

# Analysis on Safety Defect of Port Dangerous Goods Enterprise

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**Abstract:** As lots of Chinese petrochemical enterprises were established in coastal and inland port of China, several dangerous goods accidents happened in these years. Non-standard handling in port dangerous goods enterprises (PDGEs) is one of the root causes for the accidents. Safety production problems of PDGEs, which have no clear regularity, are potential threats to both human and environment. However, preventive strategies should be targeted at one or several specific safety production problem rather than all safety problems. Based on that, countermeasures are proposed according to investigations on defects and frequencies of non-standard behavior statistics of nine PDGEs, which comes from Chinese dangerous goods safety assessments of port in recent years. The countermeasures, aiming at standardizing safety production, improving condition of safety production and strengthening basic safety management of PDGEs, are of great significance to effectively prevent and resolutely curb the occurrence of accidents:

**Keywords:** Safety Assessments, Port Enterprises, Dangerous Goods, Safety Defects and Frequencies.

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## 1. INTRODUCTION

With massive construction of coastal and inland petrochemical port in recent years, there were more and more types of dangerous goods from port storage. The large number of major hazard sources has brought great pressure to safety supervision work. Dangerous goods accidents in port district occurred several times in these years, such as Xingang Port fire and explosion accident in Dalian of 2010, explosion accident in Huangdao Sinopec port in Nov, 22, 2013, "4.6" explosion of Gulei port in Zhangzhou of 2015, dangerous goods warehouse large explosion accident of Ruihai company in Tianjin port in Aug, 12, 2015. However, non-standard handling in PDGEs is one of the root causes for the accidents (G.S., 2005).

Safety production standardization (SPS) refers to establishing safety production responsibility system, to set out safety management system and operation regulations, to monitor major hazard sources and manage the risks, to establish prevention mechanism, and to regulate the production procedure. To make all the production procedures standardized according to regulations and codes, SPS is to ensure people, machine, material, method, environment, and measurement all in appropriate production condition, and to enhance safety production responsibility establishment of enterprises by continuous reformation (SAWS, 2016).

National committee on safety production standardization technical commission, which was also the first meeting of commission and held in Beijing on June 27th, 2006, marked the formal development of safety production standardization in China. On May 6th, 2011, Safety Committee of the State Council (SCSC) issued the *SCSC Guidance on Carrying out the Construction of Enterprise Safety Production Standardization* (2011 No.4), aiming at promoting the safety production standardization construction comprehensively, further standardizing safety production of enterprises, improving condition of safety production, strengthening basic safety management, effectively preventing the occurrence of accidents.

As the administrative department of port dangerous goods industry, Ministry of Transportation (MOT) issued *Notice on the Issuance of the Transportation Enterprise Safety Production Standardization Implementation Plan* (2011 No.322) on June 29, 2011, marking the transportation industry safety

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production standardization work officially started. Then, MOT issued *Transportation Enterprise Safety Production Standardization Assessment Management Measures*, *Transportation Enterprise Safety Production Standardization Assessment Indicators* and *Notice on the Issuance of the Transportation Enterprise Safety Production Standardization Management Measures and Assessment Indicators* (2012 No.175) in 2012, requiring enterprises to implement the notices according to their conditions.

Port dangerous goods enterprise safety standardization assessment and certification started from 2013 officially. In this three years, implementation of the enterprise safety responsibility is the principle line, and strengthening the "double base"(staff and working condition) of safety production is the main task. PDGEs enhanced their safety production level through standardization construction, for building a convenient, safe, economical and efficient integrated transport system, and providing reliable security in modern transportation industry.

## **2. PORT DANGEROUS GOODS SAFETY STANDARDIZATION EVALUATION CONTENT**

In port dangerous goods safety standardization evaluation, the first level of enterprises in safety production standardization evaluation requires a score more than 900 out of 1000; while the second and the third level of enterprises requires more than 800 and more than 700 out of 1000 separately. China Waterborne Transport Research Institute completed *The Assessment Rules for the Safety Production Assessment of First Level Port Dangerous Goods Enterprises* (the *Assessment Rules*). The *Assessment Rules* include 16 major categories, 51 evaluation points, 132 assessment deductions. The 16 category includes the goal of enterprise safety, management agencies and personnel safety, safety responsibility system, regulations and safety management system, safety investment, equipment, technology innovation and informatization, working team organization, operation management, hazard identification and risk control, potential hazard checking and controlling, occupation health, safety culture, emergency rescue, report for accident investigation and handling, performance evaluation and so on. The 16 category includes both "software" and "hardware" aspects of port enterprises. At the same time, the characteristics of *Assessment Rules* are as follows (K.Y. and S.L., 2012 & Y.Y., 2013):

