problem of environmental pollution; around the mid-1980s, the enterprise's attitude toward pollution production changed, enterprises have changed their attitude from passively accepting government regulations to actively promoting clean production [2].

It can be seen that clean production is both a methodological system and a goal that sets the economic and environmental requirements which enterprises and human should meet. The aim is to meet the human demand for products in a sustainable way, in other word, it will improve the utilization of resources and energy under the premise which maintains the ecological diversity. Such as Ouyang and Shen studied the choice of energy saving modes for an energy-intensive manufacturer considering non-energy benefits [3], Britain's Department of Trade and Industry put forward view on waste minimization [4], Palasciano et al. put forward a new approach for machine's management: from machine's signal acquisition to energy indexes [5], Ren et al.[6] analysed energy consumption and carbon emission during the urbanization of Shandong Province, China.

3 Predictable hazardous sources in process of clean production

Main contents of cleaner production [7]: (1) Poisonous and harmful raw materials are not used or less used, which requires the process design to be fully considered carefully; (2) Toxic and harmful intermediate products are eliminated; (3) Various kinds of risk factors are to be reduced or eliminated in the production process, such as high temperature, high pressure, low temperature, low pressure, flammable materials, explosive materials, strong noise, strong vibration; (4) Technology without waste is adopted; (5) Efficient equipment is selected; (6) Material recycling is required; (7) Operation and control are simplified and reliable; (8) Better management. As shown in figure 1.

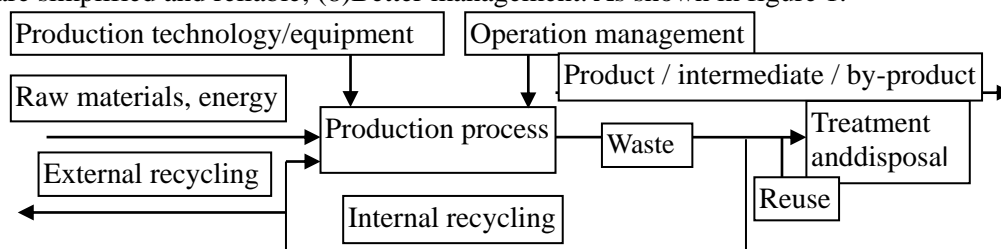


Figure. 1 The basic process of clean production [8]

The factors which hinders town-scaled clean production: unreasonable distribution of dangerous sources; the safety management rules and regulations aren't perfect; the preventive measures are lacking; the information management lags behind; the hazard facilities are unknown; people's safety consciousness is low; workers are out of operation; management personnel are in violation of regulations and unsafe behavior of enterprise organization. These factors are interactive with each other, and have impeded clean production. This phenomenon is widespread everywhere.

As to what is source of primary hazard and source of secondary hazard [9] by Baozhi Chen, the professor of Northeastern University proposes: The energy which clean production is required or the hazardous substances which clean production are produced is called source of primary hazard: the various factors that cause waste of energy or the measures that fail to limit hazardous substances are called source of secondary hazard.

4 Summary of clean production methods

People have developed many influential methods and tools at the different scales and levels of clean production. Pirinckx and Meozzi analyzed and summarized the evolution of clean production technology [1].

These methods focus on a set of different clean production methods. The current methods have become very much mature, such as the Paris algorithm for solvent selection in the whole enterprise, the EAR software for reaction path synthesis [10], Verghese and Hes put forward qualitative and quantitative tool development to support environmentally responsible decisions [11]; Hicks and Dietmar put forward improving cleaner production through the application of environmental management tools in China [12], but there is no mutual integration among these methods. At present these defects that can't be integrated have attracted people's attention. The United States academia, industry and government jointly developed a set of expert system called CPAS, its purpose is to provide engineers with a wide range of clean production technical guidance. It integrates many technical tools for clean production, such as technology modeling tool set, waste disposal design toolset and the product based toolset [13]. These tools are independent of each other and can't be called integration in the strict sense. Therefore, the development of clean production is urgently needed to establish an effective overall technical framework to guide the strong integration between these local technologies. Table1 also shows the evolution of clean production technology, which reveals the development of clean production related technology.

Clean production is a concept which involves different scale and levels, which includes almost all kinds of human activities. Therefore, the enterprises are to truly implement clean production, it is not just for scientific and technical personnel and government, it involves everyone who must to be clear about the methodology and uses it as a guide. At present, clean production are related to the process, management, technology and other fields, there are corresponding norms and guidelines, for example, Anderson and Butler studied a standard for design life and durability for mine wastes structures [14]. ISO has established two standard series ISO9000 and ISO14000 to promote international cooperation and exchanges. However, it is very difficult and impossible to establish a universal and inclusive approach to clean production. Here, we only focus on clean production technology layer.

