

## **Improvement of Corrective Action Program by US NPP Operators and Regulatory Implication**

Chang Rae Kim\*, Young Sung Choi

*Safety Policy Team, Policy Department, Korea Institute of Nuclear Safety*

*\*Corresponding author: k730kcr@kins.re.kr*

### **1. Introduction**

The level of the organization's safety assurance system can be distinguished into 'level 1' to comply with safety standards, 'level 2' to enhance and manage safety performance, and 'level 3' to achieve continuous improvement. Effective identification, evaluation and correction for any problem or deviation occurring in the system is a fundamental function to make the system sustainable. When these functions work properly in all areas of the system, the level of the organization's safety assurance system is developed from level 1 to level 3 and the safety assurance system itself is also strengthened.

The nuclear industry in the United States and other countries has established and implemented systems and practices that are known as the Corrective Action Program (CAP). Through this a culture has been set up that anyone in the nuclear power plant(NPP) can find and register the problem, and take action. In the United States, licensees are required to identify the cause of the problem at the plant and to take measures that prevent recurrence in accordance with 10 CFR Part 50 Appendix B, Criterion XVI, Corrective Action. Other countries also are obliged to continuously improve and reflect lessons-learned by corrective actions with regulatory requirements.[1]

The key premise of the CAP is that it recognizes that there are always problems in the plant, that they are identified and improved on a routine basis. And the role of CAP is to effectively and efficiently identify and correct safety significant issues before they potentially affect safety. It is important for operators to implement a strong CAP to ensure operators identify and fix problems. In 2010 report, OECD / NEA CNRA WGIP recommended the countries operating NPPs encourage operators to operate effective CAPs and said that it is more important to have effective CAPs through regulatory oversight, although there are cases where the regulator's oversight for the operator's CAP hinders the voluntary implementation of the operator.[2]

US Nuclear Operators have been operating the corrective action program(CAP) for a long time and have recently faced some problems created in several ways with CAPs. Nuclear Operators and managements were aware of these problems and tried to improve them. So the nuclear industry in the United States has developed the NEI 16-07 and proposed the CAP-02 to overcome the limitation of the existing CAP system.[3]

In this paper, the development background, contents

of CAP-02 and NRC's regulatory position on CAP-02 are described.

### **2. Improvement of Corrective Action Program**

In this section the background and contents of CAP improvement, and regulatory position of NRC are described.

#### *2.1 Initiative of Corrective Action Program*

In early commercial NPPs, technology development programs and test facilities, quality was achieved and verified with a minimum of formal, documented practices and procedures. Since sufficient experience has not accumulated in design and operation of NPPs until the early 1970s, AEC has established a long-term regulatory plan to develop a quality assurance program(QAP) and a framework of standards for licensing commercial NPPs in order to cope with the NPP construction increased explosively.

In 1965, AEC issued 10 CFR part 50 Appendix A and applied them to inspection. However, as the number of applications for NPP construction permits and operating licenses grew and quality problems were being discovered at plant sites, more definitive quality assurance regulations, standards, and guidance on their application were needed beyond 10 CFR part 50 Appendix A.

After that, AEC was tasked to begin developing a set of quality assurance program criteria to judge the adequacy of ComEd's Zion Station quality assurance program. The AEC's staffs developed the 18 criteria of NPP quality assurance in October 1968 by extracting and modifying applicable provisions from MIL-Q-9858A, NASA NHB 5500.4(1B) and RDT(Reactor Development and Technology) F2-2T quality assurance. And the 18 criteria of NPP quality assurance were issued as a code of federal regulation – 10 CFR part 50 Appendix B - in June 1970. While NASA and RDT had previously established performance-focused quality assurance program standards and definitions, other early government quality standards, such as MIL-Q-9858A and QC-1 were focused on compliance with contractual quality control and acceptance inspection systems requirements.[4]

The requirement on corrective action to assure that conditions adverse to quality are promptly identified and corrected to preclude repetition is included as the Criterion XVI.

## 2.2. Background and process of CAP improvement

US Nuclear Operators have established and implemented a QAP in accordance with ANS/ANSI 3.2 endorsed by regulatory body to meet 10 CFR part 50 Appendix B. Especially, CAP has been developed and operated to satisfy the requirement relating to corrective action.

