

From Standardization to Intrinsic Safety the Dilemma and Breakthrough of Safety Supervision in Jiangsu Province Taking Nitrification Enterprises as an Example

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Abstract: After the construction of safety standardization in Jiangsu Province in 2011, some results have been achieved in the safety supervision of nitrification enterprises, but the standardization construction is also facing the dilemma of separating the standardized evaluation from the continuous operation. This paper reviews the series of measures taken by the Emergency Management Department of Jiangsu Province, such as suspending the acceptance of secondary standardization applications and clarifying the direction of nitrification intrinsic safety transformation, and discusses the breakthrough from standardization to intrinsic safety, which can provide references for the safety supervision of other industries.

Keywords: Standardization; Intrinsic Safety; Jiangsu Province; Nitrification Enterprises; Safety Supervision

1. Introduction

Since the establishment of the People's Republic of China, China's production safety regulatory system has experienced a tortuous and slow evolution. From the perspective of institutional change, Zhang and Yin divided China's work safety regulatory system into two stages with 1979 as the boundary: centralized work safety regulatory system and decentralized work safety regulatory system [1]. In the centralized stage, the regulatory functions are concentrated in the labor departments at all levels, and the government is almost the only spokesman for safety regulation. In the decentralized stage, safety supervision has the diversified features of "enterprise responsibility, industry management, state supervision and public

oversight". Combined with the history of government institutional reform, the author divides China's safety supervision into four stages: the first stage (1949-1979), the centralized supervision stage of the labor department; the second stage (1979-1998): the decentralized supervision stage of the labor department; the third stage (1998-2018): the supervision stage of the specialized safety agency; and the fourth stage: the supervision stage centered on emergency management (2018~). The current types of safety supervision can be categorized into comprehensive supervision, direct supervision and industry supervision. Safety supervision departments at all levels comprehensively supervise work safety in their administrative areas, directly supervise work safety in the fields of hazardous chemicals, industry, mining and commerce, and related industry sectors are responsible for safety supervision in their own industries.

2. Effectiveness of Safety Supervision of Nitrification Enterprises under the Idea of Standardization

Nitrification enterprises in Jiangsu Province started to create production safety standardization since 2011, and during the establishment of the Ministry of Emergency Management (MEM) in March 2018, all of them achieved standardization. The former State Administration of Safety Supervision (SAAS) issued a total of four batches of 28 hazardous chemicals practitioners' safety production standardization first-class enterprise list, of which there are five in Jiangsu Province (including one nitrification enterprise), accounting for 18% of the total, which is ranked among the top in the country. The level of system management, education

and training, site management and other elements of nitrification enterprises has been significantly improved.

2.1 Improved the Management System and Operation Procedures of Nitrification Enterprises

In accordance with the requirements of “Jiangsu Province Hazardous Chemical Enterprises Safety Production Standardization Evaluation Criteria (for Trial Implementation)”, the nitrification enterprise has formulated the following 12 rules and regulations in addition to the 32 rules and regulations required by the general specifications: process management, opening and stopping management, equipment management, building (structure) management, electrical management, utility management, easy-to-use poison management, and regular patrol system for hazardous chemical transmission pipelines, The 44 management systems basically cover all the business processes of safety production, standardize the procedures and standards of safety production, some systems such as the open parking management system [2], the regular patrol system of dangerous chemical pipelines, learn the lessons from previous accidents, summarize the experience of safety management, the introduction of the system to prevent similar accidents from happening again. The introduction of the system strongly prevents the recurrence of similar accidents.

At the same time, nitrification enterprises also according to the production process, technology, equipment and facilities characteristics and raw materials, auxiliary materials, product hazards, the preparation of equipment, processes and other professional safety regulations, and issued to the relevant positions, clear must “implement the prescribed action, strictly prohibit optional action” principle of operation, promote safety supervision from experience management into system management. It promotes the safety supervision from experience management to system management.