5 The significance of constructing early warning information release system in towns clean production

Early warning information release system would send emergency signals and report dangerous situations to relevant departments before danger occurred according to regular or previous observation experience. It is used to avoid danger caused by human ignorance or lack of preparation, and reduce loss to the maximum extent. The roles of early warning information release system in clean production are:

- (1) To improve the staff on the standard operating procedures of skills and clean production concept.
- (2) Mechanism of condominium is cooperated closely among departments divisions.
- (3) To optimize the process, improve work efficiency, reduce operating costs, reduce energy consumption and improve the level of comprehensive utilization of resources for enterprises actively.
- (4) To perfect the corresponding policies and laws and regulations.
- (5) To speed up the construction of compulsory clean production audit system .
- (6) To improve the level of enterprises to deal with the crisis in order to enhance the competitiveness of enterprises.

6 Construct early warning information release system in towns clean production

Clean operation can be achieved through decision-making, planning, organization, safety control and environmental protection. Because the main factors that affect the clean production is technology and personnel, it can be avoided through the early warning information release system.

6.1 Perfect the early warning information release system, to promote the smooth implementation of early warning information release system in towns clean production

Early warning information release system is related to information collection, storage, analysis, forecast, release and other functions involved. It is to make early warning information release system implement and achieve good results in clean production. It should make a mechanism that each department closely cooperates and makes joint efforts under the unified leadership of the government and enterprises. At present, the timely and effective early warning mechanism for the clean production has not been established in China. The people ignore early warning in the process of cleaning production, such as lack of attention, lack of clean production forecasting organization, lack of safety information release and management from the government and enterprises. Simultaneously, the technical support for the early warning of clean production is a problem, and the experts are not fully utilized in the early warning technology and management expertise, the degree of expert participation which is in the early warning and forecasting of the clean production is not high. The early warning information release system in the clean production has not formed nationwide. The voluntary and mandatory implementation of the early warning information has no organic combination in the clean production.

6.2 Full range of safety management at all levels

Clean production will be applied in the production process in order to increase the ecological efficiency and reduce the risk to human and environment. It can promote the change from the passive response to the active action through education and training of early warning information release system. The impact of corporate clean production come from the current development situation in domestic enterprises include the lack of enterprise standard operating procedures and staff awareness is not strong. The important function of early warning information release system is educating and training. Through educating and training to enable enterprises to adapt to and become familiar with the standard operating procedures. It is a set of working operating procedures for establishing the best and most reliable way to perform a task or operation. The overall goal of standard operating procedures is to maximize performance and minimize waste. Its purpose is to ensure the staff safety and improve the consistency of task execution, and reduce defective products, non-essential processing and changes, and ultimately improve the productivity and reduce the cost, and standard operating procedure is a powerful way which can let all staff involved in clean production [15]. This can promote clean production from passive to active action.

It needs to implement the concept "begin from myself, and begin right now, and strive to create a resource-saving, environment-friendly enterprise development strategy" for every employee, and strengthen the employee concept through early warning information release system. This idea affects every person, because every person's decisions or actions may affect the production, materials, energy, water or waste generation. Through the early warning information release system, it can make different levels of managers and employees, in particular, to let managers recognize the importance of clean production. It would carry out publicity and training through early warning information release system, and set up the idea of the management and staff that are part of enterprises [16]:

(1) To form good habits that "energy-saving and emission reduction is glory, and pollution and waste is disgraceful".

(2) To firmly carry out the proposal on "I offer a plan for energy-saving and emission reduction".

(3) To actively participate in the activity "saves once electricity, a drop of oil, a cup of water, a piece of coal and a piece of paper".

Thus, everyone a sense of clean production is deeply rooted in everyone:

- (1) To vigorously promote the clean production technology.
- (2) To carry out strict environmental standards and simultaneously plan medium/high cost of cleaning programs to encourage enterprises to implementing clean production.

Clean production of enterprise's region:

(1) People should seek flaw, find harm and reasons, offer advice and suggestions, and actively participate in "small innovations, small inventions, small remold, small innovation and small tips" according to the production and operation of link.

(2) Enterprises should actively optimize the process, improve work efficiency, reduce operating costs, prevent leaking, reduce the energy consumption, and improve the level of comprehensive utilization of resources. This will promote enterprise clean production. Every employee needs to develop the clean production concept. Factors that affect clean production behaviors.

