CNPO "3+6", Exploring a New Safety Management and Control Mode for Nuclear Power In-service Inspection

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Abstract. CNPO explores a new mode of high-level field management that can cure the root cause from the three basic laws that are easily ignored by the management. By constructing six safety culture systems with the characteristics of nuclear power enterprises, CNPO strives to improve the safety quality of employees in nuclear related enterprises and continuously consolidate the foundation of safety management.

Keywords: Safety culture; Nuclear safety; Standardized management; Enterprise management; Nondestructive testing.

1. introduction
Aristotle, a famous Greek scholar, once said that career is the vivid unity of idea and practice. In recent years, generations of CNPO people have taken "safety is the lifeline of the nuclear industry" as the concept, committed to ensuring the safe, reliable and economic operation of nuclear facilities, and deeply integrated the concept and practice. With assured safety to promote the efficient development of nuclear power; with reliable quality to ensure the safety of nuclear power projects; with professional management to create the most outstanding value, adhere to their duties, do not forget the original intention, strive for excellence and inherit the ingenuity. More than 30 years have witnessed the vigorous development of China's nuclear power industry; more than 13000 days and nights have witnessed the hard work of the Wuhan people of CNNC and made positive contributions to the national economic and social development.

2. Return to the three basic laws
In 2017, the National Development and Reform Commission, the Energy Administration, the Ministry of Environmental Protection, and the National Defense Science and Technology Industry Bureau launched a special action on the "Nuclear Power Safety Management Improvement Year" in the field of China's nuclear power industry safety management; in the same year, the Standing Committee of the 12th National People's Congress The 29th meeting was held, and the "Nuclear Safety Law of the People's Republic of China" was born; in April 2018, China and the United States held the third dialogue on nuclear safety-related issues. The two sides assessed the current international nuclear safety situation, Policy measures in security and nuclear emergency are discussed. In April 2020, 17 ministries and commissions including the Ministry of Ecology and Environment, the United Nations Bureau of Science, Technology and Industry for Defense, and the Joint Coordinator of the Military Commission organized the April 15 National Security Education Day propaganda activities...Although governments at all levels...
attach great importance to safety, many companies have also made great efforts Focus on safety, but why do large, medium, small and even major accidents always happen? Let us combine CNPO's nuclear power service inspection business and return to the three basic laws that are easily overlooked!

2.1. It’s a Basic Law That The Service Inspector is Also a Human Being and Can’t Stay on The Post All The Time Without Asking For Leave

CNPO involves a wide range of nuclear power service inspection business and complex inspection equipment. For personnel who have never been engaged in a specific work, the risk of negligent operation is high. Therefore, the company once faced the embarrassment that the person in charge of a project asked for leave and led to work stagnation. In order to solve this potential safety hazard, CNPO started the standardization process in 2017, continuously standardizing the on-site production and daily management activities, and constantly adjusted and optimized the implementation scheme of standardization through organizing meetings for many times. After nearly three years of vigorous promotion, Jiangsu branch alone has completed more than 200 standardized processes, including more than 80 on-site inspection standardized processes such as surface inspection, ultrasonic inspection, radiographic inspection, valve diagnosis, skill training, pre job meeting, etc.; more than 40 standardized processes of plan and project management such as plan management, business management, on-site technical services; more than 120 standardized processes of comprehensive affairs management, such as comprehensive affairs handling process and informatization of comprehensive affairs, establishment and operation of server file management system, establishment and operation of diskless office system, equipment management and maintenance, on-site quality control, emergency drill, etc. Through the establishment of the standardized process, from the implementation of a complex inspection project to the preparation of a site document, and the management randomly designates a person, he can complete the task of this post quickly, accurately and safely, which breaks the helplessness of one person leaving his post leading to temporary suspension of work.