US Nuclear Operators have encountered some problems since they have been operating the corrective action program(CAP) for a long time. They came to rely on the CAP as the sole means to address issues. And CAPs have come to be used as a tool to manage problems or issues that occurred in the NPP, including a range of low-level issues that did not affect safety and quality unlike the initial purpose of CAP. As a result, a number of problems or issues to be addressed has accumulated in the CAP. In case of few cumulative problems, significant items were relatively easy to recognize and manage but as accumulated problems important items were more difficult to recognize and accord the right level of attention and effort. Also, excessive resources and effort have been assigned by tracking and managing CAP processes even for low-level problems that do not affect safety or quality. Conversely, staffs in NPP did not resist the newly discovered problem in the CAP and left unaddressed.

So US Nuclear Operators looked for ways to implement the corrective action requirement effectively and efficiently and INPO(Institute of Nuclear Power Operations) issued INPO 14-004 guide - *Conduct of performance improvement* – for improvement of CAP operation in November 2014. INPO 14-004 guide recommended to enhance the communication and improve the reporting culture aimed at screening and focusing problems, review administrative requirements that mandate the use of the CAP to address low-level conditions that are not adverse to quality, improve immediately or consider using other systems if not adverse to quality, review the CAP process work flow and screening processes, ensure adequate assignment of resources appropriate to the level of the problem, standardize report formats, and so on. [5]

Since then, NEI has developed the NEI 16-07 guideline - *Improving the effectiveness of issue resolution to enhance safety and efficiency* - called CAP-02 to overcome the existing CAP problems across the business and shared its implementation plan with NRC in January 2017. A draft guidelines was distributed in May 2017 and a final version was issued in May 2018 through stakeholder feedbacks including NRC and 4 regional utility groups. The purpose of NEI 16-07 is to standardize the terminology and processes of the CAP, simplify tools and methods, utilize other systems solving problems, and reduce the administrative burden of plant personnel. NEI 16-07 was recommended that all US Nuclear Operators apply by NEI's efficiency bulletin 17-14(red).[6]

## 2.3 CAP-02

NEI proposed CAP-02, emphasizing the efficiency of the CAP, but ensuring that the original principle of the CAP was not compromised. For example, CAP-02 maintains low threshold for initial entry into CAP, to ensure employees report all conditions and concerns. On the other hands the items to be addressed in the CAP are more clearly defined so that the resource allocation can be efficiently. In addition, most of issues classified as non-CAP issue which is not classified CAQ(Condition Adverse to Quality)/SCAQ(Significant CAQ) and CARC(Condition Adverse to Regulatory Compliance) are addressed at find-and-fix level depending on perceived risk as soon as they are identified.

As a result, CAP-02 focuses on CAQ/SCAQ and CARC, and ensures that non-safety matters such as business-related matters are handled through other appropriate processes. And SCAQ must be tracked and managed only through the CAP, and CAQ and CARC are allowed to use other approved processes outside the formal CAP as these are often a more efficient resolution path. Also CARC protects and maintains industry commitments underlying the reactor oversight process(ROP) of NRC.

Non-CAP issues that clearly identify the cause could be addressed through management action or other processes. Regulatory issues raised by non-NRC organizations such as OSHA(Occupational Safety and Health Administration) and EPA(Environment Protection Agency).

The level of investigation and analysis for cause of the problem is proportionate to the importance of the problem. And the process control and administrative requirements are reduced to improve the timeliness and effectiveness of problem solving.

The process begins with issue identification, proceeds through screening for immediate actions, control room review, and if the issue meets the threshold for CAP. Once issues are screened according to the CAP criteria, additional screening will be conducted to determine if the issue meet the SCAQ criteria. If the issue is identified as SCAQ, the cause analysis is performed and a CAPR(Corrective Action to Preclude Repetition) is developed and implemented. If the issue is not identified as SCAQ, the investigation per significance of issue is performed and the issue is corrected.

## 2.4 Regulatory position of NRC on CAP-02

NEI explained that the transition to CAP-02 could lead to the following changes in the inspection program of NRC. Inspectors may need to look outside CAP data system to confirm screening has been appropriate and that CAQ and CARC are appropriately addressed. And with the emphasis on "find-and-fix", inspectors may find less documentation of formal investigation and

analysis of items of lesser significance. However, the effectiveness of CAP will be maintained and checked in the ROP of NRC continuously.

