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Reflections on the Establishment of a Risk Control and Supervision and Inspection Mechanism for Water Safety Production

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ABSTRACT

The new development concept puts forward higher requirements for the construction of water safety production management system. By analyzing the characteristics of water safety production, it puts forward the optimization plan of risk pre-control system and establishes a systematic risk management and control system. Based on the improvement of the policy implementation mechanism and the construction of the supervision and inspection system, the whole process safety management closed loop is formed. The research results are of great significance in enhancing the level of safe production management in the water industry, guaranteeing the safe operation of water facilities, and providing theoretical guidance for the practice of safety management in water enterprises.

KEYWORDS

Water Safety Production; Risk Management and Control; Supervision and Inspection Mechanism; Informationization Management.

1. INTRODUCTION

Water safety production is related to urban operation and livelihood protection, and is an important part of the urban safety system. With the acceleration of urbanization and the expansion of the scale of water facilities, water safety production faces new challenges. Under the new development concept, water safety production management needs to innovate ideas and methods, and build a scientific and effective risk management and control system. Starting from the characteristics of the water industry, exploring the establishment of an all-round, multi-level safety management system is of great significance to improving the level of water production safety management.

2. RISK IDENTIFICATION AND EVALUATION SYSTEM CONSTRUCTION

2.1. Risk Evaluation System of General Hazards

2.1.1. Establishment of Risk Evaluation Assignment Table

Water safety production risk evaluation assignment table is an important tool for scientific assessment of hazardous sources, through the establishment of grading and classification scoring standards, quantitative assessment of the hazardous degree of hazardous sources, the probability of occurrence and the scope of influence and other elements. The scoring system adopts a percentage system and sets different weights according to the type and characteristics of the hazardous sources, which mainly

includes core indicators such as the condition of equipment and facilities, operating environmental conditions, operational risks of personnel, and emergency response capability[1]. In the specific scoring process, combining historical accident data and expert experience, the scoring elements are refined and scoring rules are established to ensure the objectivity and operability of the scoring. The scoring results are divided into four levels, namely, major risk, major risk, general risk and low risk, to provide a basis for subsequent differentiated control. As shown in Table 1.

Table 1. Water safety production risk evaluation assignment table

Evaluation Element	Weight	Scoring Standard	Score Range
Equipment and Facilities Condition	35%	Perfect condition rate ≥ 95%; Condition rate 85%-95%; Condition rate 75%-85%; Condition rate < 75%	0-35
Working Environment Conditions	25%	Good environment, no adverse factors; Average environment, minor adverse factors; Poor environment, obvious adverse factors; Severe environment, significant adverse factors	0-25
Personnel Operation Risk	20%	Personnel certified, operation standardized; Personnel basically qualified, operation basically standardized; Personnel lack qualifications, operation not standardized; Personnel unqualified, operation not standardized	0-20
Emergency Response Capability	20%	Emergency plan complete, strong response capability; Emergency plan basically complete, general response capability; Emergency plan incomplete, weak response capability; Emergency plan missing, poor response capability	0-20

2.1.2. Improvement of the List of Hazardous Sources

A perfect list of hazardous sources is the basic work of risk control, and it is necessary to comprehensively sort out all kinds of hazardous sources in the process of water production. The list is compiled in a classified and hierarchical management way, and systematized according to the dimensions of process, workplace and equipment and facilities. The list of hazardous sources contains basic information about the sources, types of hazards, risk levels, control requirements, emergency measures and other key elements. In the process of list preparation, the specificity of water production is fully considered, and seasonal risks, regional risks and sudden risks are included in the management scope[2]. Through regular assessment and dynamic updating mechanism, it ensures the timeliness and accuracy of the list of hazardous sources, and provides comprehensive basic data support for risk management and control.