1. There are not only conventional indicators, but also a number of rigid indicators. Rigid indicators are the main content in the clear requirements of relevant national laws, regulations, standards and codes, such as safety production management organization structuring and safety production management personnel allocation of dangerous goods enterprise in *Safety Production Law*. Rigid indicators are veto items to make the enterprise substandard by one deduction.
2. *Assessment Rules* highlight the dangerous goods, equipment facilities, and operation management, etc. Total scores of equipment facilities and operation management accounted for more than 1/4 of 1000 scores, reflecting the emphasis of "unsafe condition of goods" and "personnel's unsafe behavior". Therefore, regulating equipment facilities and operation management of enterprises lay the foundation of safety production.
3. *Assessment Rules* focus on continuous improvement. Following up laws and regulations update, management system, operation instruction and emergency plans revision in enterprise are taken into consideration and scored in *Assessment Rules*, which promotes attention of enterprise for continuous improvements.
4. *Assessment Rules* encourage science and technology innovation and informatization of enterprises. Although innovation of science and technology, and informatization development are not rigid indicators, they have high scores to show the importance of innovation and informatization to enterprises, which prompts enterprises to invest.

In addition, potential hazard checking and governance, hazard identification and risk control, occupational health, safety culture, etc. are all considered in *Assessment Rules*, which shows the importance of dangerous goods in assessment

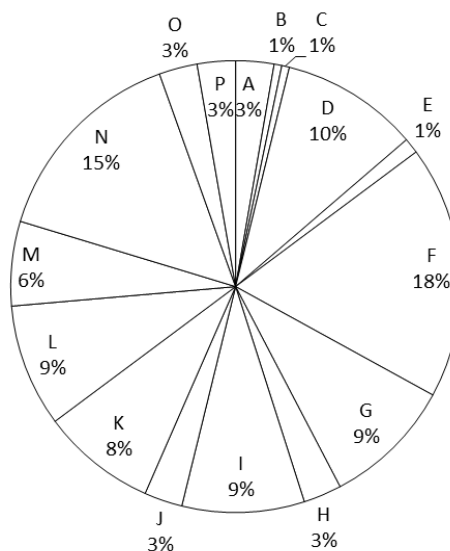
### 3. MAIN PROBLEMS

China Waterborne Transport Research Institute (WTI), as a first level safety production standardization evaluation organization for operation of port enterprises, has organized the evaluation of PDGEs in the northeast area of China, Jiangsu province, Zhejiang province, Guangxi province, etc. in recent years. Nine representative enterprises which are evaluated to be the first level of enterprises in safety production standardization are selected to analyze in this paper, and all dangerous goods ports belonging to these nine enterprises have ton class berths.

#### 3.1. Evaluation Classification

The defects of these nine enterprises are divided into sixteen categories. Figure 1 shows the statistic frequency of defects in nine dangerous goods terminal enterprises. If there are several deduction items in one category, the times of deduction should be cumulated. Meanings of the letters and times of the kind of category in Figure 1 are as follows:

A represents the goal of enterprise safety (5 times); B represents management agencies and personnel safety (once); C represents safety responsibility system (once); D represents regulations and safety management system (18 times); E represents safety investment (twice); F represents equipment (33 times); G represents technology innovation and informationization (17 times); H represents working team organization (5 times); I represents operation management (16 times); J represents hazard identification and risk control (5 times); K represents potential hazard checking and controlling (15 times); L represents occupation health (16 times); M represents safety culture; N represents emergency rescue (27 times); O represents report for accident investigation and handling (5 times); P represents performance evaluation (5 times).



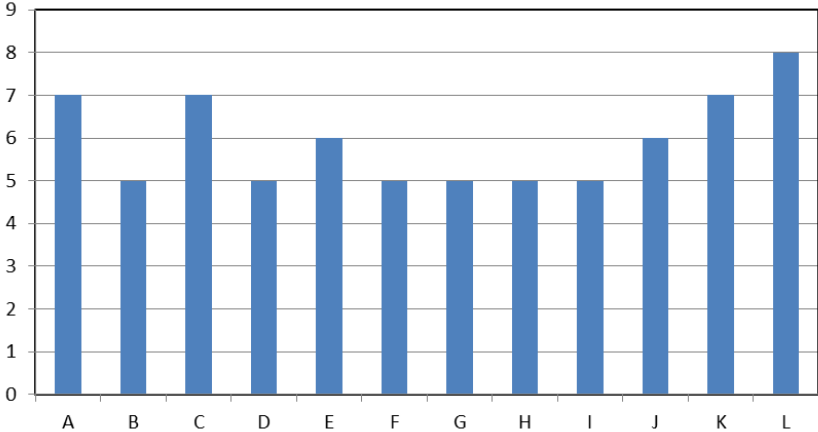
**Figure 1: Pie Chart for Statistic Frequency of Defects in 16 Categories**