2.2. It’s a Basic Law That The Service Inspector is Also Sentimental, and Can’t Deal With Things All The Time Without Being Surprised, Not Chaotic, and Not Trapped in Emotion

No matter how serious a nuclear power inspection worker usually works and how many times he is rated as an excellent worker, he may be distracted from his work due to various conditions in his life. Many things in life may greatly affect a person's mental state. It is precisely because people are affectionate that inert emotions will inevitably appear in work, which will affect the results of work. During a shutdown overhaul of a nuclear power plant, when the staff of the national nuclear safety administration asked how to determine the inspection scope of a certain equipment, the answer was: the same was true for each overhaul before. When a person does the same thing for a long time, it will produce inertia. They will not check and check strictly according to the standard, but work according to "it was like this before". Managers can't expect employees to see the right test range in their minds as soon as they see the subject. So, how can we make the workers do it right and do it well? This requires that management must be humanized. Managers of enterprises need to find ways to reduce workers' work intensity and reduce human errors.

CNPO Jiangsu Branch has compiled and revised more than 170 versions of safety specification operation instructions for 7 kinds of nuclear power nondestructive testing methods, such as ultrasonic and radiographic methods, combined with the characteristics of each inspected object. Taking pipeline automatic ultrasonic inspection as an example, in the "pipeline automatic ultrasonic inspection operation instruction", the environmental conditions of the inspection site, the existing risks, the surface state of the inspected parts, the installation methods and precautions of the inspection equipment, and the setting of the acquisition software parameters are specified in detail, so as to let people know where and how to inspect after reading the operation instruction Check, put an end to the operation by memory.
2.3. It is Also The Basic Law That The Service Inspector is a Whole and Needs to Rely on Everyone to Ensure The Correctness of Its Work

In real life, the managers of many units always like to emphasize the importance of individual subjectivity unilaterally, and require everyone to keep a high sense of responsibility. Obviously, it is very difficult to ensure the safety of work only by this kind of management thought, because managers can not expect everyone to have the same sense of responsibility as themselves. Because, first of all, the sense of responsibility is linked to the position. It is found that the sense of responsibility of the person in charge of the work is generally higher than that of the team members. In short, the higher a person's rank is, the stronger his sense of responsibility will be. Secondly, the level of responsibility varies from person to person. For a department, some employees give the leadership the impression of strong sense of responsibility, while others leave the impression of poor sense of responsibility. Second, responsibility varies with time. A person with a strong sense of responsibility in the past may no longer hold a key position of a job due to job adjustment or be disheartened because he has not been promoted and so on. Therefore, since there are variables in the sense of responsibility, we can not rely on the sense of responsibility to ensure the safety of work, but should rely on the strength of the team. This requires management visualization, so that any operation on site can achieve "correct" and "error" at a glance.

When the executor of a post lacks the sense of responsibility and does not operate according to the standard, anyone in the unit can find the operation deviation when passing through the post, so as to urge the executor to quickly return to the standard working state. In order to achieve such an ideal management mode, CNPO regularly carries out various safety education and training for all on-the-job employees, and empowers the part-time safety officer to those who perform well. The authorized staff can be the part-time safety officer of the team, and has the right to correct the unsafe state of the team members at the first time. In addition, the company encourages employees to obtain nuclear industry NDT qualification certificates as much as possible (take Jiangsu branch as an example, currently each has 4-5), and urges everyone to understand the principles and operation specifications of various testing methods, so as to support and supervise each other in daily work, and strive to make sure that anyone can judge the abnormal situation, and the judgment results will not vary from person to person Speed judgment, and high accuracy of the three goals.

3. Build six systems and consolidate the foundation of safety culture construction

Safety is the lifeline of nuclear industry, and ensuring the safe operation of nuclear power station is the primary condition for the development of nuclear industry. Nuclear safety is the premise and foundation for the development of nuclear industry. CNPO always takes the overall national security concept as the overall situation, adheres to the high and strict standards, controls the whole chain and the whole process, and strives to promote the healthy development of nuclear industry with lasting safety. The company firmly establishes the people-oriented concept and takes not sacrificing life as an insurmountable red line. Actively cultivate the nuclear safety culture, firmly establish the concept of "everyone is the last barrier", and establish a scientific, systematic, active, advanced and comprehensive safety hidden danger investigation system, so as to make the safety prevention work link by link and prevent the trouble in the bud.