2.2. Hazardous Point Management

2.2.1. Formulation of Inspection Roadmap

Inspection roadmap is an effective tool to realize the systematic management of hazardous points, and to improve the inspection efficiency and coverage through scientific planning of inspection routes. The roadmap design is based on the distribution characteristics and risk level of hazardous sources, and adopts the grid management mode to divide the inspection area into several inspection units[3]. The route design takes into full consideration of geographic location correlation, operation timing and risk correlation to form the optimal inspection path. The inspection roadmap is presented in the form of an electronic map, labeled with key inspection areas, inspection frequency and inspection

points, and combined with mobile terminals to realize intelligent navigation and on-site positioning, effectively guiding inspectors to carry out their work.

2.2.2. Standardization of Inspection Process

The standardization of inspection process is a key link to improve the quality and efficiency of inspection, through the establishment of a standardized inspection process, to achieve procedural and refined management of the inspection work. Inspection process design follows the principle of "comprehensive coverage, focus, hierarchical management", and specifies the inspection frequency, inspection content and inspection standards. The inspection process is recorded by mobile terminals, and standardized records and real-time uploads are realized through electronic checklists to ensure the authenticity and timeliness of inspection data. The inspection results are linked with the risk evaluation system to realize dynamic risk assessment and early warning and provide data support for management decisions.

2.3. Risk Discovery Ability Enhancement Strategy

Risk discovery capacity enhancement is an important part of the construction of risk control system, and the accuracy and timeliness of risk identification is enhanced through multi-dimensional capacity building. Focus on strengthening the professional ability cultivation of inspection staff, carry out systematic theoretical training and practical training to improve the professional level of risk identification. Establishing incentive mechanisms for risk discovery, encouraging frontline staff to take the initiative to discover and report hidden risks[4]. Utilize information technology to assist in risk discovery, and enhance the scientific and technological content of risk discovery through intelligent monitoring equipment, online monitoring systems and other technical means. Establish a risk information sharing mechanism, summarize and promote risk discovery experience in a timely manner, and realize the accumulation and inheritance of risk management experience.

3. WATER PRODUCTION SAFETY MANAGEMENT UNDER THE NEW DEVELOPMENT CONCEPT

3.1. The Integration of the New Development Concept and Production Safety

The new development concept emphasizes the development ideas of innovation, coordination, green, openness and sharing, and its integration into the management of water production safety can effectively improve the level of safety management. Innovation concept to promote safety production technology innovation and management mode innovation, through digital transformation to enhance the effectiveness of safety management; coordination concept focuses on the balanced development of all aspects of safety production, taking into account the production efficiency and safety; green concept to guide the water safety production to the environmentally friendly direction of development, to achieve synergistic efficiency of safety and environmental protection; open concept to promote the exchange and sharing of experience in safety management and absorption of advanced management methods; sharing concept embodied in the safety of the water safety production management[5]. Management methods; sharing concept embodied in the safety development results shared by all staff, mobilize all staff to participate in the enthusiasm of safety management. The integration of the new development concept injects new kinetic energy into water safety production and promotes safety management to a higher level.

3.2. Analysis of the Characteristics of Water Conservancy Safety Production

Water safety production has significant industry characteristics, involving a wide range, high technical requirements, strong seasonality, regional differences. Water facilities are widely distributed, from water extraction, water production to water transmission and distribution to form a

complete production chain, each link has different safety risk characteristics; the production process involves mechanical, electrical, chemical and other professional fields, the technical quality of the operating personnel requires high; water production is affected by the seasonal impact of the obvious, flood season and dry season there are different safety risk characteristics; water conditions in different regions, climate characteristics, geographic environment, the formation of unique regional safety management needs. There are differences, forming unique regional safety management needs[6]. These characteristics determine the water production safety management must take targeted management measures to establish a safety management system to adapt to the characteristics of the industry.