The implementation of early warning information release system needs to require the attention and participation of all members of early warning information release system implementation in towns. Especially all leaders who implement a reward and punishment system for early warning information release in clean production should set an example. The purpose is to promote clean production in towns according to the standard organization to organize the production and operation activities, and carry out the work.

6.3 Strengthen government investment and security, promote early warning information release system implement in towns cleaner production

Early warning information release system which implemented in cleaner production are inseparable from the government investment and security:

(1) Policy measures. Encourage the government to introduce and refine the financial resources and tax guidance and incentive policies related to towns industrial disaster warning information.

(2) Financial measures. The government should not only increase and scientific detailed management capital on disaster warning information release, but also put the capital of disaster warning information release into the government budget and be protected every year.

(3) Personnel measures. Not only to regularly hire security experts to carry out industrial disaster control counseling, lectures, training, but also to actively introduce all kinds of high-end outstanding professionals, to actively solve the personnel problem which stabilize and promote industrial disaster warning information system to effectively work .

6.4 Strengthen on-site inspection, draw the ecological map, which lays the foundation for early warning information release system in towns clean production

In the on-site inspection, managers and workers inspect different areas of the site, record the observed hazards and risks, such as improper storage of chemicals, etc. On-site inspection personnel should also record the workers' perceptions of current operating conditions and parameters, because the employees who are most familiar with the potential hazards of a device or some of the tasks that usually represent the authority's point of view, it may not be obvious to those who are on the spot. The on-site inspection should be carried out many times in order to help confirm the progress of the implementation of the action and identify new problems.

The staff of early warning information release system should draw a variety of ecological maps after on-site inspection immediately. The ecological map is a simple and practical tool, which can visually display the area and can be used in combination with on-site inspection. The ecological map can be drawn for the entire business or for a specific workspace. In order to ensure that the ecological maps is simple and easy to understand, it should be based on specific topics or processes to produce a separate ecological map under normal circumstances, including: water and wastewater emissions, energy use, the formation of solid waste, odor, noise, dust, workers' safety and health risks. Each ecological map should contain all the relevant parts for specific issues, such as water and waste water

discharge ecological map, which must be precisely specified in various locations, including overflow, overflow, leakage, excess water, et al. Each area is clearly displayed with color coded or different symbols to distinguish the area that should be monitored and the area that needs to be dealt with as soon as possible. At the same time, equipment maintenance warning which including maintenance needs, maintenance activities, work cards, maintenance materials should integrate in the ecological map, it should check warning information related work before the repair work begins, which avoid omissions or errors that affect cleaner production. Such as Jian et al.[17] put forward a study on the evaluation of product maintainability based on the life cycle theory, Feng Liu et al. constructed an early warning model for the maintenance process [18].

6.5 Gradually improve the corresponding laws and regulations to provide a legal basis to implementing early warning information release system in towns clean production

China's existing laws and regulations don't explicitly let early warning information release system use in cleaner production, so the relevant legal responsibilities are unclearly defined. At present, in the document, we can find *Safety Law of the People's Republic of China*, *Clean Production Promotion Law of the People's Republic of China* and the State Environmental Protection Administration document: notice on printing and distributing the provisions on the clean production audit procedure of key enterprises, suggestions on implementation of the *Clean Production Promotion Law*, the economic incentive system of clean production and other legal system have been promulgated. Such as Feng and Liao put forward legislation, plans, and policies for prevention and control of air pollution in China: achievements, challenges, and improvements [19]. These laws and regulations will enhance the use of early warning information release system for clean production legalization, it has a certain guiding effect on the implementation of early warning information in towns cleaner production, such as Xu [20] researched the legal system of cleaner production. Finally, it should also speed up implementation (effectuate standard, push standard, achieve standard) in order to let early warning information release apply to clean production in towns.

7 Conclusion

The authors used the theory of energy accidental release as the theory of constructing early warning information in clean production. It will suggest that the staff of the early warning information release system should analyze the risk factors which hinder clean production, follow the order which contain elimination, weakened, sound and light prompts, resistance to implement early warning information release in order to control the accidental release of energy. In other words, early warning information release is to provide a security technology and management measures to reduce waste which is caused by poor maintenance of equipment, tools and materials placed at random, staff appearance being irregular and other undesirable phenomena, the waste included funding, facilities, personnel, morale, image, efficiency, quality, finished goods; that will improve staff post skills and clean production concept, reduce the pressure at the end of treatment, promote to transform implementation of clean production from formalization to operationalizing to habituation, promote the sustainable development in towns.

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