3.1. Safety Culture System

Throughout the development of China's nuclear power industry, from the "glory of the country" of Qinshan nuclear power plant to the construction of Hualong No.1 nuclear power plant in Fuqing nuclear power plant, to the development and construction of advanced reactor types such as multi-purpose reactor and fast reactor in specific market, Chinese nuclear power people, as pioneers and leaders of China's nuclear power industry, have been pursuing excellence for more than 30 years Nuclear power industry. With the development of China's nuclear power for more than 30 years, the profound culture accumulated is the excellent culture of China's nuclear power. As the gene of the company's culture, excellence has been integrated into the company's management, ensured nuclear safety, achieved business performance, cultivated excellent talents and led the company's development.
Excellence culture tree is the logical expression model of the development context and value composition of Chinese nuclear power excellent culture. It is based on the socialist culture with Chinese characteristics, which is the "soil" with deep roots and luxuriant leaves, and symbolizes the era background of the company's cultural independence; it takes the nuclear industrial culture as the source, which is the "nutrient" for the tree to maintain its vigorous growth and the source of strength for the company's cultural confidence; it takes the nuclear safety culture as the root, which is the tree's unshakable "root" and symbolizes the company's survival; It takes nuclear safety as its lifeline, which is the soul and core of Chinese nuclear power enterprise culture; it is guided by the pursuit of excellence, which is the "backbone" of sustainable growth and symbolizes the practical process of self-improvement of corporate culture. It is characterized by subsidiary company culture, which is the "branch and leaf" of the tree absorbing sunlight, symbolizing the inclusive atmosphere of the company culture.

As a member company of China nuclear power, CNPO, while carrying forward the spirit of "two bombs and one satellite" and "four everything" nuclear industry, continues the value pursuit of "making a living on this basis, being proficient in this way" and "being precise, sincere, human and cooperative", CNPO continues to strive to cultivate enterprise culture with its own characteristics, and combines the continuation of its excellent corporate culture with the excellent cultural system integrated into China's nuclear power. Together, find out the path of practicing the "fastest curve" and move towards a common direction, and create a unique corporate culture based on the unified core values.

3.2. Safety Concept System

The state-owned enterprises are an important pillar and support force for our party's ruling and rejuvenating the country. CNNC is an important state-owned backbone enterprise, shouldering the mission of strengthening nuclear power and peaceful utilization of atomic energy to ensure national energy security. In the new era, the new CNPO will fully implement Xi Jinping's new socialist philosophy with Chinese characteristics and the community of human destiny, and continuously promote the comprehensive innovation with the core of technological innovation, thoroughly implement the development strategy driven by technological innovation, realize security development and create new development, and contribute positively to China's economic and social development and China's dream.

3.3. Safety Commitment System

As engaged in the design and service of nuclear safety machinery and equipment, the design, development and service of special equipment and tools for the inspection and maintenance of nuclear power facilities, the pre-service/in-service inspection of nuclear power facilities, the reliability analysis and research of nuclear power facilities, the development and service of aging management, and nuclear equipment For maintenance services and other nuclear power operation technical service units, CNPO always adheres to the implementation of the above tasks under the premise of nuclear safety, and strives to create a cultural atmosphere in which the public respects nuclear safety, employees guard nuclear safety, and the whole people cherish nuclear safety.

The company has always attached great importance to the construction of nuclear safety culture, and has continuously practiced the concepts and principles of nuclear safety culture in all aspects of daily nuclear power service inspection and overhaul, new inspection technology and equipment research and development, and supervision. In the face of the current rapid development of the company, the company will more actively advocate, cultivate and disseminate the participation of all employees in the construction of nuclear safety culture, and continue to improve their nuclear safety cultural literacy.

