NRC's Approach to Violations of Design Criteria: Regulatory Decision Philosophy and Control of Licensing Basis

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1. Introduction

The regulatory decisions of the US Nuclear Regulatory Commission (NRC) are based on judgments on "adequate protection" and "safety enhancements". 'Adequate protection' is a collection of mandatory requirements that must be met no matter what the cost of the operator's compliance. It has the legal basis on Article 182 (a) of the Atomic Energy Act. 'Safety enhancements' are the requirements to be undertaken if it proves to be beneficial to safety in terms of cost benefits, etc., beyond adequate protection, which are based on Article 161 (b)(i) of the Act. The division of these two dimensions has been gradually established through a number of court appeals and judgments. The case of the Union of Concerned Scientist (UCS) vs. the NRC judged by the Washington DC Court of Appeals in 1987 had a major impact on that distinction. The court stated that adequate protection need not to be specifically defined, but that it did not mean "zero risk", and that the Congress gave the NRC the power to determine its scope and content. Therefore, it is the NRC's authority and responsibility to determine the content and scope of 'safety enhancements' and the NRC will decide whether to consider costs and other factors when making decisions regarding safety enhancements. This paper introduces recent NRC decision cases to review the NRC's regulatory decision philosophy.

2. Historical Perspectives

The NRC's Fukushima Near-Term Task Force (NTTF) in 2011 stated that frequently, the concept of design-basis events has been equated to adequate protection, and the concept of beyond-design-basis events has been equated to beyond adequate protection (i.e., safety enhancements). And the NTTF recommended to clarify the scope and extent of these two concepts.

However, it is true that the NRC has continually added measures to deal with emerging issues, but historically there has been little change in the underlying area of 'adequate protection' or the list of design basis events. In fact, changes in the scope of "adequate protection" are limited to very few including the mandatory supplementary measures after 9/11 event (EA-02-026) and the imposition of a mitigating strategy after the Fukushima accident (EA -12-049).

Only the mitigation strategy of the three orders issued by the NRC immediately after the accident in Fukushima corresponded to the change of the requirements by 'adequate protection'. The containment venting system and spent fuel storage pool instruments (EA-12-051) are issued under the safety enhancements category. In the case of containment vents, the Commission initially ordered (EA-12-050) from the perspective of 'adequate protection' but changed the order (EA-13-109) from the viewpoint of 'safety enhancement'.

Against this backdrop, the NRC has re-determined that it is not desirable (and not practical) to develop a clear definition of 'adequate protection'. The NRC was aware that it is virtually impossible to consistently set this. In other words, historically, when deciding on the implementation of the new measures, the focus on adequate protection and safety enhancements was different depending on the situation at the time, and therefore, NTTF explained that it was proceeding with a kind of patchwork. For example, the EA-02-026 order, which resulted in the (Extended Damage Mitigation Guides (EDMGs) requirement, was required as an area of adequate protection in the first place, but in reality it was an event that exceeds the design basis event. In this way, it is not easy to maintain consistency in the past cases. In particular, the viewpoint of defense in depth is often in the area of 'safety enhancements, but has been implemented as a basic principle of adequate protection. The NRC stated, 'adequate protection' is a normative and philosophical concept, rather than a concept that applies the characteristics, factors, or acceptance criteria of accidents constantly reflecting on the development of science and technology and the available information and knowledge (SRM-SECY-13-0132). Finally the NRC reaffirmed to maintain an existing regulatory decision-making system (SRM-SECY-15-0168).

3. Control of Licensing Bases

This section presents examples of backfit rule applications for licensing bases to show how the concepts of adequate protection and safety enhancements, which are granted to the NRC legally, apply to actual regulatory practice and how it affects regulatory decisions. Since operating nuclear reactors are the substance of NPP risk, most interactions between regulators and operators occur and important regulatory decisions are made. Thus it is beneficial to review the examples.

Basically, NRC sets licensing bases (LB) for operation nuclear power plants based on the two criteria

of adequate protection (AP) and safety enhancements (SE). The licensing basis is both a result and a basis for all regulatory activities and will continue to change after the initial licensing, in accordance with facility changes, operator activity, and 10 CFR 50.109 'Backfit rule'.