2.2 Improved Safety Knowledge and Skills of Employees

Article 35 of the Implementing Rules for Safety Training Management in Jiangsu Province issued on March 21, 2013 stipulates that the assessment of safety training should

adhere to the principles of separation of teaching and examination, unified standards, unified question bank, and hierarchical responsibility, and step by step implementation of computerized examination with remote video monitoring. The release of this document standardizes the education and training process of the “three categories of personnel” in safety production, changing the long-standing mode of teaching and examining as a whole, which is “paying the fee for the training, and passing the training”, so that the practitioners must complete the learning and mastering of safety knowledge and skills as stipulated in the syllabus in order to be qualified to take the exam. Practitioners must seriously complete the syllabus of safety knowledge and safety skills learning and mastery, in order to successfully pass the examination. Jingjiang City Safety Supervision Bureau to implement the examination review mechanism, and constantly improve the “three types of personnel” education and training quality. [3]

At the same time, the standardization for the first time on the entry of practitioners set up a threshold, requiring chemical enterprises in Jiangsu Province, the main person in charge, in charge of safety and in charge of the technical responsible person for more than 3 years of experience in the chemical industry, with a college degree or above; chemical enterprises full-time safety management personnel have national education chemical chemical or safety engineering secondary school education, more than 2 years of experience in chemical production related to the industry, or obtain a registered safety engineer practice of hazardous substances. Dangerous substances class registered safety engineer license, or chemical chemical class intermediate or above technical title; hazardous chemicals special operators with high school or the equivalent of high school and above education, with directly engaged in the operation of hazardous work position experience. This move has fundamentally improved the safety quality of the employees in chemical enterprises.

2.3 Standardized Equipment Management and Operation Management at Production Sites

Standardization in the field management set up two A-level elements, one is the production facilities and process safety, and the other is

the operation safety, although both are 100 points, but the weight is 0.20 and 0.15, respectively, is the standardization of the 12 elements of the two elements of the highest weight, and involves a total of 9 A-level veto items, 12 B-level veto items, the enterprise in the field management, if there are irregularities, it is difficult to get a high score. In terms of production facilities and process safety, the standardization puts forward requirements for the construction of production facilities, safety facilities, special equipment, inspection and maintenance, and other basic management, and promotes enterprises to improve the conformity of the basic conditions of production safety. It analyzes the information of production process equipment from the perspective of risk management, and considers the safety disposal countermeasures in case of opening and stopping, abnormal working conditions, and introduces the relevant requirements of process safety management in a more systematic way, which points out the direction for enterprises to improve the level of safety management.

In terms of operation safety, failure to implement hazardous operation permit management is a level A veto item, directly deducting 100 points, and failure to carry out hazardous operations with the corresponding operation permit is a level B veto item, with a one-time deduction of 40 points. The safety management of the operation process accounts for 40% of the value of this element, highlighting the importance of process safety. This element also focuses on contractor management, requiring enterprises to manage the process of contractor pre-qualification, selection, preparation before commencement of work, supervision of the operation process, performance evaluation and renewal of employment, signing a safety agreement with the selected contractor, to conduct a safety briefing at the work site to the contractor, and reviewing the contractor's safety operation procedures, construction programs and emergency plans, etc., which strongly improves the contractor's Safety Behavior. Through the establishment of the information platform for safety supervision of dangerous goods operations, the ports along the river have maximized the safety supervision benefits of the system and reduced the risks of dangerous goods operations in the ports [4],

which has accumulated valuable experience for the “five-in-one” safety production information platform that was firstly promoted by Jiangsu Province in the whole country later on.

3. Problems in Standardization Construction

The creation of standardization is to test its effectiveness through independent assessment by enterprises, third-party evaluation, and government supervision and management.

Scoring through access to accounts and on-site verification is simply categorized as “passed” and “failed”, leading to an increasing separation of standardization assessment and operation. Before the “3-21” special major explosion accident in Xiangshui Tianjiayi, the safety manager of a nitrification enterprise in Yancheng wrote an article in 2015 that there are often a lot of vacancies in terms of financial investment in safety, leading to an increasingly serious phenomenon of insufficient human, material and financial resources. The production equipment of many enterprises has been unable to meet the needs of enterprises to realize safe production construction [5].

