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2012 International Symposium on Safety Science and Technology Study on effect of product liability to inherent safety

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Abstract

Many industry accidents and product liability problems occur in China in recent years. The safety of products not only influences public daily life, also affects industrial production. Product safety concept reflects the attitude of people to product safety, and is reflected in product liability system. The influences of different product liability system to the status of inherent safety were studied based on the analysis of the doctrine of liability fixation in different technology development period. It can be seen that there were still many problems in the product liability acts such as the standard and identification of product defects, compensation liability, which were not beneficial to improve the industry safety though strict liability has been accepted in our country. Therefore, product liability system should be improved, and the method of design defect determination should be established. At the same time, carrying out the risk evaluation of the products, increasing the amount and scope of compensation are also important to realize the product safety and industrial inherent safety.

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1. Introduction

With the development of technology, new technology emerged constantly, the production equipment tends to be large-scale, complicated, and the production process tends to be automation while products are diverse. Some of equipments, tools, raw materials that used in production process are the products defined in legal, and the industrial production system and process can also be regarded as generalized product. Product safety not only relates to the average consumer daily life, but also affects industrial safety, especially inherent safety. Nowadays, many accidents occurred because of the design defect of equipments, tools and production process, etc. It is not enough to focus on the production process only to improve the safety level of the industry while ignore the product safety which is the foundation of industry safety.

Product safety problem has appeared many years in the developed countries, but it was just begun to take seriously in recent years in our country. The product liability systems which established with the development of technology and economy reflect the concept of product safety of human being. Foreign academics have analyzed the problem of product liability system, the effect of product liability to product and process design, etc[1-3]. There was little study has been done in our country in the concept of product liability, not to mention its effect to inherent safety of industry. Product liability acts have been issued in many developed countries, and some laws have been established though there was not special act in product liability in our country until now. But accidents caused by product defects increased in recent years. The product liability system did not play a role efficiently. It is significance to analysis the product liability concept and the problems exist in the product liability laws to search for specific countermeasures to prevention accidents.

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2. Development of product liability concept

Product liability is the legal responsibility of the product maker or sellers and other relevant main body that lead other people's physical or property damage (not including the damage of defect product itself) because of the defect product[4]. Product liability appeared with the development of modern industry, and its doctrine of liability fixation changed with the economy and technical development constantly[5]. It influenced the manner of enterprise's product liability prevention, and also affected inherent safety of industrial production.

2.1. Contractual liability

The industrial revolution finished in Britain which led to unusual social productivity development by the 1930s. High scientific and technological products became so complicated that it's dangerous to person and property become more and more difficult to detect by ordinary people, though it has benefit at the same time. Product liability problem started to increase and aroused attention with the increase of accidents caused by a defective product that caused consumer's injury and property losses.

Winter bottom v. Wright lawsuit was seemed as the earliest precedent which was about product liability case that UK Supreme Court accepted in 1842. This case established "no contract no responsibility" principle, namely the victim couldn't prosecute producers and sellers for personal injury due to the product defects if there were no contractual relationships between them. The victim only has rights to prosecute producers and sellers whose product did not conform to the contract and caused damage for compensation. This greatly reduces the compensation extent. Product liability law was custom to improve the economic development as the original intention.

Manufacturers have no responsibility for the employees' injury caused by defect equipment because there was no contract relationship between employees and manufacturers under the ideology of contractual liability.

Accident Proneness is the concept of safety production guidance at that time. The responsibility for the accident completely due to workers and business owners does not undertake any responsibility in an accident by this theory. Accordingly, accidents prevention work was focused on the selection of workers. Inherent safety concept has not been appearance.

2.2. Negative liability

Along with the progress of science and technology, the cycle of new technology was used to project shortens greatly. Industrial production process, mechanical equipment is becoming more complex and automated. Accidents due to mechanical equipment problems became more serious. More people realized that accident liability couldn't be left to workers for their inattention. It was important to pay attention to the mechanical and material risk in accident-causing.

The negative liability was adopt by the senate trial of British in 1932 based on Donoghue v. Stevenson case which broken the limitation of contract liability determined by contract relationship. The so-called negative liability means product manufacturers or sellers should take responsibility for the injury or damage caused by defect products because of the subjective mistake which caused consumers or users' damage.

The negative liability improved the development of the doctrine of liability fixation, and the product liability concept changed form "caveat emptor" to "seller notice". The theory of accident encounter and Crossed Track replaced Accident Proneness to be the main concept to direct accident prevention. The manufacture should take responsibility to the accident caused by the defect equipments.

It was difficult for the workers who got injured because of defective equipment to demand for compensation from equipment maker, because they had to prove that the equipment maker existence fault. This concept loosened the requirements for makers undoubtedly, and counted against the realization of the industrial safety.

2.3. Strict liability

Engineering increasingly large, more and more new materials, products, technologies were used. High energy, risk, investment, complex system emerged After 1950s and 1960s. It became more and more difficult for consumer to judge product defect.