As shown in Figure 1, items of equipment have the most deduction for 33 times, while items of regulations and safety management system have 18 times, items of technology innovation and informationization have 17 times and items of operation management have 16 times. Figure 1 shows that the standardization of equipment and facilities in PDGEs has the most serious problem, while the defect of emergency rescue is also prominent. And there are still many problems in implementing

regulations and safety management system timely and in the development of safety management system in enterprises. Therefore, investment in technology innovation and application of informatization is not enough, and there are still many deficiencies in operation management, handling management, and related business management. However, it is also shown in Figure 1 that PDGEs pay more attention on the management mechanism, personnel allocation and safety responsibility system, so the deduction items of the related two categories are not so much as items of the others.

**3.2. Analysis of Deduction Items**

There are 132 deduction items of the 16 categories in dangerous goods evaluation, while 71 items are deducted. Figure 2 shows the statistics of the 12 deduction items that accumulated more than 5 times.



**Figure 2: Comparisons of Deduction Items Accumulated More Than 5 Times**

In Figure 2, a represents identifying timely and obtaining safety regulations and management system (7 times); b represents turning regulations and related requirements into rules of enterprises and implementing the rules (5 times); c represents the required announcements, safety notices, and signs (7 times); d represents timely equipment maintenance for making equipment in good condition (5 times); e represents special equipment management with specific person (6 times); f represents enough anti-pollution emergency equipment configuration, such as: oil containment booms, oil-collectors, etc. (5 times); g represents carrying out scientific and technological project or research of safety production (5 times); h represents statistics analyzing of the potential hazard checking and controlling and submitting the results to the relevant departments (5 times); i represents occupation health training for employees, making them understand the risk factors, hazards, preventive measures and emergency measures of their workplace, to reduce or eliminate the matters with harmful consequences (5 times); j represents setting up emergency equipment records, regular inspection and maintenance, to ensure emergency equipment all in good condition (6 times); k represents plan, and revised and improved according to the change of the assessment results and the actual situation (7 times); l represents emergency plans coordinating with local government plans, reporting to the local departments, and notifying the relevant work units (8 times).

Figure 2 shows that the most accumulated points are in a (7 times), c (7 times), k (7 times) and l (8 times). The biggest problem that shown in Figure 2 is that enterprises didn't keep in touch with the local government in the emergency plan enough, which indicates that most enterprises did not realize this problem, or pay little attention on that. In addition, learning and updating of regulations and emergency plans in enterprises has not been supervised timely, so that there are still potential hazards in safety production.

**4. COUNTERMEASURES**

The statistics of the deduction items is representative and enlightening for safety management of enterprise. Combined with the analysis above, some countermeasures are encouraged to improve the level of safety management for PDGEs in following aspects (G.Z., B.C. and Q.C., 2012):

1. Facilities. PDGEs should equip with required buildings, venues, facilities, and equipment considering safety production and meeting the relevant safety standards and technology requirements. According to relevant provisions of the state, effective safety protection equipment for fire protection, lifesaving and environmental protection should be prepared.
2. Emergency. PDGEs must set up emergency evacuation channel and make corresponding emergency plans. Emergency plans should cover the comprehensive emergency plan, special emergency plan and on-site disposal plan considering real situation. Also, PDGEs should carry out emergency plan training, making relevant staff understand emergency plans, be familiar with emergency duties, procedures and disposal scheme. At the same time, emergency plan exercise should be organized regularly in accordance with the exercise plan.
3. Operation. PDGEs should make the maintenance system of the building, facilities, equipment, electrical lines and fire controlling facilities, and test special equipment regularly. The ship shore inspection system should be strictly implemented, following the requirements of *Safety Check List on Ship and Shore*, and handling as the procedures calling.
4. Personnel management. PDGEs should carry out technological innovation and application actively to improve the level of technology informatization, and equip with professional technician, manager and operation personnel based on enterprises' scale of operation and business scope. The inspection system should be strictly implemented, and designated personnel needs to manage the on-site hazardous work,;
5. Standardization. Formulation and timely revision of safety production rules for each post, establishment of various accounting and files and timely submission the relevant materials and information are all important job in standardization of enterprises. There are also more matters in practical work, such as safety production rules should be distributed to every worker, safety warning signs should be set up, and irrelevant personnel should be prohibited into the workplace, and other matters according to laws, regulations, rules or other content.

## 5. CONCLUSION

According to the actual work of port dangerous goods safety standardization assessment in recent years, countermeasures of standardizing enterprise safety production, improving production safety, and strengthening safety management are put forward based on the defect statistics of nine port dangerous goods enterprises, to effectively prevent and resolutely curb accidents. In further research, the number of enterprises will be increased hopefully to make the statistical data more general and representative.

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