3.1 Lack of Risk-based Safety Management Cognition

Standardization makes safety management professional and institutionalized, but it does not solve certain professional risk problems in safety management, such as process safety, equipment safety, electrical safety, instrumentation safety, etc. The standardization review process rarely involves professional risk management maturity evaluation, as long as there is a basic system, ledger, you can get the achievable score. Enterprises for “paper compliance”, dogmatically in accordance with the standardization elements to establish a documented system, only to meet the requirements of the standard specifications, and the lack of risk in conjunction with the actual development of safety management strategies cognitive, detached from the standardization of the promotion of enterprise safety supervision of the original intention, ultimately leading to standardization of the “two skins” scene.

3.2 Lack of Continuous Improvement System Management Thinking

Enterprises to pass the review for the purpose of the government to the certificate as a precondition for licensing, the creation of standardization as a “movement”, “get certified” and face-saving projects, one-sided pursuit of the form of standardization, enterprises in the standardization of standardization certificate will be bundled up on the shelves, self-hypnosis! Production safety management has entered a new height, the basic management and site management to lower the requirements; the government in the enterprise standardization, will also reduce the supervision of enterprise safety work and frequency. After the standardization of some enterprises, the production safety management system quickly stops running, and after a period of time, it returns to the previous state, or even worse than before. In areas where safety supervision is lacking, enterprises with a lower moral bottom line will eventually overcome those with a good conscience, thus requiring timely intervention by the government to maintain continuous and strong safety supervision.

3.3 Lack of Implementation of Safety Development Concepts

Standardization provides a convenient grip for enterprise safety management and government supervision, but the requirements for enterprise safety culture construction are insufficient, ignoring the real pursuit and needs of enterprises and governments for safety. In reality, enterprises, which are responsible for various things, face multiple influences such as economy, culture and morality, and the decision-making on safety production must struggle repeatedly between rationality and sensibility, inertia and innovation, and adherence and lack, and what they choose in the end is usually a coordinated program that all parties are barely satisfied with rather than the best program that is in line with the concept of safety development. Yima gasification plant “7-19” explosion accident investigation report shows that on June 27, the enterprise found that the air separation plant equipment abnormalities, as a hazardous chemical production safety standardization of the first level of enterprises, did not seriously carry out hidden trouble management, but

layers of instructions to report, and repeatedly weigh the possibility of shutting down until July 19, 15 dead and 16 injured in a major explosion accident. Injured in a major explosion on July 19, the lesson is extremely profound.

4. Safety Supervision Ideas of the Breakthrough

In January 2020, the Jiangsu Provincial Emergency Management Agency suspended the application for the second level of standardization review, kicking off the prelude to the reflection and remediation of standardization construction, and accumulating experience for the fourth phase of emergency management-centered safety supervision. Tracing the historical development of safety management, in 1978, Clements made a report entitled “What You Don't Have, Can't Leak” (What You Don't Have, Can't Leak) at the annual meeting of the British Chemical Industry Association, which was later called the “Essential Safety Management”. In 2020, the Jiangsu Provincial Emergency Management Agency issued a series of documents such as “Guidance on Further Enhancing the Intrinsic Safety Level of Nitrification Enterprises”, taking nitrification enterprises as a breakthrough to break the dilemma of safety supervision from the idea.

4.1 Strengthen Risk Assessment and Improve Safety Measures

Nitrification enterprises should carry out thermal stability tests for relevant raw materials, intermediate products, products and by-products, assess the operational risks of distillation, drying, storage and other units, establish thermodynamic research data accounts for each link of the nitrification process reaction and distillation, and screen the optimal control points of the reaction process based on the data of thermal characteristics such as the rate of heat release and the amount of heat release. Nitrification enterprises are required to carry out reaction risk assessment in accordance with the “Guiding Opinions on Strengthening the Work of Fine Chemical Reaction Safety Risk Assessment”, set up corresponding safety facilities according to the process hazard level and assessment recommendations, improve risk control measures, and ensure that the safety facilities

satisfy the process safety requirements. In November 2020, the Jiangsu Provincial Government issued the “Provisions on the Reporting of Risks to the Safety of Industrial Enterprises in Jiangsu Province” (Decree No. 140), which stipulates that industrial enterprises shall report on the risks of safety in production. Decree No. 140), which stipulates the identification, control and reporting of safety production risks of industrial enterprises as well as related supervision and management requirements, further improving the safety supervision mechanism based on risk management.