In 1963, America's Greenman v Yuba Power Products case first confirmed strict liability principle. Under the strict liability principle, consumers don't have to prove maker existence fault, as long as proof of the damage is due to product defects or unreasonable dangerous situations, and this caused by defects or dangerous situation in the products have been

there when the product leave the control of manufacturer. Such regulation also makes the cases involving industrial damage increased sharply in the United States. In these cases, the equipment manufacturers become the defendant.

Strict liability makes the products maker of American enduring too much pressure that some of them think the strict liability has changed into absolute liability. In order to encourage product makers to develop new products actively and equal the benefit of producers and users, some new doctrine arises in recent years. These new doctrines include corporation responsibility, industry responsibility, market shares, etc. All these new doctrines belong to strict liability.

Under the strict liability principle, to avoid product liability damage, a manufacturer must consider product safety issues in design and manufacturing process, but not too much to users of the proposed requirements. Manufacturer had the responsibility to undertakes accident prevention. Modern accident prevention work should be done much earlier. The principle of strict liability created a condition for the realization of the inherent safety.

3. Product liability legal status and existing problems in China

Strict liability principle was determined in General Principles of the civil law in 1986 based on product liability law of U.S and product liability directive of the European Union. Product Quality Law specified the strict liability regulations for the loss of defective products in 1993. Tort Liability Law was issued in July 2010, which includes regulation of product liability in chapter V. Some regulations about recall of cars, food, medicines have been established and new standards replaced the old ones in recent years. The focus of product liability is on if the products have defects. Product safety should be guaranteed by the manufactures. But the situation of product safety didn't improved obviously depended on the law enforcement. There were still many problems in our laws such as defective determination standards, defective defenses and compensation, etc.

3.1. Product defect determination standards

The product defect refers to products have unreasonable danger. Product defects have always been divided into design defects, manufacturing defects, lack of warnings and instructions defects in foreign countries. Completely safe products do not exist in actual life. How safe is safe enough? This question must be answered to determine if the product have defect. It was very important to determine the standard of defect to make it more scientific and operational. And then the strict liability concept can be used correctly.

The acts about product liability in our country put forward two standards, namely the unreasonable danger standards and national standards and industrial standards to determine the defect of product.

The method for determination of unreasonable danger in Product liability acts of our country method is mainly take consumer expectations concept. It can be accepted in manufacturing defects era. With the development of technology, the product became complication and design defect increasing, consumer expectations concept showed its shortage in demonstrate design defect because it's subjectivity. This method cannot protect the interests of consumers sufficiently.

National standards and industrial standards are the basic standards to safeguard the safety of person and property. This standard can overcome the subjective defects for determination of product defect, but there are also many limitations.

- The level of National standards and industrial standards affects by existing technology level, makers' knowledge. So the standards are not necessarily reasonable advanced. If there have no complement and modification, there will be misleading. The product may appear "although conform to the compulsory standards but still have unreasonable danger".
- National standards and industrial standards sometimes have been controlled by manufactures in China. They have voice in the formulation of standards to try to reduce its responsibility, thus finally harm the interests of consumers.

Our product liability legal system is insufficient to prevent design defect. It counts against promoting enterprise to establish effective product safety management system to prevent accident liability.

Therefore, our country should adjust the relationships between unreasonable danger standard and national standards and industrial standards, determine that the "unreasonable danger" as the last standards discriminating defects. The classification of defects should be specific, and pay attention to the design defect prevention to promote the enterprise bear product liability and prevent accidents.

3.2. Identification of product liability

The identifications of product liability in China have a lot in common with the European and American countries and Japan. Our country borrowed ideas from these developed countries to formulate our defense in making product defects. But the total number is less than these countries. We have no identifications such as non-commercial purposes, government regulations, raw materials supplier's defense and special sensitivity defense.

Product Quality Law of China adopted the development risk from point of view of producers' defense. Our country encourages producers to develop new products, create social wealth under the low economic development level. But the use of technological development risk defense must clear the following problem. Technology level standard should take international scientific latest development level" as the foundation for judgment, not just with the current domestic technology level as the judgment standard. The obligation of producers must be cleared if defects would be found with the development of technology after the products in the circulation while they were not discovered before circulation. That is timely informing obligation of the producers and the department concerned to consumers.

There was no government regulation defense in the concerned laws of China, which affect the authority of influence standards and also makes producers disoriented. This is because standards are formulated and implemented by the relevant departments of the state. It is unfair for the producers to take responsibility for the mistake of standards that caused damage to users. Such regulation should be added as "producers don't assume responsibility if the product is in accord with the government issued compulsory standards even the products caused consumers' damage by its defects". But to ensure that consumers relief from failed, the state shall bear the liability for compensation. It was not influence and weakening national for product quality supervision and management, but can promote and perfect standards.