The backfit rule is a regulatory decision that can affect the licensing basis and also controls the regulatory decision on specific nuclear power plants. In accordance with the purpose of the initial enactment, the backfit rule basically ensures that the regulatory activities are not carried out outside the licensing basis, while providing a basis for justification of changing the licensing basis. Thus, it acts as a tool to the question " how safe is safe enough?"

3.1 Case 1: NRC's final decision on OPC

In January 2012, a flaw in a Byron station was revealed. When a one-phase or two-phase loss of power was lost, power system could not work as it was designed. And it was found that the problem was common one in most US NPPs. The NRC staff determined that since the OPC vulnerability discovered at Byron is a violation of the design standard that does not satisfy GDC-17 (the measures to minimize power loss possibility), i) the reactors should be immediately shut down and restarted after facility improvement, or ii) the Commission should establish a Interim Enforcement Policy (IEP) to allow temporary measures by operators and to provide a grace period for facility improvements. But the industry asserted that since it was confirmed in GDC approval process, it is not applicable to backfit rule exception. Therefore, backfit analysis is necessary. Recently the Commission decided that whether a mistake or omission at the time of permission was proved to apply compliance exception backfit but this is not the case. In other words, applying new information, technology, and interpretation from the current point of view is a new regulatory position and not a violation. The open-phase conditions were not well-known knowledge or established standards at the time of the permit, thus it is not required as an adequate protection or safety enhancement.

3.2 Case 2: Pressurizer Safety Valve issues at Byron and Braidwood stations

There has recently been a case in which the operator (Exelon) made two complaints about the imposition of the backfit by the NRC staff, and the backfit decision was finally judged to have been wrongly applied. In 2011, Exelon applied for power uprate of Byron and Braidwood NPP. During the review process, the NRC staff found that the PSVs are inappropriately used as a countermeasure for the solid water state of the pressurizer. The NRC imposed backfit to the two NPPs to resolve PSV issues in 2015. Exelon appealed to the NRR for reviewing the backfit in December of that year, and the director of NRR notified that the backfit was justified as a result of appeal review in May 2016. In response, Exelon asked EDO for a second review in June of the same year, and EDO finally decided in September that the backfit of the staff was unfair and initiated a policy to maintain backfit rule application by staff being consistent within the NRC.

3.3 Discussion

In both cases, the NRC has prioritized the licensing basis for licensed nuclear power plants and, as far as possible, respected the judgments at the time of the license. Even when the interpretation of the issue changes in the direction of increasing safety through technological advances, it does not change the licensing basis by itself. Even if a new fact is discovered that was not known at the time of the license, the existing license should be recognized and the backfit analysis must be carried out in order to reflect it in the licensing basis. As such, it is thought that it may be more dangerous to change the best regulatory decisions that have been decided in the past from the present time. In other words, past conservative decisions that might be made by experienced expert regulators, require at least that much prudence to change the decisions and that sufficient safety improvements benefits should be proven

4. Conclusion and the Future Study Needs

Two examples of how the 'adequate protection' and 'safety enhancement', which form the basis of the US NRC's regulatory decision-making, were presented in conjunction with the backfit rule's application to real regulatory practices. Adequate protection is decided by the Commission and implemented in the form of orders and regulations. In case of 'safety enhancement', it seems to be justified at the staff level. However, it is possible for the staff to use exceptions without proof of legitimacy. However, as shown in the two cases, the exceptional application is limited to respect the existing license base. In the future, these restrictions are expected to be further intensified with the planned revision of the backfit guidelines.

The NRC's regulatory decision-making approach suggests the future study needs. The uniqueness of regulatory system of a country is based on the legal system (Roman vs. Anglo-Saxon), principles (precaution vs. pragmatism), regulatory target (public vs. private), etc. Our system is based on Roman law, however, using American standards and adopting European practices for regulatory inspection and enforcement. Thus, it is necessary to first check our position in the regulatory style. In addition, while being familiar with the US regulatory framework and practices, comparative studies between US and European regulation with a due attention to European practices will be useful to enrich our nuclear safety regulatory philosophy.

REFERENCE

[1] KINS, Nuclear Safety Issue Briefing 2017-4, NRC's Approach to Violation of Design Criteria (2017.8)