4.2 Promoting Process Improvement and Reducing Safety Risks

The provincial department has taken the lead in organizing, and municipal cities have urged newly reconstructed and expanded nitrification units to adopt continuous nitrification production processes such as microchannels, promote the application of mechanized and automated production equipment and facilities in the whole process, and reduce the number of on-site operators to the maximum extent possible. Nitrification enterprises are encouraged to adopt new processes and technologies, implement on-line volume reduction technology reforms for hazardous chemicals in the nitrification production process, and minimize the storage of raw materials, intermediate and final products with explosive hazard characteristics. Nitrification enterprises in the province are required to complete the automatic control system for the whole process of raw material treatment, reaction process, distillation and refining, and product storage (packaging) by the end of 2020, in accordance with the requirements of the “Provincial Emergency Management Office on the issuance of basic requirements for intrinsic safety diagnostic and governance notice”. Microchannel reaction technology can be applied to nitrification reaction [6], chlorination reaction [7], diazotization reaction [8], coupling reaction [9], hydrogenation reaction [10] and other intermediates unstable, highly exothermic and high-risk reaction. Taking a nitrification enterprise in Nantong as an example, three 2m³ reaction kettles were replaced by 1.2L microchannel reactors, the online liquid holding capacity was reduced by more than 99%, and the risk of reaction was

reduced from Grade 3 to Grade 1, so as to realize the automated management of the whole process, and the level of intrinsic safety was significantly improved. Bian et al. wrote that microchannel reaction technology is very effective in certain dangerous processes. [11]

4.3 Strict Access Mechanism to Maintain Safety Advantages

The Jiangsu Provincial Emergency Management Department issued the “Implementation Plan for Three-Year Action on Special Rectification of Hazardous Chemical Safety” in June 2020, which requires that all municipalities should formulate and introduce the access conditions for new chemical projects before the end of 2020, and formulate and improve the catalog of hazardous chemicals “banning, limiting, and controlling” before the end of June 2021, so that construction projects of explosive hazardous chemicals, such as ammonium nitrate, nitroguanidine, ammonium chlorate, etc., can be implemented in a timely manner. Explosive hazardous chemicals such as construction projects should be strictly controlled, strictly prohibit the elimination of backward production capacity of foreign settlements and parks into the area, according to the law to eliminate the production capacity can not meet the safety production conditions. Jiangsu Province every year through the enterprise self-inspection, park inspection, county and city verification, provincial supervision mode, make full use of the major sources of danger cross-checking each other, high-risk sub-division of the field of verification, verification of the renewal of certificates, law enforcement inspections, etc., timely attention, promote, update nitrification enterprise transformation information, to form a tight management of the closed loop, to ensure that do not meet the safety conditions of the nitrification enterprise eliminated on schedule withdrawal, and always maintain the safe development of a good The situation is always good for safe development.

5. The Deepening of Knowledge of Standardization

As the saying goes, “break and then build”, safety supervision is ultimately to be built on the management system. Wang and Jiang, through the analysis and research on the

standardization of special equipment safety supervision, found that the standardization of non-standardization is one of the main reasons leading to the frequent occurrence of special equipment safety accidents. [12] In the process of promoting safety supervision from experience management to professional management, it is necessary to further deepen the cognition of the purpose, role and ideas of standardization.

5.1 Understanding the Purpose of Standardization

Standardization can have one or more specific purposes, which may include, but are not limited to, variety control, usability, compatibility, interchangeability, health, safety, environmental protection, product protection, mutual understanding, economic performance, and trade. In short, uniformity is achieved through the development, publication and implementation of standardization for optimum order and social benefit. Taking product standards as an example, the purposes of standardization can be divided into two main categories: to ensure that products can be used normally and conveniently through standardization; and to ensure that the products or their production processes will not cause damage to the environment, people and so on. From the purpose can be seen, standardization is conducive to both enterprise development, but also conducive to government supervision, enterprises and the government in the standardization of the purpose of the construction is the same.