3.3. Optimization of Risk Pre-control System

3.3.1. Forward Movement of Gate Strategy

The strategy of shifting the gate forward emphasizes the front-loading of safety management, and shifts from post-disposal to pre-prevention. In the project planning stage, safety risk assessment is incorporated into the feasibility study to identify potential risks from the source; in the engineering design stage, the concept of intrinsic safety is integrated, and advanced technology and reliable equipment are adopted; in the construction stage, the quality of construction is strictly controlled to ensure the safety of engineering and construction; and in the operation stage, the prediction and early warning mechanism is set up to detect and eliminate potential safety hazards in advance. By moving the gate forward, we have built up a whole-process, omni-directional safety prevention system to minimize the probability of safety accidents and improve the intrinsic safety level of water production[7].

3.3.2. Center of Gravity Mechanism

The mechanism of sinking the center of gravity emphasizes extending the center of gravity of safety management to the grass-roots level and enhancing the safety management capacity of the grass-roots level. Through improving the organizational structure of grass-roots safety management and equipping full-time safety management personnel, it strengthens the strength of grass-roots safety management; increases grass-roots safety investment, improves the working environment and safety protection facilities; carries out grass-roots safety education and training to improve the safety awareness and operation skills of front-line employees; establishes a grass-roots safety information reporting system to smooth the channels of uploading and downloading safety information; and implements the grass-roots safety performance assessment to mobilize the enthusiasm of grass-roots safety management. The implementation of the mechanism of sinking the center of gravity has helped the company to realize its vision of safety management[8]. The implementation of the mechanism of sinking the center of gravity makes the safety management closer to the actual production and improves the pertinence and effectiveness of safety management.

4. SYSTEMATIC RISK MANAGEMENT AND CONTROL SYSTEM CONSTRUCTION

4.1. Source Prevention Mechanism

Source prevention mechanism is the most basic and effective means of prevention and control of water production safety management, through the implantation of safety management concepts in the early stages of project construction, to achieve the risk prevention gate forward. In the project planning and design stage, fully consider the safety elements, the use of intrinsically safe equipment and facilities, optimize the production process, fundamentally eliminate or reduce safety risks. In the project construction stage, strictly implement the requirements of simultaneous design, construction and commissioning of safety facilities and the main project to ensure the quality of construction. In

the staffing link, establish a strict access system, clear job qualification requirements, select operators with professional quality, to lay a talent base for safe production. The establishment of the source prevention mechanism effectively prevents the generation and accumulation of safety risks.

4.2. System Governance Program

The system governance program adopts global thinking, considers the safety management needs of all aspects of water production, and builds a complete safety management system. The program design is based on the characteristics of water production process, systematic analysis of water intake, water production, transmission and distribution of water and other links to identify key risk points and control priorities. Establish a hierarchical management structure, clarify the responsibilities of safety management at all levels, and form an up-and-down and horizontally coordinated management network. Integrate all kinds of safety management resources, optimize resource allocation and improve management efficiency[9]. Establish a safety information management platform, realize real-time collection, analysis and sharing of safety management data, and provide data support and decision-making basis for system governance.

4.3. Special Rectification Plan

The special remediation plan focuses on key and difficult problems in water safety production and carries out targeted remediation actions. Through problem identification, determine the focus of remediation, including equipment and facility hazards, hazardous operations management, special equipment management, hazardous chemicals management and other key areas. Develop a detailed remediation program with clear remediation goals, remediation measures, division of responsibilities and time nodes. Set up a system for canceling problems, establish accounts for problems found, and implement closed-loop management. Regular assessment of remediation effects is carried out to summarize the remediation experience and solidify the remediation results[10]. The implementation of special remediation has effectively solved the outstanding problems in safety management and improved the overall safety management level.

4.4. Improvement of Control System

Improvement of the control system is the institutional guarantee to regulate the behavior of production safety, through the establishment of sound rules and regulations, to provide a systematic basis for production safety. The system covers the whole process of production safety, including the production safety responsibility system, safety operation procedures, hidden danger investigation system, emergency management system and so on. The design of the system focuses on practicability and operability, takes into full consideration the actual needs of the grassroots, and facilitates implementation and realization. A system evaluation mechanism has been established to regularly assess the effectiveness of system implementation and promptly revise and improve system provisions that are not adapted to actual needs. Through the construction of the system, production safety behaviors at all levels have been standardized, and the standardization level of safety management has been improved.