3.3. Compensation of product liability

Product liability system is relatively perfect in the United States. Our country's product liability system closes to American's from apparently look. But in fact, our country's product liability laws cannot be mentioned in the same breath regardless from compensation extent or compensation amounts with America. Consumers may demand compensation for the double in product damages in addition to product fraud, China following the actual damages principle. Consumers can not get its actual loss compensation according to this principle, especially consumers suffered the life and health damage. The amount of compensation for product liability cases with operator is far more less. The compensation was far less the benefits received, unable to achieve the purpose of prevention look from judicial practice in China. The provisions of the spirit of the compensation are still obviously deficiencies for defect product to damage. This situation is not beneficial to legislative objectives and basic function of Product Quality Law, and not conducive to the protection of victims' rights. This encourages the producers for cost saving and ignore the product quality to a certain extent.

The Tort Liability Law implemented in China in July 2010. It provided some special provisions for product liability, and made clear the product liability problem. These showed that our country becomes increasingly attention for product liability problem.

4. Effect of product liability situation to inherent safety in China

The concept of "product liability prevention" conceived based on "product liability" concept in the international community under strict liability legal constraints in recent years. The concept has been reflected in some international safety technology standard[6]. According to the concept of product liability prevention, the product designers must predict safety problems according to the principle of "the state of the art" to ensure the safety of products through the design[7-8]. Our country has introduced corresponding standards such as mechanical safety, safety instrument system and function safety, but due to lack of environment and conditions to enforcement, the standards were not imposed. This situation is bad to industrial safety realization obviously, for the mechanical and safety instrument systems are widely used in industrial production.

The products cannot achieve the necessary safety because of the product liability situation in our country. The lack of effective criteria to judge product defects, especially design defects made products manufacturing enterprises' lack of motive power of implant internal safety design and the effective method in product design process. Clear product liability defenses can make the enterprise and government each perform their own functions, promoting the update and effective implementation of the standards. Standard backward in industrial production field has been quite prominent in China. Establish suitable standards are the premise to solve the industrial safety problems.

The developed countries have formed combining system of industrial injury insurance compensation and product liability accident compensation system at present. The process of accident compensation is relatively complex and compensation limit comparatively low although exist two compensation mode for industrial injury accident compensation in China. Product liability and competition of industrial injury insurance relation has no clear rules. It is not conducive to promote the realization of industrial inherent safety.

Eliminate or reduce risk during the process of production technology and equipment design and manufacture, strengthening the safety management in the process, and improve the management of them during the using process, can only be effective control of the accident, and protecting workers' health and safety in industrial production. It is putting the

cart before the horse if ignore product safety countermeasures, such as hazard identification, risk assessment and risk reduction, and only introduced occupational safety and health management system, evaluation of equipment in the production workplace. The premise of safety management is using fully control hazard processes, equipment, mastering the craft, equipment state, so management system will work. It is important to strengthen product liability system construction, set up the product liability prevention philosophy and product liability prevention system in the enterprise internal, combine product liability with industrial insurance to fundamentally achieve industrial safety.

5. Conclusions

The influence of products liability system to industrial safety was analyzed based on the study of the development process of product liability. The problems in the product liability system were analyzed after the study of the present situation of products liability in our country. The following results could be induced from the study.

- Product safety is the foundation of industrial inherent safety. The product liability system affected safety situation of production equipments and process in industrial enterprise, which affected the inherent safety level in industry production. Strict liability doctrine can help to realize the goal of inherent safety.
- China has established product liability law system which focused on the identification of defects. But there were problems in the product defect determination standards, defect defenses and compensation which should be further adjusted and improved.
- Emphasis on product liability issues, strengthen the construction of product safety standards, perfect products liability legislation and establishing product liability prevention concept is the foundation to promote China's industrial safety.

References

- [1] Alberto Cavaliere, 2004. Product Liability in the European Union: Compensation and Deterrence Issues, *European Journal of Law and Economics* 18, p. 299.
- [2] S. Dowlatshahi, 2001. The role of product safety and liability in concurrent engineering, *Computers & Industrial Engineering* 41, p. 187.
- [3] Michael Braram, 2007. Liability and its influence on designing for product and process safety, *Safety Science* 45, p. 11.
- [4] Liu Jing, 2000. Product liability theory. China University of Political Science and Law Press, Beijing, China.
- [5] Willie Hammer, 2003. Occupational Safety Management and Engineering. Tsinghua University Press, Beijing, China.
- [6] Chen Baozhi, Wu Min, 2008. Etiologies of accident and safety concepts, *Journal of Safety Science and Technology of China* 4, p. 42
- [7] S.Dowlatshahi, 2001. The role of product safety and liability in concurrent engineering, *Computers & Industrial Engineering* 41, p. 187
- [8] Marvin Rausand, Ingrid Bouwer Utne, 2008. Product safety-principles and practices in a life cycle perspective, *Safety Science* 10, p. 1