5.2 Sort out the Role of Standardization Management

Standardization management is a bridge between the government, enterprises and society, and doing a good job of standardization is a prerequisite for organizations to achieve modern management and scientific management. A new enterprise, once incorporated into the appropriate standards, can quickly obtain social recognition, government guidance and third-party assistance. Similarly, government departments in the face of safety supervision of new industries, the first thing to do must be to establish and improve the standardization system, publicity, promote standardization construction, and then regulate against the

standard, in order to achieve twice the result with half the effort. Therefore, we are not to achieve standardization to do standardization, but need standardization and good standardization.

5.3 Rationalize the Idea of Standardized Operation

Standardized operation follows the PDCA Deming management model, adhere to the prevention-oriented, whole-process control, continuous improvement of the idea, the essence of the operation is the actual situation of the organization, management habits and documented system to form a combination of standardized management requirements, through the continuous application of the management chain in the various and revised, and truly become a guide to the behavior of the enterprise's daily work and work procedures. Taking safety management as an example, the operation of production safety standardization follows the requirements of Article 25 of the Production Safety Law of the People's Republic of China, which is to establish rules and regulations, carry out training, risk management and control, emergency drills and exercises, and investigate and rectify hidden dangers. Closed loop. The integrity of each safety management chain is repeatedly tested in practice, and faults are found in time to analyze the causes and rectify them until the problems are solved.

6. Conclusion and Outlook

Since the adjustment of safety regulation ideas, by the end of 2023, there are 22 existing nitrification enterprises in Jiangsu Province, and 28 nitrification enterprises that do not meet the safety production conditions have withdrawn voluntarily. Among the remaining 22 nitrification enterprises, there are 13 (2 in 2020) adopting microchannel or tubular reactors, and 17 (13 in 2020) adopting continuous production methods. In the special rectification of nitrification enterprise safety in 2023, the average number of hidden dangers of nitrification enterprises in Jiangsu Province is 10.3 per enterprise (42.1 per enterprise in 2020), of which the number of major hidden dangers is 0.3 per enterprise (0.75 per enterprise in 2020), and the types of problems in the nitrification process key items of the problems accounted for a smaller proportion,

and there is no fatal accident of nitrification enterprises in 3 years, reflecting the fact that the intrinsic safety level and safety supervision level of Jiangsu nitrification enterprises have been improved. This reflects that the essential safety level of nitrification enterprises in Jiangsu Province and the level of safety supervision have been significantly improved. Combined with the dilemma of safety supervision in Jiangsu Province and breakthrough practice, the author suggests that we improve our work from the following three aspects in the future.

First, adjust the standardization audit method, from evaluation to certification, which elements of the standard to be certified, which does not meet the standard is not certified. When scoring the elements, reduce the weight of basic account information and increase the weight of safety culture and process control related requirements. It is recommended to clarify that the standardization certificate is not used as a precondition for all kinds of administrative licenses, so as to provide environmental support for enterprises to steadily promote the construction of standardization.

Secondly, the safety supervision mechanism should be adjusted so that the direct supervisory responsibilities are assigned to the competent industry departments, and the emergency management department should only take the responsibility of peddling for the emerging areas where the competent industry departments have not yet been clearly defined. It is recommended that the government not be held too accountable, and that policy support be provided for reducing the frequency of law enforcement inspections and establishing safety supervision based on the nature of guidance services for accident prevention.

Thirdly, the direction of safety publicity should be adjusted from “development is the first priority” to “safe development is the first priority”, and a code of ethics for public safety should be established, so as to promote the formation of the political wisdom of prevention as the main focus, the awareness of people-oriented responsibility, the strategic vision of intrinsic safety, and the strategic vision of compliance with rules and regulations in the community. strategic vision and behavioral ethics of compliance with rules and regulations, so that risk prevention and

safety have become the common consciousness and responsibility of the whole society.

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