3.4. Safety Education System

Company leaders and department heads regularly contact the municipal emergency department to carry out emergency rescue training, organize safety preaching teams, go deep into the team to make tour presentations, and insist on treating past accidents as today's and others' accidents as their own. The concept of taking accidents as big things, taking the attempt as accidents, and actively guiding
employees to correctly understand the tasks and situation of safe production. At the same time, vigorously carry out safety education activities. Safety education activities with different themes such as "Safety Production Day", "Safety Production Month", "Pre-holiday Inspection", "Safety Culture Construction", and "Safety Knowledge Lectures" throughout the year, with different positions, different professions, and Different forms of production safety knowledge competitions regularly select and commend advanced production safety collectives and individuals such as "safety teams", "safe advanced individuals", and "excellent part-time safety officers", vigorously publicize their advanced deeds and experience, and give full play to their demonstrations Drive and radiate, forming a strong atmosphere of "set up a flag, light a lamp, and drive a group of people".

3.5. Safety Responsibility System
Responsibility is the cornerstone of China Nuclear Wuhan people's achievement of their careers and the solemn commitment of CNPO people to the country, nation and cause. CNPO people always keep their mission in mind, take the initiative, take the courage to take responsibility, earnestly fulfill their political, economic, and social responsibilities, and do their best to make due contributions to the country, nation and mankind. All the employees of the company signed the "Employee Safety Responsibility Letter of Commitment" at three levels to clarify the safety responsibilities of each department, and form a horizontal-to-side, vertical-to-bottom, criss-cross safety responsibility network to ensure that every work of safety production has a supervisor and department Leaders and specific personnel are responsible for preparing and distributing the "Safety Incident Report, Investigation and Handling Procedures" to clarify the organizational structure and work objectives of safety culture construction. Party organizations at all levels of the company closely focus on the work of the production and operation center, take direction, manage the overall situation, and ensure implementation, and earnestly fulfill the responsibility of "party management safety". Through organizing the broad masses of party members and comrades to carry out features such as "Party members have no violations, I stand for safety", "Recognize high-risk areas of responsibility", "Party building assistance inspection, hard work and development" and "Fifth party members, bright pioneers" The theme activities are driven by the demonstrations of the backbone of the party members to enhance the appeal and appeal of the role models, strengthen the employees' awareness of self-protection and mutual protection, and eliminate violations of regulations and disciplines.

3.6. Safety Process System
The famous Hain rule points out that behind every serious accident, there must be 29 minor accidents, 300 attempts and 1000 potential accidents. The law emphasizes that the root cause of the accident is the accumulation of quantity. Therefore, if enterprises want to have enough safety, they should establish a set of perfect "near miss" exposure and rectification mechanism, and continue to improve. CNPO established an experience feedback reporting system many years ago to encourage employees to actively list the potential safety hazards in their work and formulate improvement measures. For each hidden danger registered by anyone, the unit will publicly praise and give material awards. The quality and safety department of the company will sort out the registered hidden dangers every quarter, and those who provide higher value will also receive the quarterly experience feedback award. In terms of how to find potential safety hazards, in addition to the ability and experience of professional safety officers, nuclear power overhaul workers can immediately post hidden dangers in the power plant, such as finding abnormal events such as toxic and harmful gas concentration exceeding the standard, nearly being squeezed by the air lock door, nearly scratched by the insulation layer, nearly scalded by the pipeline, and so on, which will be immediately published in the wechat group. The person in charge of each team and overhaul leader shall watch whether there is a new registration every day. If so, they shall go to the scene where the problem occurs, think about how to avoid the recurrence of similar problems, and take effective solutions. All the hidden dangers listed in the wechat group must have countermeasures, and special personnel should be assigned to follow up whether similar incidents occur repeatedly. After such
continuous improvement, the company's on-site safety level has become an increasing trend, and the safety situation of employees is getting better and better.

4. Summarizes
If nuclear safety is a needle, then the construction of on-site standardized process, safety operation guidance, safety culture, safety concept, safety education, safety responsibility system, safety system, hidden danger investigation and risk assessment is a thread. Only by putting these threads on the needle, can we weave a beautiful nuclear safety. "Safety begins with heart, safety is practiced in practice", CNPO will continue to take safety as wings and fly high!

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