4.5. Implementation of Control Measures

The implementation of control measures is a key part of safety management, focusing on the transformation of safety management requirements into concrete actions. Establish an inspection and assessment mechanism to regularly check and evaluate the implementation of control measures to ensure that the responsibilities are in place, the measures are in place, and the inputs are in place. Implement the grid management mode, the control responsibility is detailed to each area, each position, to achieve comprehensive coverage, no dead ends management. Strengthen the process of control, do a good job of site management, timely detection and disposal of various types of safety

hazards. Establish incentives and constraints mechanism, the implementation of control measures and performance appraisal linked to mobilize the enthusiasm of the implementation of control measures at all levels. Through the implementation of effective measures to ensure that all safety management requirements are carried out.

5. MECHANISMS FOR IMPLEMENTING WORK SAFETY POLICIES

5.1. Improvement of the Policy System

The construction of the water production safety policy system needs to be comprehensively benchmarked against the relevant national laws and regulations, combined with the characteristics of the industry and the actual situation of enterprises, to build a multi-level, full-coverage policy framework. In the process of policy development, pay attention to the systematic and coordinated nature of the policy to form a policy network of up and down convergence, left and right linkage. The content of the policies covers various aspects of the work safety responsibility system, safety investment and security, safety education and training, emergency management, and the investigation and management of hidden dangers. The policy formulation process has widely solicited opinions from the grassroots to ensure that the policies are highly relevant and operable. A mechanism for dynamic updating of policies has been established to adjust and improve the content of policies in a timely manner in the light of practical experience and new requirements, so as to maintain the currency and applicability of policies and provide solid policy support for work safety.

5.2. Enhanced Implementation

Enhancing the implementation of policies is a key aspect of ensuring that production safety policies are effective. Through the establishment of a sound policy implementation mechanism and the use of various forms of policy interpretation and training, we ensure that personnel at all levels accurately understand and grasp the spirit of the policy. Strengthening the organizational guarantee for policy implementation, clarifying the division of responsibilities among institutions and personnel at all levels in policy implementation, and establishing a smooth policy transmission mechanism. It has strengthened the supervision and inspection of the policy implementation process, and utilized information technology to realize the whole process of tracking and management of policy implementation. Problems found in the implementation of policies are analyzed and studied in a timely manner, and effective measures are taken to promote solutions and ensure that the implementation of policies is not out of shape or distorted. The effectiveness of policy implementation has been effectively enhanced through a variety of measures.

5.3. Appraisal and Incentive Mechanism

The appraisal and incentive mechanism is an important means to promote the effective implementation of production safety policies. Establish a scientific and reasonable appraisal index system, combine production safety objectives with business performance appraisal, and highlight the important position of production safety in the overall work. The assessment includes the implementation of production safety responsibilities, the use of safety inputs, the implementation of safety management systems, and the control of safety accidents. Establish differentiated assessment standards and set reasonable assessment requirements for different levels and positions. Improve the incentive and constraint mechanism, link the assessment results with the evaluation of excellence and priority, remuneration and treatment, and fully mobilize the enthusiasm of all levels to do a good job in work safety. Regular assessment and evaluation will be carried out to summarize the lessons learned and continuously optimize and improve the assessment and incentive mechanism.

5.4. Accountability System

Accountability system is an important safeguard measure for production safety management, which strengthens the awareness of production safety responsibility at all levels through a clear accountability mechanism. The accountability system specifies the object, scope, circumstances and treatment of accountability, and seriously deals with cases such as failure to implement the responsibility for work safety, ineffective rectification of hidden safety hazards, and occurrence of safety accidents. The establishment of a hierarchical accountability mechanism, according to the nature of the problem and the degree of impact caused by the corresponding measures to deal with. Accountability process adhere to the principles of fairness and impartiality, seeking truth from facts, to ensure that the results stand the test. At the same time, we focus on the warning and educational role of accountability, through the notification of typical cases, to form a strong deterrent effect, and to promote the effective fulfillment of the responsibility of production safety at all levels.