NRC evaluated the CAP-02 (NEI 16-07 guideline) as follows. First, licensees must ensure adherence to relevant requirements in implementing their CAP. NEI 16-07 should convey that regulations and regulatory standards must be identified and addressed within the corrective action program (CAP), but it emphasizes compliance with 10 CFR part 50 Appendix B, Criterion XVI, "Corrective Action.". Second, the NRC concerns that decentralization of CAQ tracking, trending, correction, and prevention from the formal CAP to other processes could make it more difficult for licensees and the NRC to identify and address adverse trends and cumulative impacts related to corrective actions and corrective action backlogs. Third, Criterion XVI requires that steps be taken to determine the cause and to ensure the corrective action to prevent recurrence, but a graded approach to cause analysis may preclude an adequate causal analysis. Finally, NEI 16-07 states that if a SCAQ cannot be eliminated, the corrective action to preclude repetition must be able to mitigate the consequences at an acceptable level, but it does not fulfill the requirement that should prevent recurrence. NRC emphasized that each licensee is responsible for ensuring compliance with NRC regulations. While the NRC does not endorse, accept, or reject NEI 16-07, the NRC will continue to oversee implementation of licensees' CAPs through the NRC's inspection program.

The NRC has taken the position that it encourages nuclear operators to increase their CAP effectiveness in order to emphasize the importance that operators find and correct problems by themselves. Also the NRC has taken the position that it basically trusts the CAPs of operators that meet regulatory guidelines, industry standards, and have checked through the inspection of NRC(IP71152).[7] For example, when a licensee has implemented a CAP that is determined to be adequate by the NRC, the NRC may normally dispose minor violations such as SL IV violations and violations associated with green ROP or cROP findings as non-cited violations. Therefore, it is necessary to examine the progress of the CAP changes in cooperation with NRC regulatory direction.[8]

### **3. CAP operation and regulation status in Korea**

The KHNP has established and implemented a CAP since 2007. The CAP of KHNP set 13 items as CAP targets including equipment failure and performance decrease, improvement through self-diagnosis, and recommendation by regulator and auditor. The CAP committee of each plant evaluates the grade of issue which is raised by plant staff based on the importance. And the CAP of KHNP is required to establish and implement appropriate analysis and solution according to the grade of each issue.

KINS has checked the items related to the inspection among the various items addressed in KHNP's CAP through the regular inspection and the quality assurance inspection. While the NRC has checked the overall implementation of CAP as an important item of baseline by the on-site inspector, the inspection with process perspective such as effectiveness of CAP, suitability of CAP implementation, completeness of cause analysis and corrective action are performed irregularly in Korea.

### **4. Implication**

CAP-02 was proposed as one of the implementation tasks of DNP (Delivering the Nuclear Promise), a mid-term plan developed in 2016 to strengthen the competitiveness of the US nuclear industry. CAP-02 is designed to screen problems and issues arising from NPPs according to risk and uncertainty and to utilize other processes besides CAP. This is aimed at enhancing efficiency of resource utilization and reducing workload.

The NRC did not endorse, accept, or reject the implementation of CAP-02, but concerned that the NEI 16-07 related to CAP-02 may not meet relevant regulations and requirements. However, the NRC acknowledged the efforts of the industry to resolve the problems in the CAP operation and to improve the effectiveness of the corrective action, and evaluated that various standard templates and checklists to be used jointly by the industry would contribute to enhance CAP effectiveness across industry. In particular, the equipment failure investigation checklist, the human performance survey checklist, and the organizational effectiveness checklist, which were prepared for the standardized cause analysis, were developed reflecting the operational experience, and will be useful to us.

It is important for operators to implement a strong CAP to ensure that the problems and issues affecting nuclear safety are properly managed and improved, and for regulators to promote that operators use CAPs to identify and fix problems in accordance with relevant laws and regulations. The NRC fully and broadly interprets the requirements related to corrective actions of 10 CFR Part 50 Appendix B and verifies the overall implementation of the CAP through the various inspection programs. The operator's efforts to improve the CAP will increase the efficiency and effectiveness of problem solving and will contribute to the achievement of the safety culture principle - continuous improvement.

### **REFERENCES**

- [1] Effective corrective actions to enhance operational safety of nuclear installations, TECDOC-1458, IAEA, 2005
- [2] Inspection of Licensee's Corrective Action Programme, NEA/CNRA/R(2010)7, OECD/NEA, 2010.11

- [3] Improving the Effectiveness of Issue Resolution to Enhance Safety and Efficiency, NEI 16-07, NEI, 2018.5
- [4] Continuing Evolution of U.S. Nuclear Quality Assurance Principles, Practices and Requirements – PART I, ASME, 2005.8
- [5] Reduce Cumulative Impact From the Corrective Action Program, Efficiency Bulletin 16-10, NEI, 2016.3
- [6] Improving the effectiveness of issue resolution to enhance safety and reliability, Efficiency Bulletin 17-14, NEI, 2018.4
- [7] Identification and Resolution of Problems, IP 71152, NRC, 2006
- [8] NRC Enforcement Policy, NRC, 2018.5