6. CONSTRUCTION OF SUPERVISION AND INSPECTION MECHANISM

6.1. Supervision and Inspection System Design

The supervision and inspection system is designed based on the principle of comprehensive coverage and focus, and a multi-level, three-dimensional supervision and inspection network is constructed. In terms of organizational structure, establish an inspection mechanism led by the safety management department and coordinated by all functional departments, and make clear the inspection responsibilities and authority of each level. The inspection content covers the implementation of the production safety management system, the operational status of equipment and facilities, the management of work sites, and the operational behavior of personnel, forming a complete inspection list. According to the risk level and management needs, the frequency and depth of inspection are reasonably determined to ensure the scientific and effective supervision and inspection work. Establish a standardized inspection system, unify inspection specifications and requirements, and improve the standardization level of inspection work. Formulate the workflow of supervision and inspection, standardize the inspection procedures, and ensure that the inspection work is carried out in an orderly manner.

6.2. Innovation in Inspection Methods

Inspection method innovation focuses on the use of new technologies and methods to enhance the effectiveness of supervision and inspection. Through mobile terminals, Internet of Things sensors and other intelligent equipment, remote monitoring and real-time monitoring are realized to improve the timeliness and accuracy of inspection. Implementing the “Internet+” inspection mode, establishing an inspection system combining online and offline, and realizing real-time uploading and analysis of inspection data. Adopting big data analysis technology to deeply mine inspection data, identify safety risk trends and patterns, and provide a basis for accurate inspections. Carry out cross inspections and mutual inspections and evaluations to break down departmental barriers and improve the objectivity and comprehensiveness of inspections. Introducing third-party professional organizations to participate in inspections, and improving the quality of inspections with the help of professional power. Innovative inspection methods have effectively improved the pertinence and effectiveness of supervision and inspection.

6.3. Problem Rectification Tracking

Problem rectification tracking is a crucial link in the supervision and inspection work. By establishing a sound problem rectification mechanism, we ensure that the problems discovered during inspections are effectively solved. We establish a problem rectification ledger, categorize and register the

problems discovered, and clearly define the responsible personnel and rectification deadlines. We utilize information technology to achieve full-process tracking and management of problem rectification, allowing us to grasp the progress of rectification at any time. We establish a rectification acceptance mechanism, conduct on-site verification of rectification completion, and ensure the quality of rectification. For problems that are not rectified or rectified inadequately, we take timely measures such as interviews and notifications to ensure that rectification work is implemented. We regularly analyze the rectification situation, summarize rectification experiences, and promote rectification achievements to continuously improve the quality of rectification work.

6.4. Construction of Informationized Supervision Platform

The construction of an informationized supervision platform aims to create an intelligent and digitalized supervision management system. The platform architecture adopts a distributed design, realizing integrated management of data collection, transmission, storage, analysis, and display. The platform's functional modules include real-time monitoring, hidden danger investigation, rectification tracking, statistical analysis, and early warning prompts, meeting the regulatory needs of various levels. We utilize the Internet of Things (IoT) technology to achieve online monitoring of key equipment and facilities, establishing a database of equipment operating status. We use artificial intelligence technology to conduct intelligent analysis and early warning of safety risks, enhancing the foresight and proactivity of regulation. We develop mobile applications, enabling real-time uploading of on-site inspection data and rapid handling of problems. Through the construction of the informationized platform, we significantly improve the efficiency and quality of supervision and inspection work.

7. CONCLUSION

This study constructs a water safety production risk control system, perfects the risk identification and assessment mechanism, and establishes a systematic risk control framework. Through source prevention, process control, and accountability, we form a comprehensive safety management network. The new development concept-led safety production management model promotes the improvement of the water industry's safety management level. The innovative application of supervision and inspection mechanisms and the construction of an informationized platform provide strong support for safety management. These measures jointly construct a scientific and effective water safety production management system, laying a foundation for the industry's safe development.

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